NAVAL SHIPS' TECHNICAL MANUAL
FOR
[*SGML VERSION; SEE CHANGE RECORD*]

CHAPTER 050

READINESS AND CARE OF INACTIVE SHIPS

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3	1 MAY 2005	THIS CHAPTER HAS BEEN COMPLETELY REVISED TO CORRECT TECHNICAL DEFICIENCIES AND ADDRESS NEW INFORMATION.

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SAFETY SUMMARY

WARNINGS AND CAUTIONS Specific warnings and cautions applying to the system/equipment covered by this manual are summarized below. These warnings and cautions appear elsewhere in the manual following paragraph headings and immediately preceding the text to which they apply. They are repeated here for emphasis.

WARNING

These steps MUST be accomplished in the order that they are listed below or a serious accident could result. (Page 50-19)

WARNING

Trichloroethane is toxic and shall be used only under conditions of adequate ventilation. Inhalation of vapors and prolonged contact with bare skin should be avoided. Whenever trichloroethane is used in closed spaces with limited ventilation, personnel should wear airline masks with forced air ventilation. Eye protection should be worn at all times when working with trichloroethane. (Page 50-33)

WARNING

Release air pressure from the device prior to removing covers. (Page 50-63)

WARNING

Remove nylon filter bags alter trials. (Page 50-185)

CAUTION

Do not use solvent cutback corrosion preventive on reflectors. (Page 50-54)

CAUTION

The Mark 13 cutter is a high explosive device; hence, all safety- precautions, and applicable ordnance regulations indicated in the publication shall be strictly observed when handling this cutter. (Page 50-65)

CAUTION

Magnesium anodes sha11 not he used at saltwater sites, as serious hull corrosion can result. (Page 50-111)

CAUTION

A relief valve set at 5-psi shall be installed in each system under test. (Page 50-170)

CAUTION

Cleaning solution that leaks from turbine glands must be prevented from filling waste-oil and water-drain pockets and entering lubrication system via the bearings. (Page 50-188)

CHAPTER 050

INACTIVATION AND MAINTENANCE OF SHIPS AND CRAFT

SECTION 1.

INTRODUCTION

050-1.1 GENERAL INFORMATION

050-1.1.1 Responsibility. Program Executive Office (SHIPS) , Inactive Ships Program Office, PMS 333 is responsible for the upkeep of this chapter of the Naval Ships' Technical Manual (NSTM) as part of its program management responsibilities for Navy Inactive ships. OPNAVINST 4770.5, General Instructions for Inactive Ships and Craft, provides the overall policy for the inactivation and maintenance of inactive ships.

050-1.1.2 Scope. The scope of this document excludes ex-nuclear powered ships and submarines. The requirements for inactivation and maintenance of nuclear powered ships and submarines are provided under a separate NAVSEA manual, under the cognizance of PMS 392. The term ″ships″ and ″vessels″ may apply generically herein to include surface ships, service craft, and floating drydocks. The terms ″inactive status″ and ″inactive″ refer to any of the following conditions:

a. In Commission-In Reserve (ICIR) - (USN ships in stand-down prior to decommissioning).

b. In Service-In Reserve (ISIR) - (USNS ships and service craft in stand-down prior to decommissioning).

c. Out of Commission-In Reserve (OCIR) - (decommissioned USN ships).

d. Out of Service-In Reserve (OSIR) - (decommissioned USNS ships and service craft).

e. Out of Commission/Service-Not In Reserve - (surface ships stricken from the Naval Vessel Register or service craft and floating drydock which have been declared in-excess, and designated for disposal).

050-1.1.2.1 Vessels ″In Reserve″. Vessels ″In Reserve″ are being retained for reactivation in case of mobilization or future need. The inactive status period may be in excess of 20 years; therefore, inactivation procedures defined in Section 3 of this chapter reflect the requirements of long-term storage in accordance with Full Inactivation or Standard Inactivation procedures. Those vessels designated for disposal will be prepared for safe stowage commensurate with the requirements of Sections 7 and 9 of this chapter. Inactive ships are located at four U.S. Navy and three Maritime Administration (MARAD) facilities in the United States. Most inactive ships are stowed in specially designated Inactive Ship Maintenance Offices (INACTSHIPMAINTO's) under the cognizance of the Director, Navy Inactive Fleet. Inactive amphibious and auxiliary ships having merchant-type hulls and some stricken combatant ships may be stowed at National Defense Reserve Fleet (NDRF) sites operated by MARAD. The INACTSHIPMAINTO's are field activities of NAVSEA and are administered by the Officer in Charge, Inactive Ship's Management Office (INACTSHIPOFF, Portsmouth, VA).

050-1.1.3 Purpose. The purpose of this manual is to provide specific requirements for the inactivation, preservation, long-term storage, safe storage and reactivation of conventionally powered ships and craft. Detailed instructions for inactivation are contained in Section 2. Details to complete the preservation and lay-up of naval ships are contained in Sections 3, 4, 5 and 6. Safety precautions that have been found to be particularly important during inactivation and reactivation are listed Section 7. Procedures peculiar to the maintenance of inactive ships and of particular interest to the Directors of INACTSHIPMAINTO's are contained in Sections 8 and 9.

Finally, Sections 10 and 11 contain instructions and procedures related to reactivating inactive ships. Although the sections of this chapter provide detailed inactivation procedures, the inactivation plan that is issued by INACTSHIPOFF, Portsmouth VA, which is based on this NSTM, has been tailored to a specific vessel. That plan takes precedence over what is contained herein.

050-1.1.4 Corrosion and Deterioration. Corrosion and deterioration are discussed in the following paragraphs.

050-1.1.4.1 Corrosion and Rot. Corrosion and rot present the most serious forms of deterioration in inactive ships; however, both of these require moisture before occurring. By controlling the amount of moisture available to support these reactions, they can be reduced or eliminated. This control is achieved in two ways:

a. Primarily by the use of dehumidification equipment to control the humidity within the ship.

b. Secondly, by the use of primers, paints, or other preservative coatings to exclude moisture from contact with metal surfaces.

050-1.1.4.2 Deterioration. Deterioration can also be caused by dust, corrosive vapors, and gases in, the air, sunlight (UV radiation), fungi, and by galvanic effects. Deterioration from these causes is controlled, to some extent by placing equipment below decks, sealing the ship, encapsulating topside weapons systems, filtering circulating dehumidified air, selecting suitable mooring sites, and by use of impressed current cathodic protection systems.

050-1.1.4.3 Shelf Life Deterioration. A much more difficult type of deterioration to control occurs in certain materials solely as a result of time. This is termed shelf life, and usually depends on temperature and oxygen concentration. It is not affected by changing humidity or applying preservatives. Items of this nature are simply off-loaded or removed from their normal storage locations prior to the ship's decommissioning.

050-1.1.4.4 Procedures. The procedures specified in this chapter are based on waterborne storage. This results in the need for flooding alarms, blank flanges for hull openings, sleeves around shaft bearings, impressed current cathodic protection systems, special mooring facilities, and periodic dry-docking for underwater hull preservation.

050-1.1.4.5 Preservation. Preservation. Preservation measures specified in this chapter were developed to meet the conditions of readiness stated in paragraph 050-8.1.1 and to ensure adequate and economical protection from deterioration over long periods of time (up to 20 years) without re-inactivating the ship or remanning it with a skeleton crew for the purpose of maintenance.

050-1.1.5 User Feedback. The Naval Sea Systems Command (NAVSEA) encourages users to report errors or discrepancies found in the Naval Ships' Technical Manual (NSTM). Address errors, discrepancies or recommended changes to this NSTM section to: Inactive Ship Management Office (INACTSHIPOFF), Building 8, St. Julians Creek Annex, Portsmouth, VA 23702-5002, copy to Program Executive Office Ships, Attn.: Inactive Ships Program Office (PMS333), 1333 Isaac Hull Avenue SE Stop 2701, Washington Navy Yard DC 20376-2701. Submitted comments will receive a response. Queries concerning ship specific inactivation plans should be addressed to INACTSHIPOFF.

SECTION 2.
INACTIVATION

050-2.1 OVERVIEW

050-2.1.1 Inactivation. The inactivation of a ship for long-term retention is not an easy task. Rather, it is a complex and expensive operation requiring a concerted effort by all hands to complete necessary work within the limits of time and funds available for this purpose. Moreover, a lot of plain, hard work is required, even with the use of all available deck crawlers, disc sanders, wire brushes, vacuum cleaners, and other power tools.

050-2.1.2 Purpose. However, after proper completion of this work, the Navy is provided with an inactive ship that can be economically maintained (considering both manpower and funds) in an as-is condition almost indefinitely, and one capable of comparatively rapid reactivation when needed in the active fleet.

050-2.2 RESPONSIBILITIES

050-2.2.1 Turnover of Custody. Prior to turnover of custody, provisions must be made for joint inspections of a ship or craft in order for the prospective custodian to know the condition of the ship or craft that is being transferred and to ensure that the prescribed inactivation work has been completed. Accordingly, a Booklet of General Plans, tank loading and sounding tables, CSMP, and other machinery records must be made available and sighted prior to the turnover. Required turnover materials also include a listing of the tank soundings, draft readings and the location and amount of installed fixed ballast, as well as other applicable engineering documents and a reactivation work package document.

050-2.2.2 Funding. PEO SHIPS (PMS 333) will provide funds for materials and industrial support to accomplish surface ship inactivations as programmed. Funds will also be provided to the ship's NAVSEA Program Office for preparation of the ship's reactivation plan.

050-2.2.3 Participants. Responsibility for inactivation of a ship resides with the ship's Commanding Officer. The INACTSHIPOFF, and Inactive Ship Maintenance Office's (INACTSHIPMAINTO's) provide briefings and guidance before and during inactivation. The Director, INACTSHIPMAINTO, is responsible for inspecting inactivation work to ensure that preservation is properly performed and requirements for safe stowage and other work defined by the inactivation plan are accomplished. Upon completion of inactivation the Type Commander tows the ship to the designated inactive stowage facility, where the Director, INACTSHIPMAINTO accepts custody and becomes responsible for its maintenance and security.

050-2.2.3.1 Type Commander Responsibilities. The Type Commander is responsible for the following:

a. Establishing messing and berthing ashore. (NAVSEA funds as part of ship inactivation.)

b. Consumable distribution direction.

c. Towing costs. (NAVSEA funds towing preparations as part of ship inactivation).

d. Scheduling inactivation availability.

e. Screening inactivation work packages making use of ship's force and IMA's.

f. Coordinating the support for authorized pre-decommissioning equipment removals.

g. Monitoring ship's inactivation progress.

h. Coordinating adequate mooring with services available.

i. Providing security and safe stowage from time of decommissioning until arrival at INACTSHIPMAINTO.

j. If the following are considered beyond the ship's force or IMA capability, accomplishment by other facilities must be arranged:
   1. Stack Cover (16-gage Sheet Metal).
   2. Gas Free services.
   3. Bilge Cleaning.
   4. Freon removal.
   5. Shaft Locking Devices.
   6. Hazardous Material removal.
   7. CHT tank cleaning.
   8. Rudder Locking Devices.
   9. Installation of Blank Flanges on sea connections (1/2-inch plate).
   10. Diving Services (as required).
   11. Crane Services (rigging of towing bridle and offloading).
   12. Fuel and Oils Offload.
   13. Temporary Fire Protection.
   14. Transportation.
   15. Vent Covers (16-gage Sheet Metal).
   16. Porthole covers (Follow U.S. Navy Towing Manual SL740-AA-MAN-010).
   17. Hazardous Waste Removal and Disposal.

050-2.2.3.2 INACTSHIPMAINTO Responsibilities INACTSHIPMAINTO is responsible:

a. For ship's, providing inactivation plan briefing, inspections, and guidance. Determine acceptability of inactivation work prior to transfer of vessel custody to INACTSHIPMAINTO.

b. For Service Craft, obtaining proper documentation in order to prepare both the Service Craft and Boat Accounting Report (SABAR) OPNAVINST 4780.5, and the Material Readiness Report (MR), NAVSEA DET INST 4770.2.

050-2.2.4 Vacating Ship. Inactivation requires vacating the ship during the inactivation stand-down availability. A berthing barge is normally scheduled ahead of time with the Type Commander so that temporary facilities for messing and berthing can be made available as required.

050-2.2.5 Ship's Force. The ship's force is responsible for accomplishing the majority of inactivation work. Therefore, the Commanding Officer should start preparations for the Board of Inspection and Survey (INSURV) underway material inspection, as required by the Chief of Naval Operations (CNO) decommissioning guidance, if not previously accomplished within 12 months of decommissioning. An exception may be provided by the Chief of Naval Operations (N70) if the vessel is to be stricken from the Naval Vessel Register (NVR) upon decommissioning and is not designated for foreign military sale. The Commanding Officer should also start planning the inactivation. INACTSHIPOFF, Portsmouth, VA will assist in this by providing the Ship Inactivation Plan and other detailed written guidance at least five months prior to decommissioning. The cognizant INACTSHIP-

MAINTO will provide an instructional briefing to the ship's officers and work center supervisors well in advance of the ship's stand-down availability. In addition to the Safe Stowage requirements of Section 9, the following inactivation work items should be completed by ship's force prior to reporting to the NISMO:

a. For mobilization assets or foreign military sale candidates, all C-3 and C-4 CASREP deficiencies are to be corrected.

b. Remove highly combustible materials such as unapproved curtains, draperies, rugs with rubber backing, and rubber rug padding.

c. Remove unapproved bulkhead and overhead sheathing in areas contiguous to high value weapons and electronics spaces.

d. Remove unapproved upholstered or overstuffed furniture not functionally essential.

e. Document all equipment removals on DD Form 1149 which will be turned over to INACTSHIPMAINTO upon decommissioning.

f. Update ship's liquid load diagram to contents and quality of fluids in all tanks and voids, including locked in fresh water ballast. Provide update to INACTSHIPMAINTO.

g. Inventory all PCB containing transformers and large (greater than 3 lbs.) capacitors. Inventory all mercury containing gauges and indicators. Provide listing to INACTSHIPMAINTO.

050-2.3 INACTIVATION PHASES

050-2.3.1 General. The process of placing a ship in an inactive status has in the past consisted of two parts or phases, the pre-inactivation overhaul and the inactivation and preservation period. Unless specifically designated by CNO, all ships being inactivated at present do not receive a pre-inactivation overhaul. For aircraft carriers, inactivation may be split between a ship's force stand-down availability and an industrial inactivation availability.

050-2.3.1.1 Operational Tests. Before preservation, operational tests of all overhauled equipment shall be made as required to demonstrate the quality of repair work and the ability of the equipment to perform to specifications. Sea trials will be conducted following a pre-inactivation overhaul if major repair work has been accomplished on main propulsion machinery.

050-2.3.1.2 Alterations. Alterations shall not be undertaken without specific NAVSEA authorization. Alterations equivalent to repair are authorized when they can be accomplished economically. Deviations from this policy will be issued on an individual ship basis, subject to special circumstances or instructions by the CNO.

050-2.3.1.3 Drydocking. Drydocking for underwater repairs and preservation will normally be accomplished only during the pre-inactivation overhaul. However, aircraft carriers designated as Mobilization Assets will normally be drydocked during the Inactivation and Preservation Availability. For that availability, the following work may be authorized:

a. Drydock, shift block position, undock.

b. Underwater hull inspection and hull readings.

c. Docking report, docking plan updated, departure report.

d. Inspect and preserve sea chests and piping.

e. Installation of welded closures over underwater hull openings.

f. Inspect and preserve propellers.

g. Preserve rudders and skegs.

h. Preserve sonar and dome.

i. Preserve fathometer and install cover plate.

j. Replace hull zinc anodes on steel hull ships.

k. Inspect and preserve external propeller shafts.

l. Repack and seal rudder post chain(s).

m. Hull repairs for watertight integrity.

n. Preservation of underwater hull.

o. Boot topping coating system.

050-2.3.2 Pre-Inactivation Overhaul. A pre-inactivation overhaul may be scheduled, if authorized, by CNO. Work to be completed at this time includes those repairs that have been found to be difficult or uneconomical to accomplish following inactivation and that cannot be completed within a CNO specified reactivation time frame requirement. Examples of the work in this category may include repairs to boilers, main engines, generators, reduction gears, shafting, propellers, condensers, steering engines, large auxiliaries, and units that will be required for immediate use at the time of reactivation. The Type Commander is responsible for the development of the pre-inactivation overhaul work package, within the guidance provided by the CNO.

050-2.3.3 Inactivation and Preservation Availability. All machinery, boilers, turbines, piping systems, electrical apparatus, electronics equipment, weapons systems, and hull structure and fittings must be placed in the best state of preservation possible, consistent with the ship's inactivation plan, within the capability of the ship's force, assisted by such industrial facilities as may be made available.

050-2.3.3.1 Ship's Force and Regional Maintenance Center (RMC) Support. Ship's force labor and RMC support should be utilized to the greatest extent practical to accomplish inactivation and preservation and any authorized repair work, improving appearance, habitability, or completing routine maintenance.

050-2.3.3.2 Industrial Inactivation Work Items. Industrial Inactivation Work Items. The following items listed are normally considered outside of ship's force capability and are provided by an industrial facility through inactivation work requests.

a. Temporary services.

b. Temporary firemain.

c. Remove, preserve, and stow and antennas and directors.

d. Remove, preserve, and reinstall anchors and chains.

e. Install smoke stack closures.

f. Clean and gas-free aviation gas (AVGAS) tanks.

g. Clean and preserve JP-5 diesel oil tanks.

h. Install propeller shall locking devices.

i. Install positive locks on rudders.

j. Crane services.

k. . Material and services for ship's force work effort.

l. Removal of water and sludge from tanks.

m. Pest control.

n. Repairs to watertight doors and hatches.

o. Offloading fuel oil, lube oil, hydraulic oil and other contaminated liquids.

p. Camels, brows, and safety lines.

q. Truck transportation for equipment and materials authorized for removal.

r. Removal of topside electrical and deck equipment for stowage internally.

s. Remove, preserve, and stow external AVGAS piping shielding.

t. Install balloon room door cover.

u. Preserve and stow torpedo pods and pedestal.

050-2.3.3.3 Industrial Inactivation Work Priorities. Industrial accomplishment of work beyond the capacity of the ship's force shall be according to the following priority within the funds available:

a. Watertightness.

b. Weathertightness.

c. Industrial assistance work required to permit proper preservation of the ship by the ship's force or INACTSHIPMAINTO.

d. Urgent repairs to main propulsion equipment.

e. Other urgent repair items.

050-2.3.3.4 Guidance and Documentation. The information contained in the following emphasizes requirements, instructions, and information that will aid in ship's force inactivation. These instructions are applicable to all ships designated by the CNO to be placed in the inactive reserve.

050-2.3.3.5 Retention of Personnel. Except in special cases as directed by the Chief of Naval Operations, the officers and crew of a ship being inactivated will begin decrewing at the start of the inactivation stand down availability; however significant numbers of personnel will be retained until decommissioning in order to accomplish the required inactivation and preservation work. Ship's force will establish a compartment closeout schedule that completes the inactivation work upon inspection and acceptance of the spaces by INACTSHIPMAINTO.

050-2.3.3.6 Records. All material records shall be brought up to date, including all work done in placing the ship out of commission. These records will be maintained and used during the inactive life of the ship.

a. Phase out Planned Maintenance System (PMS) as equipments are laid up. Report repairs through Maintenance (and Material) Data Collection System (MDCS) to maintain a complete history. Prepare Work Requests (OPNAV 4790/2K and 2L) for all repair items not completed prior to inactivation and not previously documented. Update latest Current Ships Maintenance Project (CSMP) printout by deleting completed items and file. Bundle PMS schedules, manuals, and Maintenance Requirement Cards (MRC's) by work center and department and retain on board. Retain MDCS six- month summaries and latest monthly summaries. Leave PMS hardware in place.

b. All records referred to above, charts and all operating records including logs, damage control books, inclining experiment, Consolidate/Coordinated Shipboard Allowance List (COSAL), manufacturer' instructions, and ship's orders shall be left in their normal locations. Technical manuals and instruction books shall be inventoried and filed in numerical order. These manuals shall be indexed in both alphabetical and numerical order. Blueprints shall be inventoried, indexed, and filed in numerical order.

c. The foregoing stowage requirements apply only to Unclassified records. Classified documentation of continuing interest (such as damage control books) shall be inventoried and stored in one central compartment or turned over to the cognizant INACTSHIPMAINTO for retention. Other classified records, not of continuing interest, shall be destroyed. Refer to SECNAVINST 5212.5, Disposal of Navy and Marine Corps Records.

050-2.3.3.7 Inactivation and Material Readiness Reports. These reports are the responsibility of the INACTSHIPMAINTO, and shall be submitted in accordance with NAVSEAINST 4770.2, Material Readiness Reporting Procedures for Vessels in the Inactive Fleet.

050-2.3.3.8 Allowance List Material. OPNAVINST 4770.5 contains general instructions for the various categories of allowance list material to be retained aboard or removed (with concurrence of the appropriate activity) from ships being inactivated. In addition, the Systems Commands and Inventory Control Points (ICP's) have ordered the removal of certain specific items because of their being dangerous or deteriorative on a 3-year basis. Material not specifically authorized for redistribution or turn-in must be retained on board. A detailed list of these items may be found in paragraph 050-3.15.3.1.

050-2.3.3.9 Integrated Logistics Overhaul (ILO). Integrated Logistics Overhaul (ILO). An Intrafleet Supply Support Operation Team (ISSOT) is located near each INACTSHIPMAINTO for the purpose of conducting supply overhauls. At the conclusion of a modified ILO (if considered essential), all automated and manual records will be updated to reflect the current ship's inventories and configuration. Magnetic tape copies of all ship's files will be produced and sent to the Configuration Data Manager (CDM). Hardback copies of all automated files will be produced and secured onboard so that reactivation can be performed either as a manual or automated ship, as best fits the circumstances. A duplicate copy of the hardcopy configuration and stock record files (SNAP II Equipment Record (EQU) and Stock Record File (SRF) respective] will be sent to INACTSHIPOFF, Portsmouth, VA. All the above shall be in accordance with OPNAV INST 4770.5 and NAVSUPINST 4470.4, Policy and Procedures for Planning and Executing Actions Necessary to Facilitate System Stock Level Adjustment and Reapplication of Repair Part Related Material Removed as a Result of Ship Decommissionings.

050-2.3.3.10 Pest Control. Prior to acceptance of the vessel by INACTSHIPMAINTO, it shall have been cleared of all pests by extermination. A pest free certificate from the exterminator shall be provided to INACTSHIPMAINTO at turnover. Refer to Section 9, Preparation for Safe Stowage, for further information.

050-2.3.3.11 Shore Services. During inactivation, a ship is ICIR or ISIR and must usually be provided the following from an outside source until the systems are inactivated: electrical power for both power and lighting circuits, steam for galley and heating, steam for inactivation purposes, potable water, and compressed air. The sup-

plying of these services from an outside source will help to free manpower for inactivation work. After inactivation, when the ship or craft is OCIR or OSIR, services are reduced to an outside source of electrical power that is to be connected to the main switchboard. This power shall be from shore, if available; if not, it may be provided from a ship that is ICIR or ISIR. Lighting circuits shall be retained in service, as they are often required for inspections and other work. Lamps of full wattage are to be maintained in lighting fixtures. Other electrical circuits shall be maintained ready for use, but deenergized when not in use. Fire mains shall be drained thoroughly, dried, and left open to D/H. When steam is provided from an outside source, condensate drains shall be led overboard or returned to the source, not to the engineering spaces.

050-2.3.3.12 Reuse of Material. Power panels, distribution boxes, sheet metal D/H enclosures, D/H ductwork, D/H machines, safety screens, and other inactivation items that may be available from ships undergoing disposal or from other sources (including the inactivating ship's own equipment) are to be used to the fullest extent.

050-2.3.3.13 Preservation Measures. The following preservation measures (described in detail in Sections 3, 4, 5 and 6 of this chapter) are to be accomplished prior to the end of the inactivation period:

a. Dehumidification of the ship's interior, the propulsion plant, and topside weapons systems for Mobilization Assets, Foreign Military Sale candidates and logistic support asset.

b. Cathodic protection for the underwater hull of all mobilization assets and ships in category Foreign Military Sale (FMS).

c. Preservation of exterior and certain interior corrodible surfaces by use of paint or solvent cut back corrosion preventives.

d. Preservation by special measures, such as those required for sea chests and external shaft bearings.

While no relaxation of preservation standards will be permitted, proposals for new procedures and materials that will do the job better or at reduced cost or effort are encouraged and should be submitted to INACTSHIPOFF, Portsmouth, VA by the local INACTSHIPMAINTO.

050-2.3.3.14 Topside Equipment. As many topside equipments and fixtures as practical shall be removed and placed below decks under dehumidification; this includes winches, radar antennas, weather deck gratings, stern anchors, saluting batteries and scupper downcomers. Equipment so removed must be preserved and tagged showing the proper installed location. Appropriate entries must be made in ship's records, and the reactivation work package, showing stowed location and installed location. A complete list of mounting bolts, nuts, and other hardware required for reinstallation shall be placed in a sturdy bag and physically attached to each unit removed from its normal position. When equipment is moved, any electrical cabling that is connected shall be neatly made up and sealed at the ends. If the exposed portion is short, the cables shall be pulled back into the ship and the stuffing tube blanked off with a pipe plug, shrink-on plastic cap, or other approved method. Long cable runs may be left in place, but the ends must be sealed to exclude moisture. Remove outside signal and spotlights fixtures and store inside D/H area of ship; use ″Heat Shrink″ tape or tubing on cable ends for protection and tag cables appropriately. If topside equipment must be left in place, individual package enclosures shall be installed or the equipment shall be preserved as part of the hull structure, as applicable. Package enclosures are to be connected to the ship dynamic dehumidification system (paragraph 050-6.7).

050-2.3.4 Safe Storage Preparation. For preparation of Naval ships for safe storage, refer to Section 9 of this chapter.

SECTION 3
DETAILED PRESERVATION INSTRUCTIONS

050-3.1 GENERAL

050-3.1.1 Overview. This section sets forth detailed instructions for the application of the general preservation guidance outlined in Section 2 to specific equipment and parts of the ship.

050-3.1.2 Painting. . In general, painting is done according to NSTM S9086-VD-STM-020 Chapter 631, VOLUME 2, PRESERVATION OF SHIPS IN SERVICE - SURFACE PREPARATION AND PAINTING, except as modified in this section. Standard stock materials are to be used to the maximum possible extent. The object of any painting that is done during inactivation is to protect and preserve, not solely to improve the ship's appearance. For this reason, touchup should be accomplished whenever possible, applying only one coat of primer on bare spots in spaces that will be under dehumidification (D/H). Additional primer coats may be applied in passageways and areas where excessive wear to paint surfaces is likely to occur. When repainting is necessary, prepare properly according to NSTM S9086-VD-STM-020 Chapter 631, VOLUME 2, PRESERVATION OF SHIPS IN SERVICE - SURFACE PREPARATION AND PAINTING, and apply new paint with care. More than any other factor, durable paint coverage depends on proper preparation of the surface before painting. Emphasis on preservation of retention assets is required.

050-3.2 DRYDOCKING AND LANDBORNE STOWAGE

050-3.2.1 Overview. Ships may be drydocked initially during inactivation in order to undergo necessary inspections, repairs to and preservation of the underwater hull and fittings. This is called Inactivation Drydocking. Maintenance Drydocking occurs when an inactive ship is drydocked for periodic preservation and hull inspection and cleaning. Landborne stowage occurs when an inactive ship is removed from the water.

050-3.2.2 Drydocking. Instructions in NSTM S9086-7G-STM-010 Chapter 997, DOCKING INSTRUCTIONS AND ROUTINE WORK IN DRY DOCK, shall apply except as modified by current NAVSEA instructions issued for specific purposes.

Funding permitting, ships may be docked during inactivation in order to accomplish necessary inspections, repairs to and preservation of underwater hull and fittings, removal of propellers, outboard blanking of sea connections, installation of galvanic anodes, setting up of shaft packing glands, and installation of shaft boots as prescribed in this section. Docking may be required for certain ships for such work as reinstallation of sonar transducers and domes. Hull descriptions, berthing sites, and docking intervals for steel and aluminum hull ships are defined as follows:

a. Thin hull ships. Those ships with plating less than 1/2-inch thick (20.4 pound plate) at the waterline.

b. Heavy hull ships. Those ships with plating 1/2-inch thick, or greater, at the waterline.

c. Freshwater berthing sites. Philadelphia, Pennsylvania.

d. Saltwater berthing sites. Bremerton, WA; Pearl Harbor, HI.

e. Category B and C Ships. Maintenance categories for inactive ships, established by the Chief of Naval Operations.

f. Docking Intervals. The maximum docking interval for steel and aluminum hull ships under impressed current

cathodic protection is 15 years for planning purposes, regardless of the type of water at the berthing site. Ships under impressed current cathodic protection, with a history of satisfactory potential readings, and having a waterline area that appears satisfactory after 15 years, may be extended to a 20 year docking interval. Category B and C ships should be scheduled for docking in accordance with the prescribed intervals, but if funding limitations do not allow docking of all hulls scheduled, priority should go to Category B ships first. Category C ships may be deferred as necessary.

050-3.2.2.1 Steel Underwater Hull. The preservation methods outlined inNSTM S9086-VD-STM-010 Chapter 631, VOLUME 1, PRESERVATION OF SHIPS IN SERVICE – GENERAL, shall be used except as modified in this section. Policy is to preserve the underwater hull up to the upper limit of the boot topping as part of the inactivation drydocking. The underwater hull and boot topping area shall be thoroughly inspected during the final drydocking period before inactivation to determine the work to be done. As a guideline to represervation of these areas, if it is found that more than 35 percent of the underwater or boot topping area have a deteriorated coating system that requires represervation, then the following procedures shall apply:

a. If the coating deterioration is generally scattered over the total area, remove entire coating system by abrasive blasting. If the deterioration is confined to a specific area, excluding minor scattered deterioration, then only the deteriorated areas shall be abrasive blasted and represerved.

b. Abrasive-blast cleaning shall meet the requirements of Steel Preparation Specifications, No. 10, Near-White Blast Cleaning. A pictorial guide is also available that can be used in determining the degree of blast cleaning achieved; this is the Abrasive Blasting Guide for Aged or Coated Steel Surfaces, Technical Bulletin No. 49, published by the Society of Naval Architects and Marine Engineers.

c. Touchup or total preservation of the underwater hull shall be as follows: An epoxy system approved for underwater hulls, as specified in NSTM S9086-VD-STM-020 Chapter 631, VOLUME 2, PRESERVATION OF SHIPS IN SERVICE - SURFACE PREPARATION AND PAINTING, shall be applied in the specified number of coats and to the approved mil thickness. Antifouling need not be applied to the underwater hull unless immediate activation is foreseen. For an emergency activation, the hull can be cleaned of fouling by underwater cleaning techniques. Complete represervation of the hull can be accomplished at a later date whenever there is opportunity for drydocking.

d. The boot topping area shall be defined as 2 feet above and 2 feet below the inactive waterline. Touchup or total represervation of the boot topping area shall be as follows: The preferred system for steel hulls shall consist of an inorganic zinc silicate coating approved for exterior use as specified in NSTM S9086-VD-STM-020 Chapter 631, VOLUME 2, PRESERVATION OF SHIPS IN SERVICE - SURFACE PREPARATION AND PAINTING. It shall be applied in one coat at 3 to 5 mils dry film thickness. Any residual deposits resulting from the curing process and which form on the surface of the zinc coating shall be removed by scrubbing with freshwater, or in accordance with the coating manufacturer's instructions. Apply a mist coat (maximum 1 mil) of epoxy polyamide primer, Formula 150, over the zinc coating followed by a full coat to 2 to 3 mils dry film thickness. If this system is not available, if funds are limited, or if the hull is nonferrous, the following alternate system is acceptable: One coat each of Formula 150, Formula 155, and Formula 151 at 2 to 3 mils dry film thickness per coat. Regardless of whether the preferred or the alternate system is selected, no antifouling coating system shall be applied over the epoxy coating.

050-3.2.2.2 Aluminum Underwater Hull. The preservation methods outlined in NSTM S9086-VD-STM-010 Chapter 631, VOLUME 1, PRESERVATION OF SHIPS IN SERVICE – GENERAL shall be used except as modified in this section. Policy is to preserve the underwater hull up to the upper limit of the boot topping as part of the inactivation drydocking. The underwater hull and boot topping area shall be thoroughly inspected during the final drydocking period before inactivation to determine preservation work to be done. As a guideline to rep-

reservation of these areas, if it is found that more than 35 percent of the underwater or boot topping areas have a deteriorated coating system that requires represervation, the following shall apply:

a. If the coating deterioration is generally scattered over the total area, remove entire coating system by abrasive blasting. Since harsh grit blasting or certain wire brush materials could result in excessive hull damage, the requirements of NSTM S9086-VD-STM-010 Chapter 631, VOLUME 1, PRESERVATION OF SHIPS IN SERVICE – GENERAL shall be followed.

b. Touchup to total represervation of the underwater hull and boot topping area shall be performed in compliance with requirements of NSTM S9086-VD-STM-010 Chapter 631, VOLUME 1, PRESERVATION OF SHIPS IN SERVICE – GENERAL as applicable except no anti-fouling paint shall be used.

050-3.2.2.3 Fiberglass Underwater Hull. Reserved.

050-3.2.2.4 Wood Underwater Hull. Preservation techniques for wood hulls are aimed at preventing decay and marine border attack, and attaining sufficient air and water tightness to permit dehumidification of the ship interior. A first step, therefore, is to stop all leaks, no matter how minor. Repair work, installation of new planks, sheathing, and caulking shall be accomplished as specified in NSTM S9086-VD-STM-020 Chapter 631, VOLUME 2, PRESERVATION OF SHIPS IN SERVICE - SURFACE PREPARATION AND PAINTING.

050-3.2.3 Maintenance Drydocking. When an inactive ship is drydocked for periodic preservation, the underwater body shall be inspected to determine if touchup or complete preservation is required. The extent of recoating shall be determined by considering the following factors in relation to the next anticipated docking period: condition of coating at current docking, previous time out of dock, time until next docking, whether a cathodic protection system is installed, and the previous performance record of the coating system to be used. If preservation is deemed necessary, the underwater body shall be thoroughly cleaned by abrasive blasting and shall be coated with the coating systems specified herein.

050-3.2.4 Hull Inspection and Repairs. Hull inspections shall be conducted in accordance with NSTM S9086-7G-STM-010 Chapter 997, DOCKING INSTRUCTIONS AND ROUTINE WORK IN DRY DOCK and NSTM S9086-DA-STM-010 Chapter 100, HULL STRUCTURES, and this paragraph. They are to be conducted, as necessary, to determine the overall material condition of the hull, and to determine the need for repairs in order to ensure security, watertight integrity, and satisfactory material condition.

Inspect the entire underwater hull after it has been sandblasted and coated with wash primer. Inspect all plating seams, rivets, and welds for deterioration, paying particular attention to the afloat waterline area.

The visual inspection shall be followed by such measurements as are necessary to establish the extent and nature of required repairs. Some thickness measurement techniques, depths gauges, and drill tests may be used as required for this purpose. General guidance may be found in NSTM S9086-DA-STM-010 Chapter 100, HULL STRUCTURES, and in MIL STD 2710 (SHIPS).

050-3.2.5 Reports. A docking report shall be prepared and submitted according to instructions included with form NAVSEA 9070/1 and NSTM S9086-7G-STM-010 Chapter 997, DOCKING INSTRUCTIONS AND ROUTINE WORK IN DRY DOCK, except as modified by this paragraph. One copy of the report shall be sent to NAVSEA. After the initial inactivation drydocking, some readings (e.g., shaft data, bearing data, propeller and rudder data) need not be reported unless damage or failure of preservation has occurred since the previous docking. In addition, the INACTSHIPMAINTO shall submit a supplementary sheet or sheets containing hull deterioration measurements and a narrative description of hull condition upon docking as follows:

a. A statement of general hull condition:
   1. Good. The average loss in the original thickness of the shell plating and the maximum depths of pitting do not exceed 10 percent, and the surface is relatively smooth.
   2. Fair. Corrosion does not exceed the criteria in NAVSEAINST 9110.13 and NAVSEAINST 9110.57, and the worst areas have no pitting exceeding 25 percent of original plate thickness.
   3. Poor. Hull conditions fail to meet the fair criteria.

NOTE

For the Material Readiness Report, OPNAV 4770-1, evaluate the hull after repairs.

b. A statement identifying significantly corroded and eroded areas are discovered, such as shell plating, boot topping area, trivets, sea chests, rudders, rope guards, fairwaters, and struts.

c. A brief description of hull repairs completed.

d. Data of previous drydocking.

e. Inactivation location and date.

f. Date cathodic protection installed.

g. Estimate of additional time the ship could have remained out of dock without serious additional deterioration.

h. Methods of inspection (identify instruments used).

i. Condition and type of stern tube and strut bearings preservation; is visibly intact, analyze the preservative solutions for chloride content.

050-3.2.6 Landborne Stowage. Vessels scheduled for dry stowage shall be preserved as detailed in paragraph 050-3.2.2.1, 050-3.2.2.2, or 050-3.2.2.3 and no antifouling need be applied. If existing antifouling is in good condition, it shall be retained.

050-3.3 SUPERSTRUCTURE AND HULL

050-3.3.1 Flooding Markers. The ships name, bow numbers, and draft marks shall be painted in accordance with instructions in NSTM S9086-VD-STM-010 Chapter 631, VOLUME 1, PRESERVATION OF SHIPS IN SERVICE – GENERAL. In addition, flooding markers shall be applied to identify the inactive ships water line and to provide a distant observer a base line to visually detect a change in draft. The marker shall be 6-inch by 3-foot horizontal international orange stripes painted on the hull forward, aft, and midships at the water edge to allow visual inspection.

050-3.3.2 Galvanic Cathodic Protection. A galvanic, anode cathodic protection system shall be installed on the stern of inactive, steel and aluminum hulled ships. A system that provides 3 years of protection shall be installed according to the requirements of NSTM S9086-VF-STM-010 Chapter 633, CATHODIC PROTECTION. If galvanic anodes previously installed on the stern have deteriorated less than 50 percent, they should be retained. The function of these anodes is to protect the hull from corrosion in the event the ship is activated. During the inactive period, the impressed current catholic protection system will protect the hull and will prevent dissolution of the galvanic anodes; the latter will then be functional upon activation or in the event that the impressed current catholic protection system is removed or rendered inoperative for any reason. Galvanic anodes must not be painted over during bottom preservation; any masking should be removed before undocking.

050-3.3.3 Watertight Integrity. Underwater leaks, no matter how minor, shall be stopped. Integrity inspections shall be accomplished semiannually for MOB B and annually for non-MOB B vessels.

050-3.3.4 Experimental Hull Coatings. Those ships and craft that have experimental coatings shall be reported to INACTSHIPMAINTO on NAVSEA 9190/1, 9190/2, and 9190/3 (refer to NSTM S9086-VD-STM-010 Chapter 631, VOLUME 1, PRESERVATION OF SHIPS IN SERVICE – GENERAL). If covered by separate correspondence, Report Control Symbol 9070-2 applies to those reporting requirements.

050-3.3.5 Surface Ship Sea Connections. SURFACE SHIP SEA CONNECTIONS. When funding permits docking during inactivation of surface ships, all sea connections shall be blanked outboard rather than inboard. Internal blanking will be accomplished at the inboard flange of the first skin valve. Interference removed to facilitate blanking is to be wired in a conspicuous location near the installed blank. All sea valves are to be wired shut with multiple strand seizing wire. Internal blanks shall be fabricated from 1/2-inch thick steel plate and installed with a 0.060 solid rubber gasket having the same number of boltholes as the flange. (Cloth inserted rubber gaskets per HH-P-151, Class 1 cut from 1/8-inch thickness sheet, not bonded or seamed, is an authorized substitute gasket material.) Internal blanks shall be painted yellow and a stenciled serial number shall be painted on each blank. A list shall be prepared and provided to INACTSHIPMAINTO containing the following information for all internally installed blanks: blank serial number, compartment number, frame number, port or starboard, and system blanked. Procedures in paragraph 050-3.12.3 shall be followed for the installation of depth sounder cover plates. All other sea connections that cannot be internally blanked shall be externally blanked with welded blanks. These welded blanks may be installed either during drydocking or by wet welding while the ship is in a waterborne condition. If the blanks are installed during drydocking, the welding procedures described in NSTM S9086-CH-STM-010 Chapter 074, VOLUME 1, WELDING AND ALLIED PROCESSES, shall be followed.

050-3.3.5.1 Welding Procedures. The hull shall be surveyed to verify the size and location of all openings listed on the Docking Plan. Each opening shall be checked to ensure it is free from damage or obstructions. If blanks are to be installed while the ship is waterborne, a UDATS or commercial underwater television/communications equivalent will be employed for immediate on-site review of the hull openings, doubler plates, and splitter bars. The hull plates immediately adjacent to the openings will be examined and all welded and riveted seams will be noted. A complete video or written record of the inspection, or both, will be prepared for inclusion in the permanent deactivation record of the ship.

Two methods exist concerning blanks and both methods are considered viable. The preferred method is the use of dome and barrel blanks but welded blanks can be used. Dome and barrel blanks shall be fabricated using NAVSEA dwg 7281519, sheets 4, 20 and 21. When fabricating dome blanks, only one cutting operation is necessary and no welding is required to attach coamings or flat bar reinforcements. There is processing time required for each dome on the forming machine, but once the dies on the machine have been set for a certain size, many domes can be produced rapidly.

The welded blanks shall be fabricated using NAVSEA dwg 805-2250-443, Type Drawing, Outboard Closures, Welded Type, as a guide for fabricating and installing. The closure blanks shall be fabricated from 3/8-inch plate (thickness includes 1/8-inch corrosion allowance to avoid more expensive galvanizing or other protective coating). Closures shall have a coaming with minimum height of 2 inches to facilitate future removal underwater. The coaming shall be sloped, if possible, to lessen the chance for mechanical damage. Coaming shall be approximately 3 inches high on closures with stiffeners. Each coaming shall be sized so that the distance from hull opening to the circumference of the coaming is approximately 3 inches. Closures weighing over 25 pounds shall be provided with lifting eyes to which 3/4-inch shackles can be connected for future removal of closures by divers. Number and thickness of lifting eyes shall be determined by weight and size of the closure. Closures shall be drilled and tapped for 1/2-inch pipe fittings (two holes in each closure) for water displacement and air testing.

Two-inch diameter, 3/8-inch thick cover plates will be welded over holes after test is complete. In lieu of the drilled and tapped holes, pipe couplings can be fitted and welded in drilled holes and then closed with seal-welded pipe plugs after the test. The latter method is recommended.

Closures will be identified with a number corresponding to the number on the docking plan. A protective coating will be applied to the exterior and interior of each closure.

Prior to installation of dome and barrel or welded blanks, the hull shall be cleaned to bright metal in an area approximately 6-inches wide around the hull openings where the blanks will be installed. For underwater cleaning, water blasting and pneumatic or hydraulic tools may be used. For underwater installation, closures shall be keelhauled to within 2 to 3 inches of final location. Fit-up lugs tack-welded to the ship's hull and tapered wedges and hull pins will be used in the final fit-up for welding. If ship's hull plates are contoured, smaller blanks must be temporarily positioned in proper location, marked to fit hull contour and returned to the surface where marked coaming will be shaped with a cutting torch to the proper contour. A template will be used to determine the contour for larger closures. All closures shall be fitted to the hull (with no gaps greater than 1/8 inch) prior to welding. A fire watch shall be posted inside the ship in the areas where welding is being performed.

After each blank has been welded in place, it shall be tested for leaks. The blanks will be pressure tested to 12 psig or 24.4 inch Hg vacuum box equivalent to ensure tightness of the blanks. For blanks installed by wet welding while the ship is waterborne, the test shall be made while the diving stages remain in place. After successful pressure testing, the test equipment will be removed and threaded caps installed in their place.

050-3.3.5.2 Wet-Welding Limitations Wet welding may be performed only within the following limitations:

a. The wet-welding process must receive prior approval from NAVSEA.

b. Before underwater blanking operations are undertaken, commands and commercial contractors must be cleared by NAVSEA to use a wet-welding process.

c. Both the approved wet-welding procedure and the diver/welders must successfully pass the procedure and performance qualification tests that are described in NSTM S9086-CH-STM-010 Chapter 074, VOLUME 1, WELDING AND ALLIED PROCESSES. These procedures and performance tests must be conducted for each ship on which diving and wet welding will be used. The written reports of the procedure and performance qualifications shall form part of the permanent deactivation record of the ship.

d. The approved wet-welding process shall be used only for depositing fillet welds.

e. The approved wet-welding process shall be used for welding only on hulls fabricated from mild steel (MILS-22698, classes A, B, C, and D) and high-tensile steels (MIL-S-16113C, Grade HT, and MIL-S-24113, Grade N).

050-3.3.6 Steel Sides Above Waterline, Decks, and Upperworks. Painting shall be accomplished for preservation only, not for appearance. No firmly adhering paint shall be removed, and whenever practicable, the work should be confined to thorough cleaning and preservation of bare and rusted spots or areas. Where existing topcoats are reduced in thickness because of wear or other causes, but are otherwise in good condition, an additional top coat or coats should be applied as necessary. The durability of a paint system depends largely upon thorough, correct surface preparation as well as coating thickness. A more durable coating system is achieved by the application of a successive number of relatively thin coats, than by the application of one heavy coat or several heavy coats. Thick single coats of paint are more susceptible to cracking, flaking, and chipping than is a coat of equivalent thickness consisting of a buildup of successive thin coats. When a ship enters inactive status and also while in that status, all bare and rusted areas shall be thoroughly cleaned and preserved as follows:

a. Areas requiring preservation shall be cleaned by hand and power tools (paragraphs 5.3.2. and 5.3.3 of NSTM S9086-VD-STM-010 Chapter 631, VOLUME 1, PRESERVATION OF SHIPS IN SERVICE – GENERAL) to remove loose rust and corrosion products (abrasive blasting may be used if allowed by local environmental regulations). It is possible that some tightly adherent rust and corrosion products may remain after preparation, especially in restricted areas (such as inside cracks and joints). Edges of adjacent sound paint shall be feathered where practical.

b. In restricted areas where rust or corrosion products remain, apply Pre-Prime 167 (NSN 8010-01-359-3115), or equal, as the prime coat. Pre-Prime 167 seals and inerts rust and has strong capillary action to pull itself into cracks and joints prior to curing. The prime coat shall be followed by two coats of Bar-Rust 235 (NSN 8010-01-359-7235) (5 mils minimum dry film thickness (DFT) per coat), or equal, and a topcoat of haze gray (#26270) per MIL-E-24635 (NSN 8010-01-344-5309) (3-mil maximum DFT) for a total of four coats of paint.

c. In "open face" areas where cracks and joints are not present, the paint system shall consist of two coats of Bar-Rust 235 (NSN 8010-01-359-7235) (5-mil minimum DFT per coat), or equal, and a top coat of haze gray (#26270) per MIL-E-24635 (NSN 8010-01-344-5309) (3-mil maximum DFT) for a total of three coats of paint.

d. Where paint has a tendency to pull away and leave thin films such as the edges of plates, edges of lightening holes, weld lines, etc., apply a third coat of Bar-Rust 235 (NSN 8010-01-359-7235) (5-mil minimum DFT), or equal, before applying the top coat of haze gray (#26270) per MIL-E-24635 (NSN 8010-01-344-5309) (3-mil maximum DFT).

e. On horizontal surfaces, deck gray, formula 20 may be used to touch up haze gray (#26270) per MIL-E-24635 (NSN 8010-01-344-5309).

050-3.3.6.1 Coating Systems. Whenever it is practicable and funds are available, the following coating systems are recommended for optimum service life, maximum durability, and minimum maintenance:

a. Abrasive-blast to near-white metal all of the freeboard area from the upper limit of the boot top to the main deck or cap rail. Extend this blast-cleaned area inboard and downward 6 inches below the cap rail or deck coaming. Apply an inorganic zinc silicate coating approved for exterior topside use as specified in NSTM S9086-VD-STM-010 Chapter 631, VOLUME 1, PRESERVATION OF SHIPS IN SERVICE – GENERAL (9190). To preserve color uniformity of adjacent ships in the berthing site, use only an inorganic zinc coating that has a dull grayish color. This color is characteristic of the majority of these coatings, but some manufacturers introduce a reddish colorant into their inorganic zinc products. For color uniformity, the latter should not be used. Apply the inorganic zinc coating in one coat at 3-to 5-mil dry film thickness. No additional topcoat is required.

b. . Complete the same abrasive blasting procedure as detailed above. Apply a mist coat of formula 150 to a maximum dry-film thickness of 1 mil. After drying, apply two coats of epoxy-polyamide coating, MIL-P-24441, as follows: one coat, each of formula 151 haze gray topcoat. Apply each coat at 2-to 3-mils dry film thickness to a total minimum coating thickness of 6 mils.

050-3.3.6.2 Bituminous Emulsion (NSN 8030-00-290-5140, 5-Gallon Pail). For use on weather-deck areas, under lockers, cable reels, ammunition ready service boxes, and other such areas where water ordinarily stands causing excessive corrosion. Surface shall be thoroughly cleaned, and all rust and paint removed prior to coating application, except that it may be applied over intact primer. For appearance, a coat of aluminum paint may be applied directly over the bituminous emulsion.

050-3.3.6.3 Inaccessible Places. To facilitate removal of rust and scale in inaccessible places, such as areas behind kickpipes and fittings, spray application is suggested. The appropriate grade of metal-conditioning compound should be applied over the areas affected. Grade I, light, will loosen rust and scale more rapidly than grade 2, heavy. However, where difficulty with washing off because of heavy rain is experienced, grade 2, heavy, should be used, grade 2, heavy, may also be more suited for vertical surfaces.

050-3.4 DECKS AND DECK EQUIPMENT

050-3.4.1 Decks.

050-3.4.1.1 Wood Decks. The following is general information relative to the preservation of wood decks. Preservation measures for wood are intended to:

a. Limit ingress of water into structural areas, and underlying wood decks, and facilitate drainage of water from under wood decks.

b. Limit moisture penetration into wood to prevent rot.

c. Treat wood with preservative to slow fungus attack. Drainage may be facilitated by drilling drain holes approximately an inch in diameter in steel bounding bars at the level of deck plating. These holes shall be reamed out annually. In addition, all carriers shall be listed about two degrees and rimmed about one degree to facilitate run-off rainwater.

Wood sides above water line and upper works shall be thoroughly cleaned and any bare wood coated by brushing, spraying, or soaking with wood preservative conforming to MIL-W-18142 (NSN 8030-00-282-0971). All topside fraying surfaces and other locations where water can penetrate and cause decay shall be saturated with wood preservatives and sealed to prevent entry of water. After at least 72 hours drying time, the entire surface shall be coated by spray or brush with one coat of aluminum paint, prepared by mixing 2.0 pounds aluminum paint FED SPEC TT-A-468, type II, class B, to 1 gallon of mixing varnish, MIL-V-1174, followed by two coats of exterior gray paint. Application of paints or preservatives should only be accomplished after a period of relatively dry weather.

Special attention must be paid to sealing for dehumidification, as wood tends to shrink and split or open seams through which moisture can pass into the interior of the ship. To avoid the drying effect of the sun's heat, it is advantageous to erect a shelter over the topside structure. Typical plans are NAVSEA dwgs 805-688682 through 805-688685, prepared for MSCO types. Where practicable, the topside shelter shall enclose the deck machinery sufficiently to provide a reasonable hermetic seal. The topside equipment should then be kept under dynamic dehumidification with the below-decks equipment. In this way, optimum preservation of topside equipment will result, in addition to protecting the wood from decay.

050-3.4.1.2 Decks Inactivation. Flight decks shall be watertight; repairs will be authorized only on a case basis when the existing deck shows evidence of leaking. Deteriorated nonskid on steel decks shall be removed and a suitable coating applied. For MOB-B assets, Flight deck openings (i.e. landing lights, firefighting and washdown nozzles, etc.) shall be covered by 1/8 inch or 3/8 inch steel plate and seal welded. After welding apply a suitable paint coating in accordance with paragraph 050 3.3.6. Tiedown fittings shall be covered with 1/4 steel plate for steel decks and aluminum plate for aluminum decks. The plates shall be drilled and tapped for a ″J bolt″ or other mechanical means of attaching to deck. Seal with waterproof caulking to exclude the entrance of water. Catwalk tracks and elevator areas shall be covered by 1/2 inch exterior plywood. Deck hatches shall be serviced and sealed in accordance with paragraph 050-6.5.5.

a. Use 1/8 inch steel plate for the following applications:
   1. Landing lights
   2. Firefighting and Washdown nozzles.

b. Use 3/8 inch steel plate for the following applications:
   1. Deck drains.
   2. Deck hatches.

NOTE

Asbestos containing materials have been found to be in nonskid, especially in applications requiring additional fireproofing. Any nonskid to be removed must be tested for the presence of ACMs. INACTSHIPMAINTO representatives may require additional testing of remaining nonskid (refer to Table 050-9-1, paragraph 1.m.(1.).

050-3.4.1.3 Steel Decks Covered With Non-Skid. Nonskid shall be in good condition and the deck shall be watertight. Nonskid shall be removed and a suitable paint coating applied, only in areas showing signs of deterioration.

050-3.4.1.4 MSO and MSC Decks. If decks have been covered with polyurethane, only local patching is required. If ordinary paint has been used, it shall be removed and the polyurethane coating, conforming to MIL-D-2461 Type II Class 2, shall be applied in accordance with NSTM S9086-VG-STM-010 Chapter 634, DECK COVERINGS.

050-3.4.1.5 LSD Well Decks. No repair or preservation is required until activation.

050-3.4.2 Masts, Spars, Booms, Cranes, Boat Davits, Rigging, Lifelines, and Stanchions. Steel masts, spars, and booms shall be primed and painted with haze gray epoxy based paint as necessary to ensure preservation. If wood, apply aluminum paint before over coating with haze gray. Boat booms shall be removed and stored in a dehumidified space. For boat and aircraft (B & A) cranes, place boom in stowage cradle and enclose control stand.

050-3.4.2.1 Masts, Spars, Booms, Cranes, Boat Davits, Rigging, Lifelines, and Stanchions (Carriers (CV) Only) Steel masts, spars, and booms shall be primed and painted with haze gray epoxy based paint as necessary to ensure preservation. If wood, apply aluminum paint before over coating with haze gray. Boat booms shall be removed and stored in the hanger bay, a non-dehumidified space, unless the total encapsulation method of inactivation has been employed. For boat and aircraft (B & A) cranes, place boom in stowage cradle, enclose control stand, and remove wire rope for disposal. A/C hook and boat hook shall be cleaned, preserved with grade 2 thin-film corrosion preventive compound, tagged and stowed in the hanger bay, a non-dehumidified space

050-3.4.3 Wire Rope. Wire rope running rigging shall be removed from place and turned in for disposal (e.g., Defense Reutilization and Marketing Office (DRMO) or Region (DRMR)) during stand-down.

Remove all serving from wire rope standing rigging which remains in place. Clean the exterior surface and preserve with three coats of solvent cutback corrosion preventive, MI-C-16173 (“ESGARD PL-2”), Grade 2

050-3.4.4 Winches. Whenever possible, weather deck winches are to be removed from their foundations and placed in dehumidified spaces such as enclosed tanks or well deck or cargo holds. Winches remaining on the weather deck shall be encapsulated and placed under D/H.

050-3.4.5 Davits. As applicable, cranes (excluding machinery) shall be painted as specified in paragraph 050-3.4.2. The socket steps shall be thoroughly lubricated with the lubricant regularly used. All items (e.g., goosenecks, swivels, ramp, sheaves, blocks, and pins) shall be cleaned, preserved with Grade 2 thin film corrosion preventive compound. Davit keeper bars must be welded to preclude davit movement. Appropriate records should be made in the ships stowage plans, CSMP, and the activation work list.

To simplify the procedure, the boat handling system is categorized into four subsystems: electrical, davit arm(s) and sheaves, winch and stowage.

a. Entire System.
   1. Perform system inspection, cleaning and test operation of the boat handling system. Log any non-corrected discrepancies in the CSMP.
   2. Secure power to the system and tag “OUT OF SERVICE.”
   3. A complete set of mounting bolts and associated hardware required for reinstallation is to be placed into a cloth bag (NSN 8105-00-281-3924) and attached to the removed component. Attach an identification tag to each item to indicate original installed location.
   4. Clean and paint all exposed surfaces requiring touchup, except nameplates, in accordance with NSTM S9086-VD-STM-010 Chapter 631, VOLUME 1, PRESERVATION OF SHIPS IN SERVICE – GENERAL, Table 63 1-3 4.
   5. Lubricate all grease points in accordance with PMS.

b. Electrical Subsystem
   1. Motor Controller: If motor controller is on the weather deck, place a desiccant bag (NSN 6850-00-264-6573) inside the controller box and close the cover. Use E & T Plastics, Inc. shrink wrap (part number ET-SW-312), or equal and shrink the plastic wrap around the controller. If the motor controller is located within a dehumidified space, no additional lay-up maintenance is required.
   2. Control/Limit Switches:

      (a.) Control Switches (Master Switch, Emergency disconnect Switch and Emergency Run Switch): Attach an identification tag to each item to indicate original installed location. Disassemble and stow in a dehumidified space.

      (b.) Limit Switches: Leave in place. Preserve any unpainted surfaces with grade 2 solvent cutback corrosion preventive compound (MIL-C-16173).

      (c.) Electrical Cabling: All electrical cabling that is exposed due to the removal of a component must be sealed or removed as detailed in paragraph 050.3.9.2.1.

c. Davit Arm(s) and Sheaves Subsystem.

WARNING

These steps MUST be accomplished in the order that they are listed below or a serious accident could result.

1. Davit Arm(s): Ensure arm(s) are left in stowed position.

   (a.) Trackway davits: Tack weld the keeper bar(s) to the frame to ensure the arms(s) remain stowed.

   (b.) Pivoted davits: Tack weld the locking pin into the latch mechanism release handle to ensure the davit arm(s) remain stowed.

2. Shock absorber(s), quick release hook(s), floating block(s), falls tensioning devices(s) and sheaves: Attach an identification tag to each item to indicate original installed location. Ensure all sheaves are match marked. Disassemble and stow in dehumidified space, unless otherwise noted. Refer to paragraph 050-3.4.5.c.(5) for sheaves internal to a strongback.
3. Preventer Stays and Spanline (as applicable): Clean the exterior surface and preserve with grade 1 solvent outback corrosion preventive compound (MIL-C-16173). If replacement is necessary, replace with aramid fiber (KEVLAR) in accordance with NAVSEA drawing 803-5184124.
4. Wire Rope and Monkey Lines: Remove for disposal.
5. Strongback and subcomponents (internal sheaves, bearings and latching mechanism): If there is sufficient accessible interior dehumidified space available to store the strongback assembly and mounting subcomponent (i.e., LST 1179 Class tank top), dismantle and stow entire assembly. If adequate internal ship space is not available, leave strongback assembly in place, preserve all accessible internal parts with grade 2 solvent cutback corrosion preventive compound (MIL-C-16173) and ensure latching mechanism is engaged and locked in place.

d. Winch Subsystem.
   1. Winch Drum(s): Remove the winch drum cover(s), clean the winch drum(s) and reassemble. Preserve any unpainted surfaces with grade 2 solvent cutback corrosion preventive compound (MIL-C-16173). Paint all exposed surfaces needing touch up. Do not paint nameplates.
   2. Gear Case: Drain the existing oil from the gear case. Blank off any vents or holes, if they exist, then fill the gear case with fresh oil so that the reduction gear will be fully immersed in oil. Preserve any unpainted surfaces with grade 2 solvent cutback corrosion preventive compound (MIL-C-16173). Paint all exposed surfaces needing touch up. Do not paint nameplates.
   3. Entire winch subsystem: Provide enclosure over each winch with dehumidification.

e. Stowage Subsystem.
   1. Keel Rest(s): Stow in lowered position. If hydraulic pump is used, attach an identification tag and stow in a dehumidified space. Preserve any unpainted surfaces with grade 2 solvent cutback corrosion preventive compound (MIL-C-16173).

050-3.4.6 Lifelines. . Portable lifeline stanchions and lifelines should be removed from place and stowed under dehumidification when their removal will not create a safety hazard. The exterior surfaces of stanchions remaining in place shall be painted with the same paint used on the rest of the ship. The interior surfaces, bases, sockets, and other inaccessible areas shall be treated with metal conditioning compound, cleaned of rust to the maximum possible extent, and preserved with grade 1 compound.

050-3.4.7 Cordage.. Except for lines necessary for safe mooring in the inactive berthing area, all cordage shall be offloaded, and either turned in to a supply activity ashore or redistributed as directed by the Type Commander. Springlay shall be considered cordage for the purposes of this paragraph.

050-3.4.8 Anchors, Chains, and Chain Lockers. Preservation procedures for anchors, chains, and chain lockers include

a. Anchors shall be touched up in accordance with paragraph 050-3.3.6.

b. Chains shall be scraped to remove loose rust and scale, and stowed in the chain locker under dehumidification.

c. Chain lockers and sump shall be cleaned and preserved while the chains are removed, then placed under dynamic dehumidification.

050-3.4.9 Ship's Boats. All ship's boats shall be removed during inactivation. Per NSTM S9086-TX-STM-010 Chapter 583, BOATS AND SMALL CRAFT, a Boat Inspection Report (BIR), NAVSEA 9583/3 (Rev 11-97), shall be obtained for each assigned boat during the first month of stand down prior to decommissioning. The BIR can be accomplished by any Intermediate Maintenance Activity, SUPSHIP, or Naval Shipyard. Cost of inspection, if necessary, will be funded from ship's OPTAR funds. The completed report shall be forwarded requesting disposition instructions to:
Commander
Naval Surface Warfare Center
Detachment Norfolk, Carderock Division
116 Lake View Parkway, Suite 200
Suffolk, VA 23435-2698

These actions need to be accomplished at the earliest opportunity to ensure that the boats are designated for either turn-in or for disposal prior to removal.

050-3.4.10 Inflatable Life Boats. Inflatable boats shall be removed and shipped:

a. East Coast, NAVSURFLANT READSUPPGRU PH 757-444-7139.

b. West Coast, COMNAVSURFPAC PH 619-437-2241.

Abandon-ship equipment installed in lifeboats, floater nets, and inflatable boats shall be removed and turned in to stocking point.

050-3.5 TANKS

050-3.5.1 Fuel and Lubricating Oil Tanks. The following is general information for guidance in the preservation of fuel oil, diesel oil, lubricating oil, gasoline, and JP5 tanks and their contents.

050-3.5.2 Stripping Tanks. All fuel tanks of every kind including ship's propulsion, storage, service, settling and JP5 tanks shall be pumped empty and stripped of residual fuel. Completion of this action for ships and craft scheduled for transfer to the Navy Inactive Fleet shall be validated by INACTSHIPMAINTO during compartment turnover inspections, and reported to the Navy Inactive Fleet upon completion of inactivation for each vessel. (Refer to Table 050-9-1).

Tank vents shall be closed upon installation of desiccant bags and final closing of the tanks.

Those tanks that were cleaned to remove all oil films shall be dried and sealed with desiccant bags unless ballasted with water.

050-3.5.2.1 Fuel Oil Seawater Compensating Tanks. The removal of seawater and residual fuel from compensating tanks for the purpose of tank cleaning requires a controlled process. The removing activity shall develop a procedure using the following references as a guide:

SUPSHIP, Portsmouth SKETCH 53711-541-6687001 COMPENSATING FUEL OIL TANKS ON CG-47, DD-963, AND DDG-993 CLASS SHIPS, GUIDANCE FOR PROCESS CONTROL PROCEDURE PREPARATION WHILE WATERBORNE

Procedures for Dewatering/Defueling Individual Compensating Fuel Tanks on DD-963 and CG-47 class ships, INGALLS SHIPBUILDING, PLANNING YARD ENGINEERING, Rev. A, October 1999.

050-3.5.3 Standard Inactivation Or Safe Stow Inactivation. Tank vents shall remain open with flash screens installed, and tanks sealed from adjacent spaces (manhole covers installed).

050-3.5.3.1 Fuel Oil Storage, Service, Settling, JP5, FO Contamination, Waste Oil and Oily Waste Water Tanks. Each fuel oil storage, service, settling, JP5, FO Contamination, Waste Oil and Oily Waste Water tank shall be pumped to empty. Water and sludge shall be stripped from all tanks.

050-3.5.3.2 AVGAS and MOGAS (Not Ship Propulsion) Tanks. All tanks and systems shall be completely emptied of all fuel and thoroughly flushed. The tanks and systems shall be cleaned and gas freed to meet the classification Safe For Men Safe For Hot Work in accordance with NSTM S9086-CH-STM-030 Chapter 074, VOLUME 3-GAS FREE ENGINEERING.

050-3.5.3.3 Lubricating Oil Storage Tanks. These tanks shall be pumped empty and hand wiped. Tanks shall be protected by dynamic D/H. The vents shall be open.

050-3.5.3.4 Tanks Required to be Ballasted. Fuel tanks required to be ballasted will be cleaned and gas freed, then filled with fresh water. All other tanks required to be ballasted will be filled with clean fresh water. Required tanks as well as location are contingent upon the tow master's determination and NAVSEA SL740-AA-MAN-101 (U.S. Navy Towing Manual). Do not use corrosion inhibitors.

Since corrosion inhibitors are effective only below the level of the water, thin-film rust preventive, MIL-C-16173, Grade 2 or MIL-P-20305 should be applied to all areas above anticipated water line and to about two feet below. These areas shall be inspected as far as practical at the time of routine material inspections.

050-3.5.3.5 Tank Systems. . All pump rooms, cofferdams, steam smothering lines, heating lines, and cargo vent lines in their entirety shall be drained, cleaned, and gas freed as necessary to remove free fuels.

050-3.5.4 Cargo Tanks In AO Type Ships. Cargo tanks, cargo pipelines, and pumps shall be thoroughly stripped, cleaned, and gas free in accordance with the Manual for Cargo Tank Cleaning (NAVSEA 0900-016-0010) prior to arrival for inactivation.

All pump rooms, cofferdams, steam smothering lines, heating lines, and cargo vent lines shall be drained, cleaned, and gas freed.

050-3.5.4.1 Cargo Tanks Preservation. Preservation of cargo tanks with tank coating systems (MIL-P-23236) applied shall be limited to cleaning and touchup of those localized areas where rust and corrosion are evident in accordance with NSTM S9086-VD-STM-010 Chapter 631, VOLUME 1, PRESERVATION OF SHIPS IN SERVICE – GENERAL. The tanks shall be closed and sealed from other sections of the ship and the atmosphere with no additional preservation coating applied or D/H airflow. The vents shall be left open with flash screens installed.

050-3.5.4.2 Rust and Scale. Cargo tanks [uncoated or coated with paints other than coatings (MIL-P-23236)]; shall have all loose rust and scale, exclusive of bonded scale, removed from the interior surfaces of the tanks. The tanks shall be preserved by applying a coat of rust preventive compound MIL-C-16173, Grade 2, to all interior surfaces. Hatches and openings of tanks shall be closed and sealed. Vents of these tanks shall remain open with flash screens installed and tanks sealed from adjacent spaces under D/H.

050-3.5.5 Ballast and Freshwater Tanks. Ballast and freshwater tanks not used to ballast the ship shall be dried out, rough scraped, and placed under dynamic D/H (refer to Section 6). Safety screens must be provided to cover those tanks placed under dehumidification.

The bilge gravity drain system and associated collection tanks shall be thoroughly drained. The collection tank internal surfaces shall be dry, rough scraped and left open to dehumidification. Safety screens shall be installed over tank openings.

050-3.5.5.1 Corrosion Inhibitor . Since the corrosion inhibitor is only effective below the water, thin-film rust prevention MIL-C-16173, Grade 2 should be applied to all areas above the anticipated waterline and to about two feet below. These areas shall be inspected as far as practical at the time of routine material inspections.

050-3.5.5.2 Bacteria. Anaerobic bacteria present in water may be responsible for corrosion of steel under conditions where oxygen is excluded. This type of activity results in the evolution of hydrogen sulfide gas, H_2 S, with its characteristic odor of rotten eggs. If this condition is noted during periodic inspections of inactive ships, notify NAVSEA.

050-3.5.5.3 Ballasting Tanks. . The procedure for the preservation of ballasting tanks coated with flotation compound in LPD, LSD, and LST type ships is as follows:

a. Thoroughly clean and remove all traces of flotation compound from ballast tanks that have been treated with flotation type rust preventive compound.

b. . After testing for absence of vapors per NSTM S9086-CH-STM-030 Chapter 074, VOLUME 3-GAS FREE ENGINEERING, place the tanks under dynamic D/H. Do not apply any type of protective coating.

050-3.5.6 Double Bottoms, Cofferdams, and Blisters. Open, rough scrape, and clean out loose debris from voids, double bottoms, cofferdams, and blisters; then leave open to dehumidified air with a safety screen installed across manholes in decks.

NOTE

In case of open ocean tows, secure voids, etc. for sea per tow master's determination and NAVSEA SL740-AA-MAN-101 (Subject: U.S. Navy Towing Manual). Hang safety screens in the vicinity of those tanks that will be reopened and placed under dehumidification.

050-3.5.7 Locked In Fresh Water Ballast Tanks and Voids. Test contents of tank or void for sodium chromate concentration. If above 5 ppm, remove ballast water and dispose of as a hazardous waste.

050-3.6 MAIN PROPULSION SYSTEMS AND AUXILIARY PRIME MOVERS

050-3.6.1 Gas Turbines. Gas turbines shall be inactivated and preserved during periods of inactivation in accordance with the requirements and instructions of NSTM S9086-HC-STM-010 Chapter 234, MARINE GAS TURBINES. Reactivation procedures shall also be in accordance with the requirements and instructions of NSTM S9086-HC-STM-010 Chapter 234, MARINE GAS TURBINES.

050-3.6.2 Boilers Inactivation. Accomplish the following in accordance with NSTM S9086-GY-STM-010 Chapter 221 BOILERS:

a. Conduct a visual inspection and document material conditions and all boiler discrepancies, submit a report of boiler conditions and all repairs required for reactivation. (Enter in CSMP and BIRMIS.)

b. Following completion of inspection, place boilers under hot air lay-up.

c. Within 24 hours of deactivating hot air lay-up, provide desiccant bag protection as follows:
   1. Place twelve (12) desiccant bags in steam drum.
   2. Place eighteen (18) to twenty-four (24) desiccant bags in water drum and headers.
   3. Place twelve (12) to eighteen (18) desiccant bags in the saturated furnace.
   4. Place twelve (12) desiccant bags in the super heater furnace.
   5. Provide humidity cards in spaces with desiccant bags. Check humidity cards every seven (7) days and replace desiccant bags when cards indicate 50 percent relative humidity.
   6. Continue maintenance of desiccant bags until activation of dehumidification equipment.

d. Upon activation of D/H equipment, remove desiccant bags and prepare each boiler for dehumidification as follows:
   1. Remove 25 percent of the access panels and inspection doors.
   2. Leave drum manholes and header handholes open.
   3. Remove one (1) burner register from each furnace and install screen mesh covers to provide D/H to furnace firesides.

e. Safety valve atmosphere escape piping (SVAEP): Seal weld covers on all boiler steam escape piping in accordance with paragraph 050-6.5.5. Drain and dry the SVAEP entire piping system in accordance with paragraphs 050-3.8.7 and 050-3.8.7.1.

050-3.6.2.1 Boiler Cleaning. In order to properly prepare the boiler firesides for inactivation, water washing, as prescribed in NSTM S9086-GY-STM-010 Chapter 221 BOILERS, is considered the best method of ensuring that all soot and accumulations of fireside deposit buildup are removed. However, water washing will have an adverse effect on the brickwork and refractory materials if the boiler is not thoroughly dried out afterwards. For this reason, Commanding Officers of ships to be inactivated are to schedule and carry out water washing of boiler firesides so as to ensure that the boilers so cleaned will have been steamed a minimum of 100 hours of underway operation before commencement of inactivation overhaul. The procedure is as follows:

a. Water washing and drying out must be done according to the procedure described in NSTM S9086-GY-STM-010 Chapter 221 BOILERS.

b. Clean boilers thoroughly since there will be no further washing of the boilers before inactivation. Particular attention should be paid to the economizers.

c. As soon as the firing and idling cycles prescribed in NSTM S9086-GY-STM-010 Chapter 221 BOILERS are completed, steam the boiler to obtain a minimum of 100 hours of underway operation. Maintain the boiler firing rate as high as practical during this period in order to ensure complete dryness of the furnace refractory. Light off both furnaces of a double furnace boiler.

d. Subsequent to cleaning the boiler, tubes must be blown a minimum of once a watch to keep the firesides clean.

e. The Commanding Officer must also prepare a work request for the Naval shipyard or repair facility assigned the inactivation overhaul to inspect the firesides, watersides, and brickwork of all boilers, submit a report of inspection, and make recommendations as to repairs required or cleaning necessary. The request to the shipyard should also list all known defects or outstanding work and a report of compliance with the foregoing described procedure for water washing and drying out the boilers. The ship's force is to accomplish all work required to prepare the boiler for inspection, and to perform all overhaul work and boiler lay up work within its capacity.

050-3.6.2.2 Boiler Inspection. The following procedure is to be used as a guide in the preparation of the boiler for inspection and inactivation. Ship's force will assist or accomplish work wherever possible. The procedure should not be construed as limiting the scope of the inspection or work to be accomplished in any way. It may be modified or elaborated upon as necessary for specified boilers when unusual conditions are encountered.

a. Remove all access panels and inspect doors (including superheater access doors).

b. Remove all boiler drum internals.

c. Remove all refractory corbels in the boiler furnace.

d. Cut out exploratory blocks of tubes in different areas of tubebanks to permit inspection of trouble spots (areas which experience indicates to be particularly susceptible to furnace side deposit buildup). Recommended areas are:

1. For divided furnace S.H. control boiler:

(a.) From inside the furnace, main tube bank (saturated side), starting from the 10th RA tube from front furnace wall to about the 15th tube, cut an exploratory block into the tube bank. This block should extend to midpoint of the bank. A similar block should be removed, starting with second RA tube from rear furnace wall. Then, similarly, and directly opposite to these blocks, cut in from boiler outboard side (under the economizer) to midpoint of the bank.

(b.) From within both furnaces, cut out the division wall tubes at the superheater support plate locations. The width of these blocks should be 3 to 5 tubes, or as may be needed for adequate inspection of these plates.

(c.) If visual inspection of superheater tubes has revealed distortion and internal or external corrosion, an exploratory block of tubes may be cut into the superheater to permit further inspection of superheater tubes.

2. For two drum D-type boilers:

(a.) From outboard (economizer) side, main tube bank, starting with the third tube from the front furnace wall to about the 12th tube, cut an exploratory block into tube bank. This block should extend to the midpoint or center row. A similar block should be removed, starting with the third tube from the rear furnace wall.

(b.) From the furnace side, cut out superheater screening tubes as necessary to permit access, and inspection of superheater support plates.

(c.) If visual inspection of superheater tubes has revealed distortion and internal or external corrosion, an exploratory block of tubes may be cut to permit further inspection of superheater tubes.

e. Tubes removed should be split and examined for internal corrosion.

f. Make a thorough inspection of all areas noting in particular the following:

1. Front and rear portion of water drum where generating tubes enter the drums and tubes in these areas.
2. Superheater tubes, seal plates, and support plates. Remove brick and diagonal seal plates adjacent to the superheater on both superheater and saturated sides in order to inspect fully the superheater tube ends where they enter the heater.
3. Drum protection plates above and below superheater.
4. Headers and tube surfaces from which corbels have been removed.
5. Plastic chrome bore on stud tubes for condition and dampness. Remove chrome ore if any evidence of dampness exists.
6. All refractory surfaces, including refractory and insulation behind all waterwalls. This will require removal of some casing panels to permit inspection.
7. For boilers that do not have floor tubes, two refractory exploratory blocks about 18 inches square should be cut out down to the brick pan in diagonal corners or an 18-inch square should be removed from the center of the pan. If any evidence of dampness exists, the brick should be removed from the entire deck and 1 foot up the wall of the boiler.

g. The following work should be accomplished:

1. Mechanically clean boiler watersides.
2. Mechanically clean all accessible areas of the boiler firesides. Cut out additional tubes, if necessary to gain access to remove built up deposits. All deposits imbedded around tubes should be removed.
3. Mechanically clean all accessible areas of the boiler firesides. Cut out additional tubes, if necessary to gain access to remove built up deposits. All deposits imbedded around tubes should be removed.
4. For boilers having floor tubes, remove the refractory from the floor regardless of its condition. This floor must not be replaced until activation. The brick pans and outside of the floor tubes should be thoroughly cleaned and painted with two coats of heat-resistant paint.

h. The boiler casing panels, access doors, and drum internals must be reinstalled and the boilers then preserved in accordance with D/H procedures outlined in paragraph 050-6.6. The boilers, uptakes, and smoke pipes shall be preserved by dehumidified air in accordance with NAVSEA dwg 53805-150726A and paragraph 050-6.6.

i. On DE-type boilers, the plastic refractory covering the lower ends of the furnace side wall tubes and the side wall header should be removed and not reinstalled until activation of the ship. Boilers and refractories shall be kept dried out during the inactive period by circulation of dehumidified air through the furnace by means of package D/H machines or recirculating fans discharging into the furnace and allowing the air to escape from the furnace through a manhole or access plate in the uptake within the ship.

050-3.6.2.3 Uptakes and Smoke Pipes. Uptakes and smoke pipes must have interiors cleaned thoroughly, painted with high temperature aluminum paint, and preserved by D/H. The inner smoke pipe and the annular space between the inner and outer smoke pipes shall be sealed off from the weather by closing these spaces at top of the smoke pipe. Open accesses and expansion joints in the outer smoke pipe which permit exposure of spaces to the weather must be sealed. Refer to paragraph 050-6.5.5. If practicable, the annular space between the

inner and outer smoke pipes and uptakes must be placed under D/H by removing access doors. Surfaces exposed to weather must be preserved according to paragraph 050-4.1.1.

Rig staging, clean uptake and smoke pipe interiors by wire brushing (cover economizers during wire brushing). Prepare the annular space between the inner and outer smoke pipes and uptakes for dehumidification.

All asbestos/fiberglass insulation shall be repaired/sealed, such as pipe lagging, equipment insulation and structural (bulkhead, overheads, etc).

Seal all open weather accesses and expansion joints in the outer smoke pipes in accordance with paragraph 050-6.5.5. Seal off the inner smoke pipe and the annular space between the inner and outer smoke pipes from the weather by closing these spaces at the top of the smoke pipe.

NOTE

Seal smoke pipes as soon as possible to prevent rainwater entering boilers and uptake spaces. Empty uptake spaces of material spares that have a shelf life. Clean, preserve (MIL-C-16173, Grade 2) and secure shipboard COSAL spares.

050-3.6.3 Steam Turbines and Reduction Gears. Inactivation shall conform to the following: NSTM S9086-G9-STM-010 Chapter 231, PROPULSION & SSTG STEAM TURBINES, NSTM S9086-HK-STM-010 Chapter 241, PROPULSION REDUCTION GEARS, COUPLINGS, CLUTCHES, AND ASSOCIATED COMPONENTS and NSTM S9086-RG-STM-010 Chapter 502, AUXILIARY STEAM TURBINES. The steam and water sides of steam turbines and reciprocation steam engines will be preserved with D/H. The interior surfaces of lubricating oil systems of the engines and reduction gears must be preserved with grade 2 compound by pumping it through the lubricating oil system. Prior to compound application, the steam must be completely drained, lines broken as necessary, and must be thoroughly cleaned, including the sump. Cotton muslin bags fabricated from Type 1, class C of JAN-C-485 cloth, (cotton sheeting, NSN 8305-00-244-1595), should be installed in main lube oil strainers during circulation of preservative. The bags should be discarded and replaced by clean bags when they become coated with foreign matter. The machinery must be jacked over slowly while preserving interior surfaces by pumping or fogging.

050-3.6.3.1 1 Reduction Gear Casings. Reduction gear casings shall be prevented at top and bottom as practicable to allow diffusion of dry air. The venting is done as the last measure of inactivation in the engine rooms. Vent openings must be covered with a very fine, strong wire screen, securely fastened, and installed so as to prevent entry of foreign material. Take care in performing this venting, as entry of foreign matter into the turbines and gears is very serious. After interiors of the gear casings have attained an acceptable relative humidity, subsequent venting of units may be through built-in vents (if installed) provided such vents are protected from entry of foreign material. A responsible person must be present at all times when openings are not protected by a screen. During periodic overhauls and dockings that require industrial assistance, openings must be kept closed. Inspection to verify the absence of foreign matter is mandatory prior to sealing or jacking over turbines and reduction gears.

050-3.6.3.1.1 Line Shaft Bearing(s). Line shaft bearings shall be drained, sump cleaned and filled with grade 2 compound and jacked over at the same time that the main reduction gears are being preserved. Drain the grade 2 compound from the bearings upon completion of jacking over the main reduction gears. Spray grade 2 compound into the upper section of the casing. Wipe all excess grade 2 compound from sump and reinstall access plate and drain plug. Post sign stating that line shaft bearings(s) have been preserved with grade 2 compound.

050-3.6.3.2 Main Engines. After preservation of main engines they must be secured with the propeller(s) in the docking position and a permanent shaft lock installed on the tail shaft coupling. Refer to paragraph 050-3.6.5.1 for details on locking main propulsion shafting. A sign shall be placed at the throttle stating DO NOT JACK--SHAFT LOCKED and giving the compartment number of the shaft locking device location. As applicable, remove carbon packing, reassemble rings, clean, fit, wrap in grade C paper, and box. Tag each ring to identify the recess in the gland housing or diaphragm from which removed, as well as the gland or diaphragm and unit. Stow adjacent to the unit, being careful to prevent breakage or contact with oil or grease. Place a tag on the gland or diaphragm of the unit from which the carbons were removed, showing location of stowage and box number containing the rings.

050-3.6.4 Diesel and Gasoline Engines. Procedures described herein for diesel engines are in general applicable to gasoline engines except for the fuel injection system. Gasoline engine combustion chambers, cylinder walls, and pistons should be treated using a spray through the spark plug holes. Inactivation should be in accordance with NSTM S9086-HB-STM-010 Chapter 233, DIESEL ENGINES.

050-3.6.4.1 Detailed Procedures. The instructions that follow are issued as a general guide to be amplified as the detailed design of the particular engine requires. The final procedure adopted must be such that a sufficient quantity of the appropriate grade of compound is brought into intimate contact with the metal to be protected. The compound must displace any remaining trace of dirt, water, or oil and leave a continuous protective film on the surfaces. The excess compound is drained off to prevent the formation of stagnant pools that may, with age, tend to solidify and complicate putting an engine back into service. When engines are preserved and stored in a dehumidified space, no external preservation need be applied. Hereafter in this procedure, when the word “preservative” is used, it shall be defined as follows:

a. MIL-C-16173 (ESGARD PL-2) Grade 2, for all fluid systems and internal surfaces of high speed engines (1500 RPM or more) and fuel systems of low speed engines.
b. Appropriate grade of MIL-C-16173 (ESGARD PL-2) Grade 2 for low speed engine water and lubricating systems and external surfaces of all engines.

050-3.6.4.2 Motoring and Air Operation. If motoring or operation on air is feasible, the following steps are indicated:

a. Thoroughly drain engine of all water, lubrication oil, and fuel oil.
b. Remove oil-cartridge type filter elements and clean the interiors of all strainer and filter housings or containers.
c. Install new cartridge type filter elements.
d. Flush engine seawater system with preservative.
e. Drain freshwater system and fill with preservative by connecting a supply line to the drain connection for the system. Cause system to overflow from expansion tank vent to ensure all surfaces are coated with preservative. All ferrous parts such as ferrous housings, shafts, gears, flanges, or studs should be properly treated.
f. Fill lubrication system to normal capacity with preservative so that the pump can take a full suction and in wet sump type engines, a good splash effect from the cranks can be attained.
g. Disconnect fuel line at injection pump header and circulate type 1, grade 10 or 30, MIL-L-21260 through the injectors, booster pump, filter, and fuel lines. Spray or brush preservative on internal surfaces of fuel tanks. Do not use grade 2 preservative in injection pumps or nozzles.

h. Relieve cylinder compression by opening relief or indicator cocks or by placing shims under exhaust valve tappets or by other suitable means to keep the engine from firing.

i. Drain lubricating oil and cooling water from engine reserve and reduction gear systems.

j. Treat filters and strainers in reverse and reduction gear lubricating system in the manner as those in engine system covered by steps b and c.

k. Flush reserve and reduction gear water system with preservative.

l. Fill reserve and reduction gear water system with preservative to normal capacity.

m. Motor engine at a speed sufficient to circulate compound through engine system. Several minutes is usually adequate, but visual checks should be made to verify that the compound is reaching all points. If an electrical starting motor is used for turning the engine, runs should be limited to 30 seconds each to prevent overheating the motor; at least two minutes should elapse between runs.

n. Remove inspection and access covers and spray all gears, rockers, linkage, cams, and push rods with preservative while engine is being motored. Spray all surfaces, bearings, linkages, working parts of dry type clutches and reverse mechanism. (No harm will be done if compound comes in contact with friction surfaces.)

o. Drain excess compound from all systems, paying particular attention to low spots, pockets, and exposed piping where the compound could collect. Save draining of compound for future use.

p. Reconnect all lines for normal operation.

q. Remove any shims previously placed under valve tappets.

r. Replace all inspection, handhole, and valve covers.

s. Seal all openings into engine to prevent entrance of dirt or water.

t. Using grade 2 compound, spray or brush over all external unpainted areas; however, if engine must be exposed to the weather, grade 1 compound should be used for this purpose. When engines are preserved and stored in a dehumidified space in a warehouse or aboard ship, no external preservative need be applied.

q. Tag engine to indicate the following:

1. Fluid systems have been treated with rust preventive. The tag must include the date on which engine was treated.
2. Statement that engine is not to be turned over until ready to be put into operation (as turning over may impair the protective film).
3. Statement that procedure as specified in Section 11 must be followed before placing engine in service.
4. Statement that lubrication, cooling, and fuel systems must be filled before operating.

050-3.6.4.3 Non-Motoring or Air Operation. Where it is not practical to motor an engine over by air, starting motor, or motorized generator to treat it with preservative, application may be made as follows:

a. Drain fuel and water systems completely.

b. Fill freshwater system with preservative by connecting a supply line to drain connection for the system. Cause system to overflow from expansion tank vent to ensure all surfaces are coated. Drain compound from the system and close drain connection.

c. Fill seawater system with preservative in the same manner as fresh water system. If installed in a ship, verify that the sea valve is locked closed and does not leak. All ferrous parts such as shafts, gears, flanges, or studs should be properly treated.

d. Drain lubricating oil system. Remove all filter elements, clean strainer and wipe down interiors of strainers, and filter containers, install new filter elements.

e. Break open a fitting in the lubricating oil piping system and connect discharge side of separately driven pump to the disconnected engine lubricating oil system fitting.

f. Use separately driven pump to circulate preservative throughout the lubricating oil system of the engine while engine is being jacked or barred over. Discharge pressure of this separately driven pump should approximate the operating pressure of the engine lubricating oil system. Where possible, access plates should be removed to verify that compound reaches all points of lubricating oil system.

g. Interior surfaces of engine should be sprayed with preservative, and should include all internal parts such as the crankcase, connecting rods, crankshaft, and lower cylinder bores.

h. Remove inspection and access covers and spray all gears, rockers, linkage, cams and push with preservative while engine is being jacked or barred over with the turning gear. Spray all surfaces, bearings, linkages and working parts of dry type clutches and reverse mechanism. No harm will be done if compound comes in contact with friction surfaces.

i. Circulate type 1, grade 10 or 30, MIL-L-21260 through the injectors and fuel system. Do not use grade 2 preservative in injection pumps or nozzles.

j. Spray or brush preservative on internal surfaces of fuel tanks.

k. Disconnect separately driven pumps installed in step e.

l. Remove excess draining of compound from all pockets.

m. Replace access plates and covers.

n. Seal all openings into engine to prevent entrance of dirt or water.

o. Using grade 2 compound, spray or brush over all external unpainted areas. If engine is to be exposed to the weather, grade 1 compound should be used for this purpose. When engines are preserved and stored in dehumidified space in a warehouse or aboard ship, no external preservation need be applied.

p. Tag engine to indicate the following:
   1. Statement that the fluid systems have been treated with a rust preventive compound.
   2. Date on which engine was treated.
   3. Statement that engine is not to be turned over until ready to be put into operation (as this may impair the protective film).
   4. Statement that procedure as specified in Section 11 be followed in placing engine in service.
   5. Statement that lubrication, cooling, and fuel systems must be filled before opening.

050-3.6.4.4 Excess Compound. The total volume of combustion space is small. Any excess of compound may result in a hydraulic lock and cause serious damage when engine is started. Be sure to drain excess.

050-3.6.4.5 Reusing Compound. The compounds used have excellent flushing properties. When treating a dirty engine, remove any foreign matter that may collect on screens and strainers before considering engine properly treated and ready for future service. While used compounds may be added to and reused for the same purpose repeatedly, extreme care should be exercised toward cleanliness. Before reusing any compound, accumulated dregs should be allowed to settle out and be discarded. The remaining liquid should then be filtered.

050-3.6.5 Propellers, Main Propulsion Shafting, Rudders, and Skegs. The following is general information for guidance in the preservation of the subject items.

While the ship is in drydock, remove rope guards and fairwaters if not covered by effective boot seals (refer to paragraph 050-3.7.1 for criteria to determine if boot seals are effective) and inspect the shaft rubber covering for defects and degree of adhesion. If defects are found under the rubber, repair all cracks, pits, and rubber covering defects in accordance with prevailing NAVSEA instructions and military specifications. If the shafts have been rubber covered without removing the shaft waster rings, located at the ends of bearing journals, remove rubber covering for a distance of approximately 12 inches from the bearing journal, clip off waster ring and chip back bearing journal one-half inch. Inspect shaft surface for cracks, repair as necessary and replace rubber covering as previously specified. Apply pretreatment, formula 117, and antifouling paint to the rubber-covered surfaces, as specified for the steel portions of the hull. Anticorrosive paint must be omitted.

Remove submarine propellers and stow on deck of submarine from which removed. The shaft taper thus exposed is preserved by utilizing a fabricated structure similar to that shown on NAVSEA dwg SS212-4302-232996. Non-corrodible propellers that have been removed must be cleaned and preserved with either solvent cutback corrosion preventive grade 1, or strippable plastic coating. Steel propellers must; be cleaned and preserved by painting with one coat of wash primer, followed by two coats of red lead primer and two coats of gray deck paint. For ships that will proceed to the assigned berthing area under their own power, no preservation of propellers and shafting should be accomplished until arrival at that activity. After arrival in the berthing area, the ships must be docked and preserved in accordance with instructions contained in the chapter.

050-3.6.5.1 Shaft Locks. Install shaft locks to prevent accidental turning of shafts. This lock or keeper plate shall be fabricated of 1/2-inch steel plate, fitted to the coupling flange and drilled to accommodate the three top coupling bolts. The keeper plate shall be secured to the coupling flange with original coupling bolts and nuts, and ends of plate secured to hull frames port and starboard by four 1-inch diameter bolts, tow on each side. Refer to U.S. Navy Towing Manual.

050-3.6.5.2 Non-Corrodible Propellers. Non-corrodible propellers that have been removed must be cleaned and preserved with either solvent cutback corrosion preventive grade 1, or strippable plastic coating.

050-3.6.5.3 Controllable Pitch Propellers. Refer to NAVSEA 0944-LP-007-2010, figure 5-30. Pack items numbered 17 and 18. Plug both drains holes. Allow the blades to drift astern (this will occur during the tow.) Place desiccant bags in the system controllers. Upon completion of the above, ship's force inspect the gravity drain tank weekly and top off as necessary. Upon arrival of the ship at the INACTSHIPMAINTO, INACTSHIPMAINTO personnel will perform weekly checks during the first four weeks, topping off as necessary.

050-3.6.5.3.1 Check propeller hub lube oil system seals. Retain hub lube oil at 95 percent capacity when seals are in good condition. In cases where seals are leaking, drain the oil and flush out a system, renew seals, and refill the hub with lube oil to 95 percent capacity.

050-3.6.5.3.2 Propeller. Propeller blade rotating joints shall be preserved by application of polysulfide rubber paste. Details for applying this sealant are found in paragraph 050-3.7. Coat propeller, stem tube, and strut with the same coating system and number of coats as for steel hull ships (refer to paragraph 050-3.2.2.1).

050-3.6.5.4 Rudders and Skegs. Rudders and Skegs. Rudders and skegs are to be inspected while in drydock. If evidence of leakage is found, make necessary repairs and air tests. Represerve the interiors in accordance with NSTM S9086-VD-STM-020 Chapter 631, VOLUME 2, PRESERVATION OF SHIPS IN SERVICE - SURFACE

PREPARATION AND PAINTING, and the exteriors with the same system as the remainder of the hull (paragraph 050-3.2.2.1). Rubber-bearing clearances need not be taken if readings were taken during the inactivation or any recent drydocking.

Packing around rudder shafts shall be inspected and replaced where necessary with enough packing of appropriate size to seal the shaft with zero leakage. The quantity of packing installed shall be such as to maximize the amount of adjustment remaining on the packing gland take up studs (more than two inches of adjustment is not required).

050-3.6.5.5 Syntron or Mechanical Seal. Syntron and mechanical seals on the inboard end of the stern tube are to be removed and replaced with enough flax packing of appropriate size to seal the shaft with zero leakage. The quantity of packing installed shall be such as to maximize the amount of adjustment remaining on the packing gland take up studs (more than two inches of adjustment is not required). Replace gland and pull up tight to seal. Hang syntron seals on a bulkhead adjacent to the shaft gland.

050-3.7 PROPULSION SHAFT OUTBOARD BEARINGS AND STERN TUBE

050-3.7.1 General.

a. Seal. A leak proof seal must be provided to prevent the ingress of foul and silt-laden water and its various contaminants and will retain the preservative compound in the bearings during the inactive status of the ship. Either of the two procedures described herein should be followed to provide divers with a standard method of removal upon activation. The propulsion bearing seals should be installed after a positive lock has been secured on the shafts to prevent accidental turning of the shaft when the ship is undertow. One method of sealing is to use a two-component, cold bonded polysulfide (Thiokol) paste conforming to MIL-S-23498. This material may be applied to metallic or plastic hulls, and with certain modifications is adaptable to wood.

b. Preservative Compound. Use MIL-C-16173 Grade 2 (ESGARD PL-2). Protect all bearings and point surfaces to prevent chemical and electrical corrosion and displace all seawater to exclude the formation of marine growths and accumulation of abrasive mud or silt during the inactivation period. The preservative compound prevents freeze-up of the bearings, provides initial bearing lubrication, and be capable of being flushed out of the bearings at the time of reactivation of the ship.

050-3.7.2 Seal and Preservative. To adequately preserve the water lubricated stern tube and strut bearings of inactive ships, a leak proof seal and an effective preservative compound must be employed which will meet the following general requirements:

a. Seal. A leak proof seal must be provided to prevent the ingress of foul and silt-laden water and its various contaminants and will retain the preservative compound in the bearings during the inactive status of the ship. Either of the two procedures described herein should be followed to provide divers with a standard method of removal upon activation. The propulsion bearing seals should be installed after a positive lock has been secured on the shafts to prevent accidental turning of the shaft when the ship is undertow. One method of sealing is to use a two-component, cold bonded polysulfide (Thiokol) paste conforming to MIL-S-23498. This material may be applied to metallic or plastic hulls.

b. Preservative Compound. The preservative compound employed in this method must be water soluble, of low viscosity, and penetrable to all bearing voids. It must effectively protect all bearing and joint surfaces to prevent

chemical and electrical corrosion and displace all seawater to exclude the formation of marine growths and accumulation of abrasive mud or silt during the inactivation period. The preservative compound must prevent freeze-ups of the bearings, must provide initial bearing lubrication, and be capable of being flushed out of the bearings at the time of reactivation of the ship.

050-3.7.3 Materials, Equipment and Supplies. The following items are used to preserve the propulsion outboard bearings and stern tube:

a. Sealing Compound, MIL-S-23498 or equivalent, and associated primer. Pending availability of military specification material, Technical Research Company, Seattle, USN Ship Bearing Sealant is available. Other alternates which may perform acceptably are PR-380-MT (primer 1523M) manufactured by Products Research and Chemical Corporation, Gloucester City, NJ, and Sealing Compound Bearing Preservation (formula 117 primer), supplied by Philadelphia Resins Corporation, Montgomeryville, PA.

b. Mixing motor, approximately 350 rpm, 1/2 horsepower minimum, with chuck for item c.

c. Propeller mixer, 3 blade.

WARNING

Trichloroethane is toxic and shall be used only under conditions of adequate ventilation. Inhalation of vapors and prolonged contact with bare skin should be avoided. Whenever trichloroethane is used in closed spaces with limited ventilation, personnel should wear airline masks with forced air ventilation. Eye protection should be worn at all times when working with trichloroethane.

d. d. Trichloroethane solvent, 10 gallons.

e. Clean rags (grease and oil-free), 1 small bale.

f. 2-inch paintbrush (new), 2 each.

g. Paddles, oak or aluminum.

h. Putty knife.

i. 1/2-inch by 4-inch black iron nipples and caps, two per strut, also drills and taps for installing.

j. 2-inch wide vinyl or paper masking tape, 1 roll.

k. Antifreeze solution, ethylene glycol type, 20 percent by volume, to be used in the event that the ship is to be stored in water which may go below 0°C (32°F).

4

l. Large funnel for filling struts and stern tubes

m. Solvent-resistant gloves.

n. Can opener, rim-cutting type.

o. Scissors.

p. Shore durometer, type A (Shore Instruments Company, Jamaica, NY).

050-3.7.4 Bearing Sealing Procedures. The procedure for bearing preservation includes the following:

a. Inspection and cleaning of bearings

b. Preparation and cleaning of surfaces

c. Preparation of bearing seal primer and its application

d. Mixing and catalyzing of bearing sealant followed by its application

e. Curing time

f. Pressurization and testing for leaks

g. Introduction of preservative compound by gravity into bearing voids for complete immersion of the bearings.

NOTE

All materials used in plugs and structural modifications described herein, when not covered by a specification, shall be selected based on electrolytic corrosion compatibility and corrosion resistance to seawater.

050-3.7.4.1 Inspection and Cleaning. Remove and check the fairwaters and rope guards and determine that shafts have been inspected and repaired where necessary. Perform necessary cleaning of each bearing by use of air and water. Insert copper tubing between each stave for the entire length of the bearing and eject lodged sediment with a stream of air or water. When excessive clearances are in evidence, renew bearing staves as needed.

050-3.7.4.2 Preliminary Steps Before Sealing Procedure.

a. Drill and tap 1/2-inch IPS in tops of rope guards and fairwaters prior to their reinstallation on the ship (see Figure 050-3-2).

b. Remove tallow filling plugs from bottom of fairwaters and stern tubes to check for entrapped water. If stern tubes are leaking water at this point, they must be steamed out thoroughly and allowed to dry before soaking can take place. Refill with preservative and replace plugs.

c. Install rope guards and fairwaters and screw in 4-inch-long 1/2-inch IPS black iron filling and venting nipples. After struts will have nipples in fairwater and rope guard (Figure 050-3-2), while intermediate struts will have nipples in fore and after fairwaters. Do not install stem-tube fairwaters.

d. Insert items (removable) such as rags, packing, plugs, or rope into all voids through which sand could enter bearings during subsequent sandblasting operation. Water ingress and egress holes in fairwaters and rope guards may be conveniently plugged with tapered wooden plugs.

e. Disconnect water service pipe line to forward end of stern tube. Subsequent testing and filling and venting will be accomplished at this point.

f. Repack all stem tube packing glands with new packing. Tighten packing gland retaining ring firmly in place so that the gland will later withstand a pressure of 2 psi without leakage.

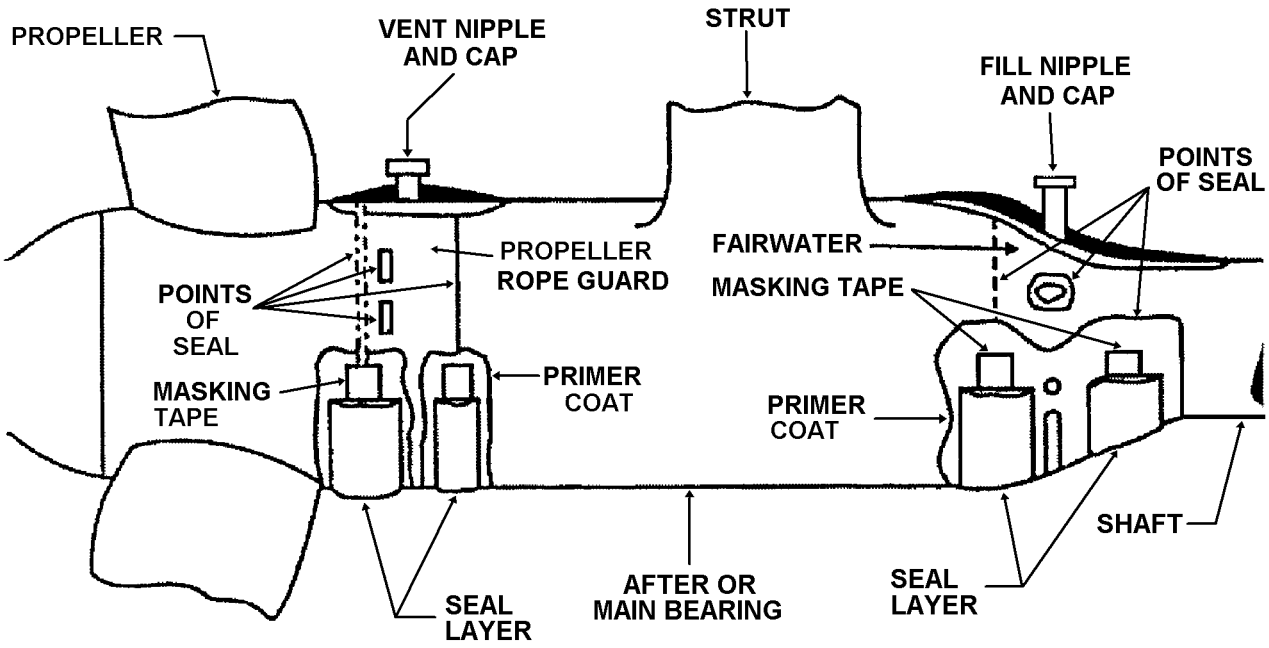

Figure 050-3-1 Sealing Shaft Bearings

050-3.7.4.3 Preparation of Surfaces. The surfaces to receive the primer and sealant shall be dry sandblasted approximately 4 inches from each point of seal, including the rubber shaft covering. Sandblasting shall be down to bare shiny metal except for the rubber shaft covering. Remove dust with a clean, dry paintbrush; brush away from masking materials and surfaces to be sealed; remove rags, rope, or masking tape. All areas must be clean and dry prior to the application of primer. If there is any oil, grease, or waxy contamination on surfaces to receive the primer or sealant, remove it by wiping the contaminated area with a clean rag wetted with trichloroethane. Cut 2-inch wide vinyl or masking tape into short pieces and stretch the pieces over the water circulating holes and openings, contacting the surfaces not more than 1/4 inch beyond opening. Tape around fairwater sealing between the fairwater and shaft, and between the fairwater and strut barrel. The same applies to the gap between the rope guards and strut barrel or propellers. If any openings exist at time of sealant application, the sealant will permeate into the openings and, as a result, the sealant cannot be removed by peeling when required, and difficulties in locating and cutting out the plugged holes are encountered. It is essential that the tape does not extend more than 1/4 inch beyond any opening. Use caution so that sandblasted areas are not touched by fingers or hands.

050-3.7.4.4 Preparation and Application of Bearing Seal Primer. After sandblasting and taping, prepare the primer in accordance with the manufacturer's instructions and apply with a clean brush to all sandblasted and taped areas, including rubber areas that have been sandblasted. Apply a very thin coating of primer, ensuring complete coverage, which is necessary in obtaining a good bond of the sealant. Allow to dry for the time period recommended by the manufacturer before applying bearing sealant. If sealant application does not follow within the manufacturer's specified time limit, clean primed areas with trichloroethane and reprime.

050-3.7.4.5 Mixing and Catalyzing of Ship Bearing Sealant. Mix the sealant components as recommended by the manufacturer. The importance of thorough mixing cannot be over-emphasized, as proper mixing is critical in acquiring a complete cure. This has been a source of difficulty in the past. A propeller-type mixer is recommended attached to a motor of one-half horsepower minimum. To perform the actual mixing, securely attach the mixing motor to an immovable object. The operator then sits in front of the mixer holding the can of base material. Cut the rims out of both the base mix and catalyst cans, and using a putty knife, transfer all the catalyst paste into the base material can. Add fiberglass particles to sealant for strength. The mixing operation may now proceed. Best mixing can be accomplished by folding the material in the can by raising and lowering it while also rotating it. Stop the mixer twice during mixing operation and scrape down the propeller and shaft, in order that no

unmixed material will remain. Also, ensure that no material on the sides or bottom of the can is left unmixed. If steaks of colored material can still be seen in the material, it is not thoroughly mixed, and must not be used without further mixing. The catalyzed material must be used immediately, as mixed sealants have a limited pot life. Do not use sealant that has started to set.

050-3.7.4.6 Application of The Sealant:

a. Apply thoroughly mixed sealant with either wooden or aluminum paddles or spatulas. The material shall be applied to a thickness of 1/2-inch minimum and 4-6 inches wide in contact with metal or rubber adjacent to each point of seal. If the gap to be jumped exceeds two inches, the thickness of the sealant should be increased to 1 inch or more.

b. Sealant shall be forced into all indentations such as pits and cracks, and then be faired out to as fine a feather edge as possible (1/8 inch maximum thickness at edge) and the entire surface smoothed out to prevent drag when the ship is being towed through the water. Gloves wet with trichloroethane are appropriate for this fairing and smoothing operation. See Figures 050-3-2 and 050-3-3.

c. One or two days at 75° to 80°F (and longer times at lower temperatures) will be required to fully cure the material. The cure may be hastened with the application of external heat in accordance with the manufacturer's recommendations. Care should be taken, however, that the material is cured throughout, and not just on the surface, before pressure testing takes place. Live steam should not be used in such a way as to cause cavitation of the sealant. If drydock temperature is below 70°F and undocking of the ship is less than 24 hours away, cure to a durometer a hardness of 60 with infrared lamps.

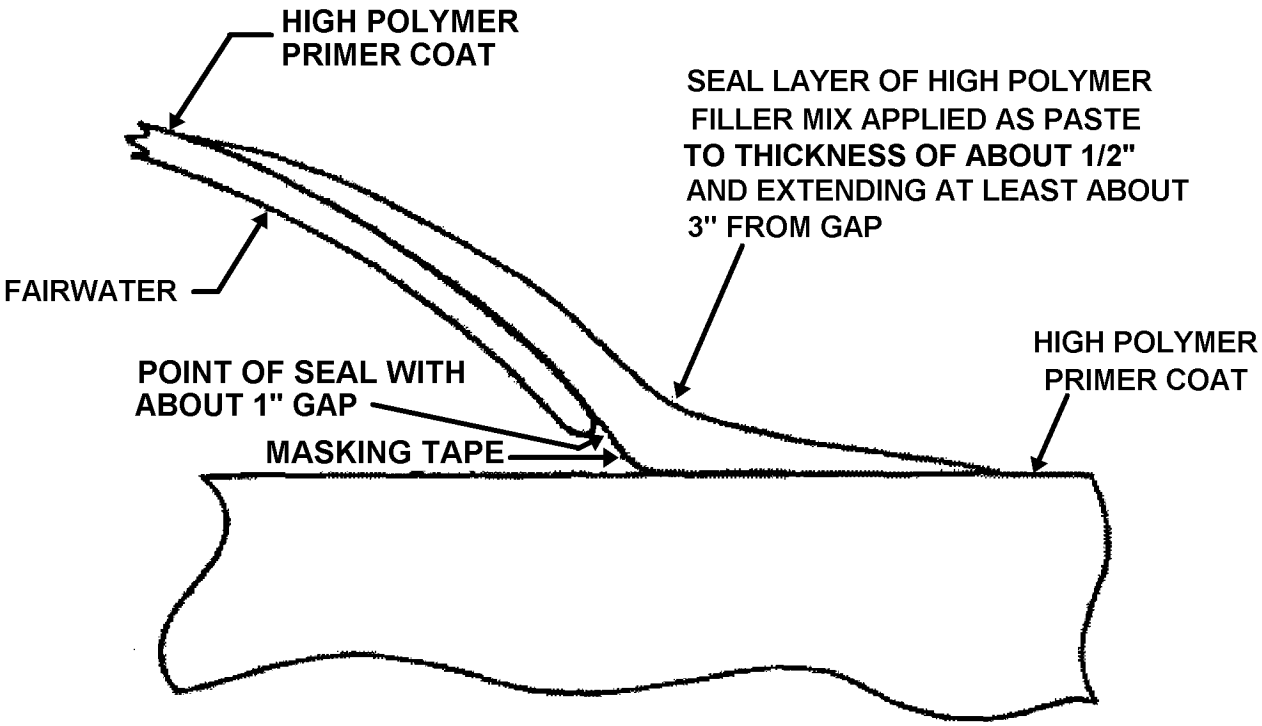

Figure 050-3-2 Sealing Fairwaters

050-3.7.4.7 Pressurization and Testing for Leakage.

a. Air test all strut bearings and stern tubes at 2 psi gauge pressure to a no-pressure-drop test for 30 minutes. All

seals and entire strut should be checked with a soap solution, including those portions not covered by sealant. The no-pressure-drop test alone is not sufficient evidence of a perfect seal (the pressure may change with temperature). Soap solution must be used on all sealed areas and packing glands. At this point, the necessity of ensuring that the packing gland at the forward end of the stern tube is not leaking cannot be overemphasized. Do not go by a no-pressure-drop test, only by the soap bubble test.

b. In the event of a leak either through the sealant or immediately adjacent to it, mark a circle around the leak with chalk. Release the pressure, thoroughly wash soap solution off with clean water, wash with solvent, and allow to dry. Patch with a small quantity of sealant, fair, cure with an infrared lamp just below blistering point of the material, and retest. The whole operation can be done in 30 minutes. In a event of a leak in a casting away from a primed area due to a casting defect or around tallow fill plugs in the bearing sleeve, sandblast around leak, prime, seal, and retest.

c. After successful pressure testing, remove forward nipple and aft cap. Fill strut by gravity through forward hole with a antifreeze solution, if required. Replace cap on after-nipple and cover with sealant. Hot patch forward hole with sealant. Fill stern tube through funnel inserted in disconnected water service line opening in forward end of stern tube. Venting will take place around the funnel. All filling should be done through a funnel to eliminate the possibility of full line water pressure being applied to the seals.

050-3.7.4.8 Corrosion Preventive Solutions. For water lubricated stern tube and strut bearings of rubber, laminated phenolic, and lignum vitae material, the preservation compound used shall be prepared as follows:

a. In areas where the berthing water temperature remains above 0°C (32°F), stem tubes and bearings shall be filled with a preservative compound conforming to MIL-C-16173, Grade 2 (ESGARD).
   1. The Material Safety Data Sheet (MSDS) and container labels for ESGARD PL-2 should be carefully reviewed regarding required precautionary measures prior to starting any procedure involving this material. All personnel working with ESGARD PL-2 should receive preassignment and periodic refresher training, as an integral part of the Command's Hazardous Materials Control Program, as delineated in OPNAVINST 5100.19D. Critical aspects of this training should include a review of the potential hazards related to use of engineering controls and use of personal protective equipment and respiratory' protection, first aid, as well as damage control, spill cleanup and disposal procedures.
   2. Personnel should avoid skin contact with ESGARD PL-2. Skin contact can result in dermatitis, folliculitis, or oil acne. It is recommended that rubber or oil resistant gloves, or other gloves of equivalent resistance to penetration by ESGARD PL-2, be worn to prevent skin contact with this material. Use of elbow-length gloves with large cuffs may also be required for some operations, particularly when coating vertical or overhead surfaces using a brush or roller. Use of other items of protective clothing (e.g. impervious apron, shoe covers or boots, impervious coveralls) may also be required, based on the type and magnitude of the operation. Personnel should wash all potentially exposed skin areas with soap) and water at breaks, and at the conclusion of the operation or work shift. ESGARD PL-2 should be promptly removed from the skin using soap and water. Clothing contaminated with ESGARD PL-2 should be removed as soon as feasible and thoroughly laundered prior to reuse. Contaminated protective clothing anti equipment should be thoroughly cleaned with soap and water following use, prior to storage. Personnel should seek prompt medical attention in the event a dermatological condition, or other condition possibly related to exposure to ESGARD PL-2, is detected.
   3. Eye contact with ESGARD PL-2 should be prevented by use of chemical worker's goggles, where supplemented by a full-length face shield, where splashing of the material could be a problem, unless equivalent protection is provided by use of a full-face piece respirator. An American National Standard Institute-approved source of potable water (15 minute supply minimum) should be readily available for use near each work area. In the event of eye contact with ESGARD PL-2, personnel should immediately flush their eyes for a minimum of 15 minutes; then obtain prompt medical assistance.
   4. Respiratory protection should be selected, based on recommendations from the local cognizant industrial hygienist, after reviewing the specific operation of concern. Vapors from ESGARD PL-2 can cause pulmonary irritation, dizziness, and nausea in exposed personnel. Where respiratory protection is considered necessary, it must be National Institute for Occupational Safety and Health/Mine Safety and Health Administration (NIOSH/MSHA) approved for this purpose. Use of a NIOSH/MSHA approved organic vapor respirator, equipped with a particulate prefilter, will probably be sufficient for many operations not performed within enclosed or confined areas. Operations performed in enclosed or confined areas, or major

operations involving spray application of ESGARD PL-2, may require the use of a NIOSH/MSHA approved supplied-by-air respirator, based on specific guidance provided by the local cognizant industrial hygienist. Operations performed in confined areas should also receive special evaluation by the cognizant. Gas Free Engineer, who should certify the safety of the operation prior to allowing these preservative coating operations to begin.

5. Ventilation should be provided for all operations involving use of ESGARD PL-2, when mists and vapors could accumulate in work areas. Ventilation systems, where used, should be designed and located so as to capture mists and vapors at the point of generation, with discharge outside occupied spaces in a manner precluding recirculation of vapors and possible exposure of other personnel.
6. Decomposition products from ESGARD PL-2, as would be formed during a fire involving this material, are considered toxic. Personnel engaged in damage control efforts should be provided with NIOSH/MSHA approved positive pressure respiratory protection to preclude exposure to these products.
7. ESGARD PL-2 is incompatible with strong oxidizing agents.

b. In areas where the berthing water temperature remains 0°C (32°F), the corrosion-inhibiting solution shall be inhibiting antifreeze with four parts of freshwater. In place of corrosion inhibiting antifreeze, the stern tubes and bearings may be filled with a preservation compound conforming to MIL-P-20088.

050-3.7.5 Removal By Divers. Upon activation, the material should be peeled from water circulating holes and other areas where necessary water circulation might otherwise be impeded before turning the shaft.

050-3.7.6 Record. In the submission of Docking Reports (NAVSEA 9070-2), all work accomplished as instructed throughout this paragraph shall be indicated on the Docking Report and shall be entered into the Maintenance Data System (MDS), together with necessary instruction for removal by divers at time of activation. Photographs showing details of the bearing preservation appended to Docking Report are recommended as a valuable device to reduce the length of descriptive narrative in reports.

050-3.7.7 Alternate Boot Sealing Method. An alternate method of boot sealing was developed by rubber technologists working at the Puget Sound Naval Shipyard. The basic materials used are sheet rubber (MIL-S015058C, Type III), phosphor bronze flexible cables, and phosphor bronze cable terminals. (Refer to plans DD 667-S4302-H-1396279 and S4302-H-1492176 for details.) Sheet rubber is used to make a watertight cover approximating the contour of the bearing structure. Flexible cables are used to help secure the ends of the cemented rubber boot to the shaft, strut barrel, propeller hub, or stern tube extension. The seal shall have an outer protective jacket consisting of a laced-on corset of vinyl or neoprene-coated nylon cloth. This shall apply for both vacuum and gravity filled boot seals.

050-3.7.7.1 Preservative Compound. The same preservative compound employed for the plastic seal should also be employed with this method (paragraph 050-3.7.4.8).

050-3.7.7.2 Principle of Construction. Bearing preservation by the sheet rubber method involves nine steps. These are:

a. Inspection and cleaning of bearings prior to preservation.

b. Structural modifications involve construction of a circular metal band or rubber band to provide a smooth gasket sealing surface for one end of the boot. The other end of the boot is sealed onto the shaft after cementing a rubber band over the shaft.

c. Determination of size and shape of rubber boot to be cut from sheet rubber.

d. Construction of the lap seam of boot by skiving, overlapping the edges, and cementing together.

e. Cementing the ends of boot to the shaft, and to one of the structural modifications on the strut barrel, propeller hub, or stern tube extension as the case may be.

f. Clamp the two ends of the rubber boot.

g. Testing the boot for leaks.

h. Lacing on the outer jacket of vinyl or neoprene-coated glass cloth.

i. Filling the rubber boot with rust-preventive solution so that the bearings are immersed.

050-3.7.7.2.1 Inspect and Clean.

a. Remove and check the fairwaters and rope guards, and determine that shafts have been inspected and repaired in accordance with paragraph 050-3.6.5. Perform necessary cleaning of each bearing by use of air and water. Insert copper tubing between each stave for the entire length of the bearing and force air and water to eject lodged sediments. Inspect the system to determine whether the bearings and journals are in good condition. Record clearances and renew bearing staves as needed to overcome excessive clearances. Propulsion shaft bearing systems shall be determined to be in good condition by the following criteria:
   1. The ship has been recently active and operating satisfactorily with no obvious defects having been detected by routine inspection while taking clearance readings during drydocking.
   2. The ship's bearings have been previously preserved with watertight seals (of any design), and the preservation docking report indicates that the bearings were clean and in good condition.
   3. For all other cases, one or more randomly selected bearings must be pulled, and the shaft journal, shaft protective coating, and bearing must be inspected to determine condition. If the condition of the randomly selected bearing shaft and journal is good, all others may be assumed good. If the system needs cleaning or repair, all others must be pulled, cleaned, and repaired.

b. Propulsion shaft bearing systems shall not be preserved for the following types of ships:
   1. Ships whose propeller shaft bearing systems are not known, or have not been determined to be in good condition as defined above, and when lack of funds prohibits adequate inspection, cleaning, and repair.
   2. Ships whose propeller shafts have not been inspected and repaired in accordance with paragraph 050-3.6.5.
   3. LSD and LST types fitted with grease-lubricated outboard bearings.

050-3.7.7.2.2 Structural Modifications. Structural modifications are made to provide a smooth gasket surface for securing the rubber boots. Smooth refers to a degree of finish that may be a sandblasted metal surface without the presence of pitting. The following modifications are acceptable:

a. On structures that do not provide sufficient smooth, pit-free cylindrical surface for securing one end of the rubber boot, such as wide-blade propellers without any forward hub area, a watertight metal band may be welded onto the strut barrel, propeller hub, or stern tube extension, as the case may be. This metal band consists of a steel, brass, or bronze ring, installed as a split ring. This is shown on Figure 050-3-4. This is one device that is applicable to all conditions of strut barrel propeller hub, or stern tube extension, that may not permit the use of method 2 as follows. The selection of the type of metal shall be made based on reducing electrolytic action and/or to facilitate welding. NAVSEA Plans S4302-H-1492176, and DD667-S4302-H-1396279 show the use of a bolted flanged propeller hub extension. Figure 050-3-5 shows a band clamp compressed tapered rubber gasket. Both later mentioned devices also provide a satisfactory seal where there is insufficient land area for cable clamps.

b. On structures that provide a cylindrical surface for at least 3 inches, a rubber band shall be cemented to the strut barrel, propeller hub, or stern tube extension, as the case may be. The locations of the two metal rods and rubber band are shown on Figure 050-3-6.

c. If a double-boot construction is employed, either the method described in 1 or 2 may be used. Two 3/16-inch steel rods may be tack-welded to the fairwater to prevent the cables from sliding downward on the gasket surface. The position of the steel rods is shown on Figure 050-3-7 if the angle is steep.

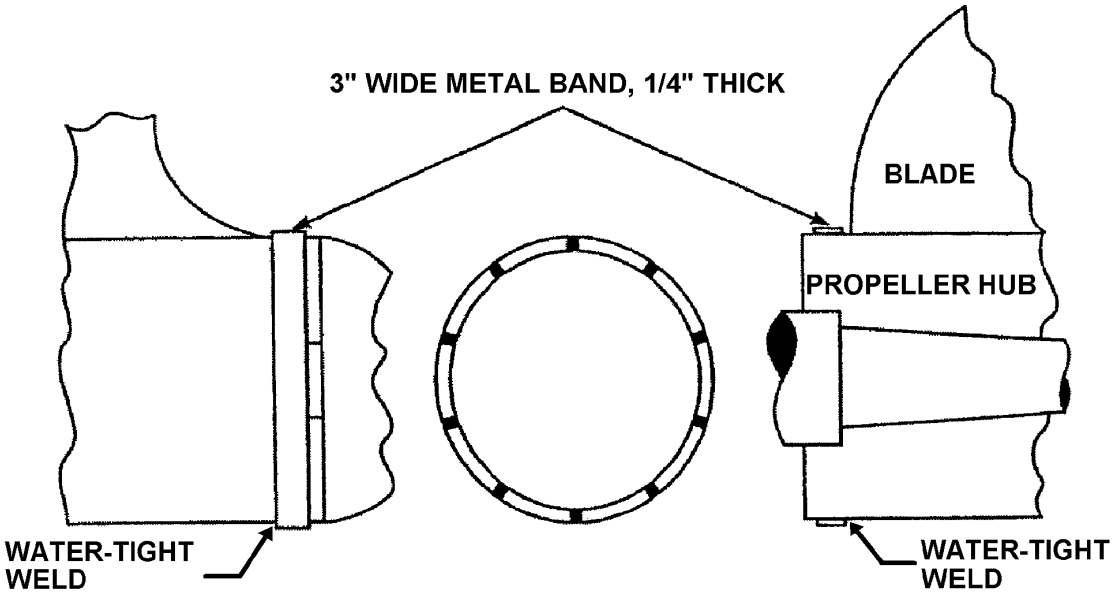

Figure 050-3-3 Metal Band Method

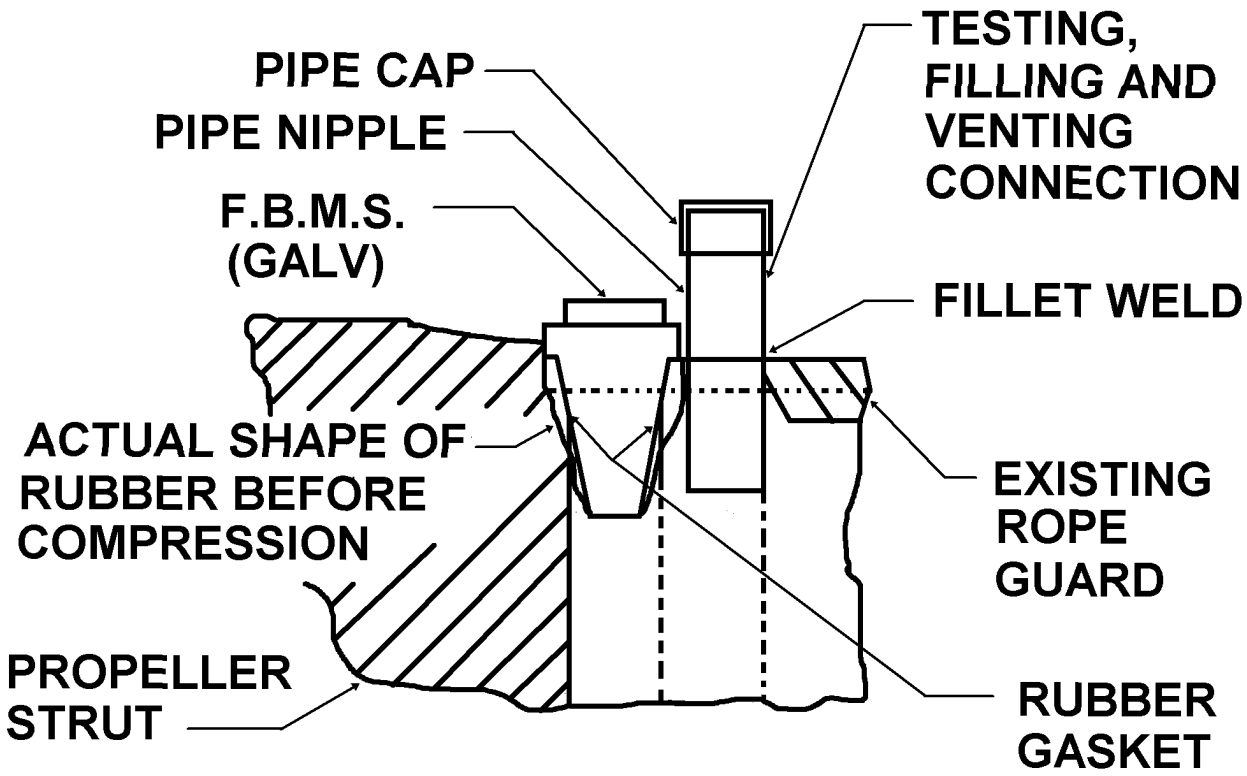

Figure 050-3-4 Band Clamp Compressed Tapered Rubber Gasket

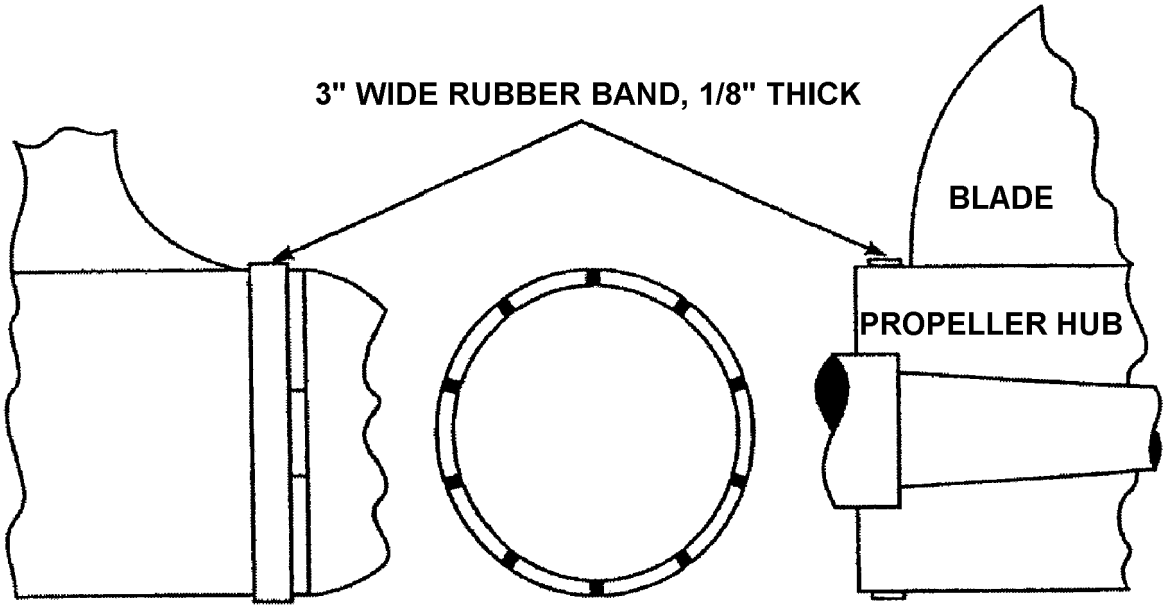

Figure 050-3-5 Rubber Band Method

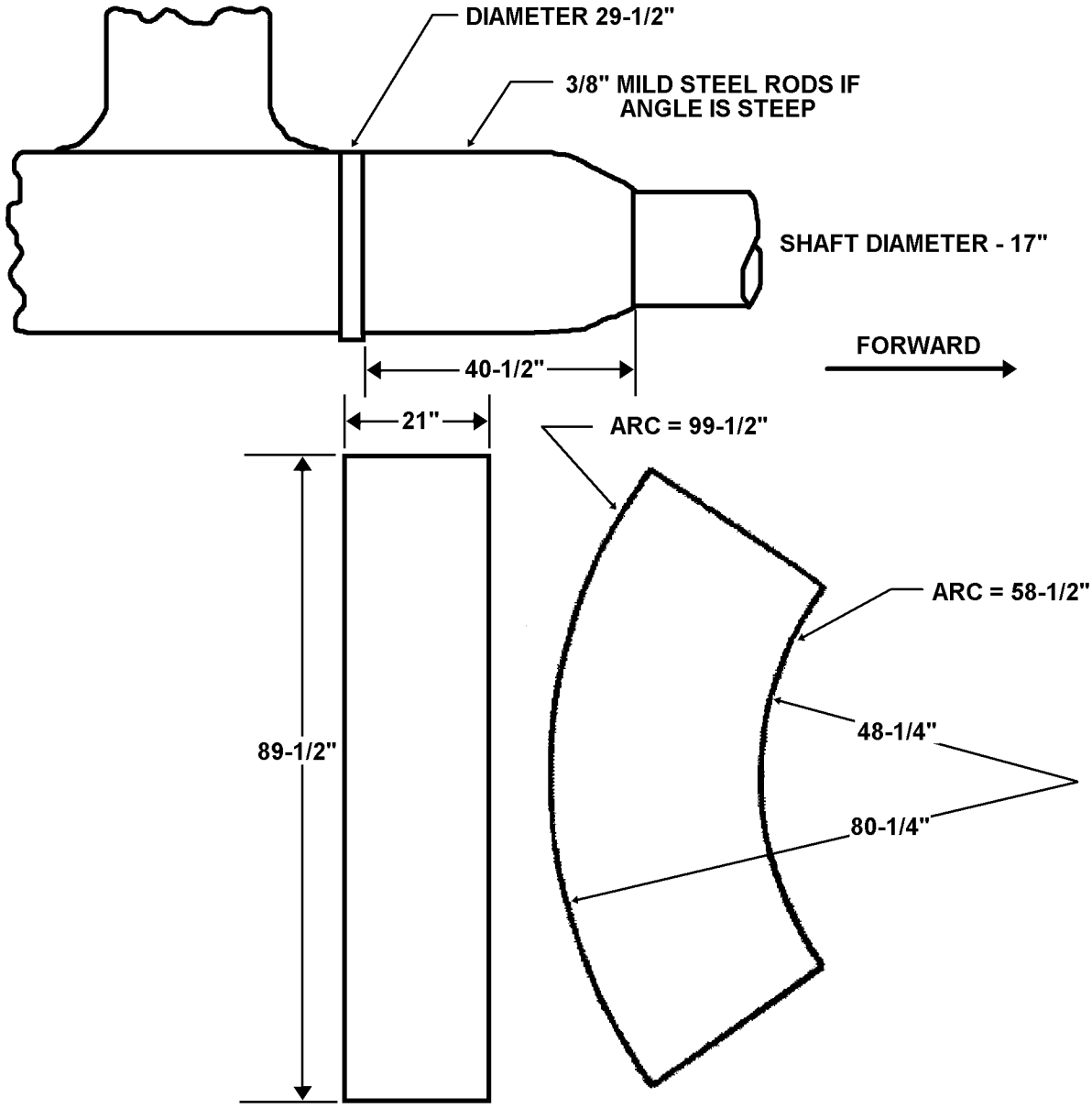

Figure 050-3-6 Double-Boot Method

050-3.7.7.2.3 Determination of The Size and Shape of The Boot. Develop the pattern for the structure to be sealed. Decide whether one or two boots are necessary in order that the cemented boot will go over the structure without a person resorting to excessive effort in fitting the boot.

a. Method 1 The single-boot construction is made from sheet rubber. The pattern is cut to make either a cylinder lampshade or a cone so that the cemented boot will fit snugly enough to permit it to be cemented over the fairwater, propeller hub, rope guard, shaft, or sterntube extension, as the case may be. Allow sufficient material to make a 3-inch lap seam. Some simple patterns to fit over the forward and aft fairwater are shown schematically on Figures 050-3-6, 050-3-7, and 050-3-8. The manner of marking out the pattern is to scribe arcs with chalk on the sheet rubber material. The circumferences of the small and large arcs shall be made to accommodate the shaft at one end and the structural modification at the other end, respectively. An allowance of three inches shall be made for the construction of the lap seam. An additional 2 inches in circumference is allowed for

the boot employed in the heat-curing method as space is necessary to insert the heater. Boot pucker caused by heating element insertion or by other causes such as dimensional error, should be minimized so it may be compensated by the flexible cable clamp.

b. Method 2 The two-boot construction is used whenever one part of the structure may be sealed with a cylindrical boot and the remaining part with a conical section. Figure 3-7 shows how the double boot construction is adaptable to a long fairwater with a hump in its contour. A multi-piece boot may be fabricated as shown on Figure 3-8.

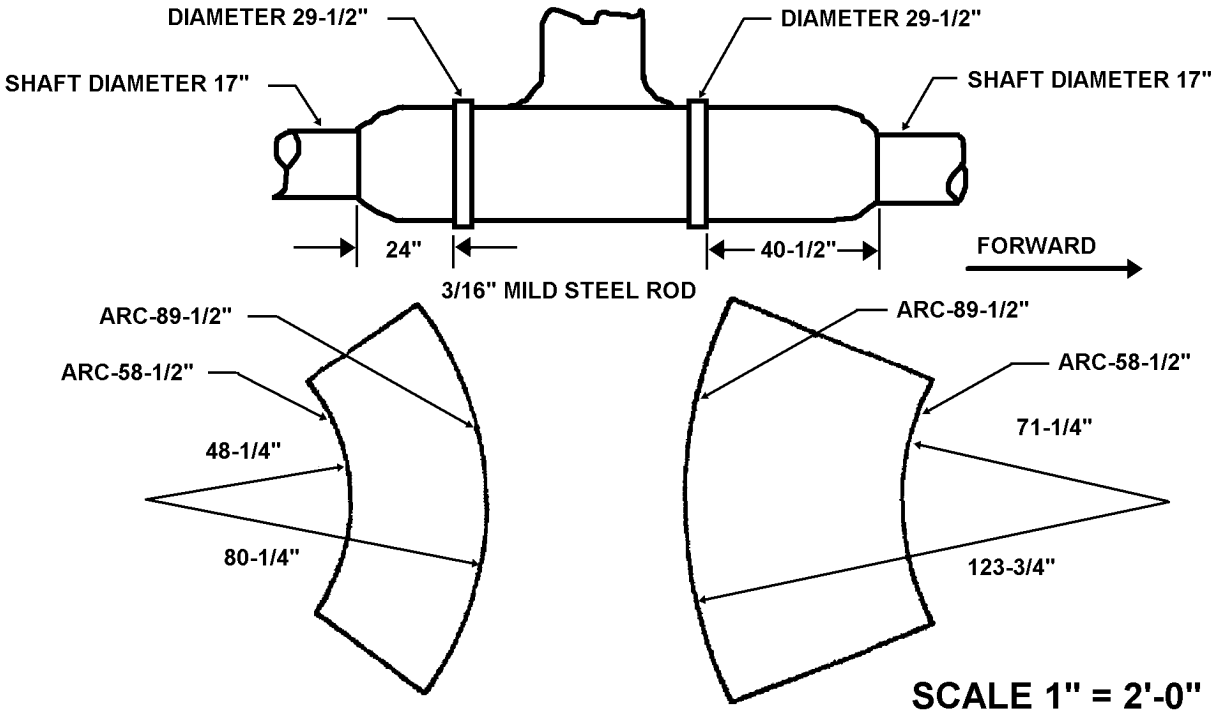

Figure 050-3-7 Sample Boot Pattern A

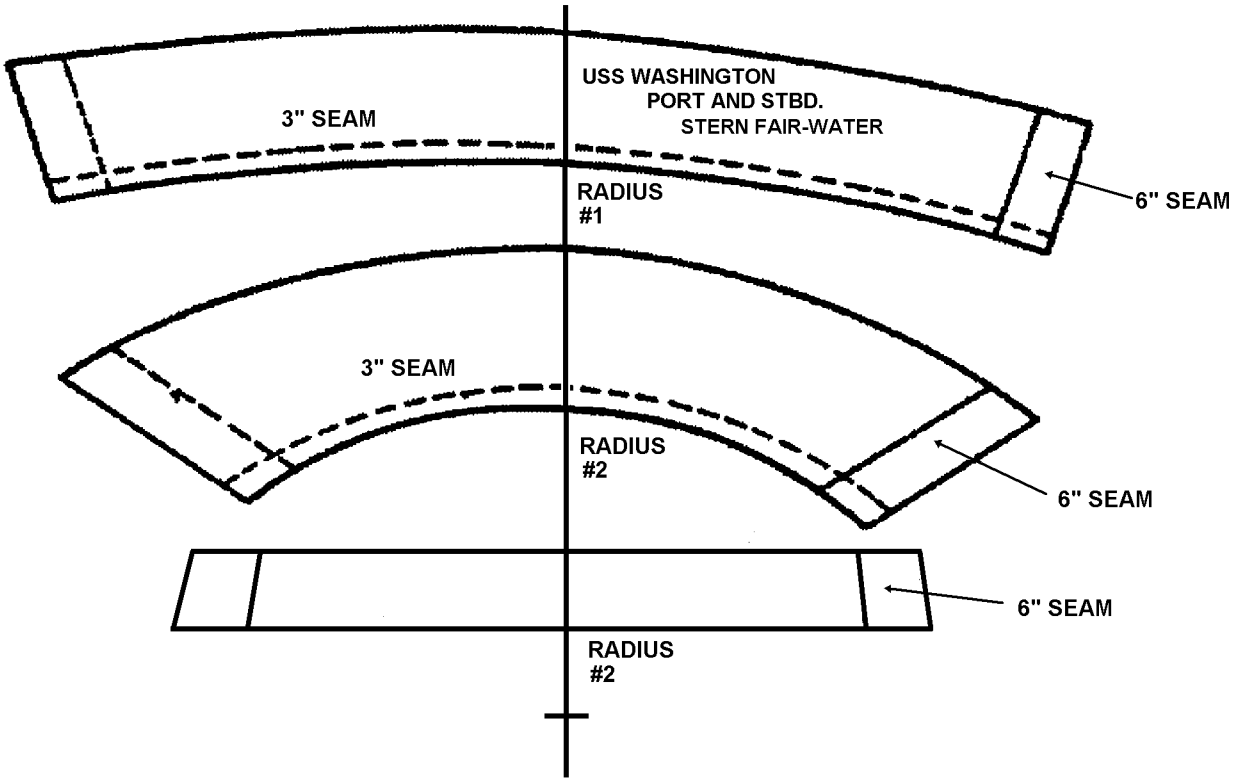

Figure 050-3-8 Sample Boot Pattern B

050-3.7.7.2.4 Construct The Lap Seam of The Boot. The boot in sheet form is laid over the open space of the shaft. The joint or lap seam shall be cemented by one of two methods.

a. Method 1. Heat-vulcanize the cemented joint that is made as follows:

(1.) The edges of the neoprene rubber boot to be cemented are skived and buffed with sandpaper and cleaned with rubber solvent.

(2.) Two coats of PSNS H-8 cement or one coat of Gaco catalyzed cement (1 part N-39 by volume to 16 parts of N-29) is applied. Allow a drying time of 30 minutes between coats for the PSNS H-8 cement.

(3.) When the last coat of cement is dried to a tacky feel, join the two surfaces together to form a 3-inch lap seam. Roll and stitch the seams together with a conventional rubber roller and stitcher, respectively, to work out trapped air.

(4.) Assemble the electric heater (fabricated locally). The cemented seam is positioned between the air bag (may be procured from PSNS) inflated to 10 psi, and the bottom plate of the electric heater.

(5.) Close the electric circuit to the heater. The rubber at the seam shall be heated from room temperature up to the specified time and temperature, which is 30 minutes between 280°F to 300°F for the PSNS H-8 cemented joint, and 30 minutes between 230°F to 250°F for the using cement (652-S-240-5) joint. Allow the rubber to cool under pressure for 30 minutes before dismantling the heater and removing the rubber boot.

(6.) Skive the ends of the boot where the cable clamps are employed to form a continuous surface without the abrupt change introduced by the lap joint.

b Method 2. When temperature in drydock exceeds 65°F, it is possible to cement the lap seam without the application of external heat. This method is suited where space limitation precludes the use of a heater. The joint is made as follows:

(1.) The edges of the neoprene rubber boot to be cemented are skived and buffed with sandpaper and cleaned with rubber solvent.

(2.) One coat of catalyzed cement (652-S-240-5) is applied. Allow solvent to evaporate for about 1 hour before joining the surfaces. Experience has shown that drying time specified here is only suggestive.

(3.) Join the edges of the rubber boot together to form a 3 inch lap seam. Apply pressure on the cemented joint with a roller, and remove trapped air with a stitcher.

(4.) Allow the cemented rubber boot to be suspended on the shaft for 24 hours or longer.

(5.) Skive the ends of the rubber boot where the cable clamps are employed over the lap joint.

050-3.7.7.2.5 Cement and Clamp The Two Ends of The Rubber Boot. The ends of the rubber boot are secured with cement and cable clamps. One end is secured on the gasketed shaft and the other end on the aforementioned metal or rubber band. The gaskets are cemented down using catalyzed cement (652-S-240-5) when adhered to rubber but when adhered to steel, two coats of primer of cement (652-S-240-18) must be used first. The gaskets should be skived and lapped carefully. After the rubber boot is drawn and cemented in place over the bearing structure, a hole is cut in it for the installation of the vent or filling fitting. The upper half of the vent or filling fitting is drawn down to the lower half to seal the joint, as shown on NAVSEA dwg S4302-H-1492176. After the cable clamps are secured circumferentially around the boot and the structure to be sealed, gradual compression of the rubber is made so that uniform pressure is exerted on the rubber to affect a secondary seal. Note 10 of NAVSEA dwg S4302-H-1492176 permits the alternate use of BAND-IT pipe and hose clamps in lieu of cable clamps for small diameter shafts. Although this wide band clamp does not conform to irregular surfaces or accommodate boot pucker as well as the capable clamp, care in installation will permit its use on small diameter shafts.

050-3.7.7.2.6 Test For Leakage. An air pressure, soap solution test to determine that the boot seal does not leak shall be performed for either gravity or vacuum filled systems. One psig air pressure shall be applied to boot seals to detect leaks. If any leaks occur, tightening of cable clamps, cemented sheet rubber or neoprene putty patches, or repairs to welds will stop any small leak that may be present.

050-3.7.7.2.7 Outer Jacket. The outer jacket of vinyl or neoprene coated nylon cloth must be laced over the rubber boot before introducing the solution, by either method 1 or 2, to mechanically protect the seal as well as to prevent the seal from ballooning in method 1. The outer jacket or corset seams are made with nylon thread (do not use cotton thread) and eyelets (SNSN G42-G-1410), which provide a means of lacing the corset over the rubber boot with one-quarter-inch nylon rope or 14 gage soft copper wire lacing (MIL-W-3861).

050-3.7.7.2.8 Filling The Boot With Rust-Preventive Solution. There are two methods that may be employed for filling the boot with rust-preventive solution; one is by vacuum feed and the other by gravity feed.

a. Method 1. The rust-preventive solution may be introduced under a vacuum. A minimum vacuum of 3 inches of mercury is ample. Introduce the solution at the lowest level fitting and apply a vacuum at the other fitting. Shut off all valve connections to the boot or boots before stopping the vacuum pump.

b. Method 2. When a vacuum pump is not available the rust-preventive solution may be fed in by gravity. When employing method 2, it is necessary to prevent the solution from ballooning the rubber boot.

050-3.7.7.3 Application Assistance. Activities that desire technical assistance with the first few applications of this boot seal may obtain the services of rubber technologists by arrangement with the Commander, Naval Shipyard, Puget Sound.

050-3.7.7.4 Removal By Divers. The following action is required of divers upon activation of a ship without prior drydocking:

a. Laced-on outer jacket of vinyl or neoprene-coated nylon cloth; cut lacings and remove outer jacket.

b. . Boot seal secured by flexible cable clamps; cut boot only along cable and along longitudinal seams.

c. Boot seal with compressed tapered rubber gasket used for wide bladed propeller applications; remove wide bank clamp and gasket.

050-3.7.8 Material Selection. All materials used in fabrication of the boot seals and structural modifications described herein, where not covered by a specification, shall be selected based on electrolytic corrosion compatibility and corrosion resistance to seawater. Cable clamps are to be electrically grounded to the strut, stem tube, fairwater or other convenient hull appendage (not to the shaft or propeller) to eliminate any possible maleffects from electrical current flow from cathodic protection.

050-3.8 AUXILIARY SYSTEMS AND EQUIPMENT

050-3.8.1 Condensers, Air Ejectors and Distilling Plants. Comply with the following in the inactivation of condensers, air ejectors, and distilling plants. The steam and condensate sides of condensers and air ejectors are to be preserved with D/H air. However this does not apply to the saltwater side which is to be flushed with fresh water, opened, drained, cleaned out (mechanically clean salt water sides, if flushing is not effective), and left open to D/H air with a wire screen covering the opening. Condensers lined with portland cement, and having damaged areas, should be scaled, wire brushed, and coated with two coats of formulas 150. The opening or openings between the steam side of the condenser and the ship's spaces, if any, should only be small bleed point(s) which will not allow the D/H air pressure within the system to decrease to the point where poor circulation is obtained in the condensate lines.

050-3.8.1.1 Flush Complete Distilling Plant With Fresh Water. Drain and dry out. Deactivate piping systems in accordance with paragraph 050-3.8.7. Remove inspection plates from all components, hand scale tube nests and interior surfaces as required. Inspect baffle plates/vapor screens for needed repair. Remove headers from heat exchangers, remove marine growth from headers and air lance tube nests. Header and inspection plates are to be left open to D/H air. Pumps are to be preserved in accordance with paragraph 050-3.8.6. Document necessary repairs on work requests and place in the activation package.

050-3.8.2 Refrigerating Plants, Air Conditioning Systems, and All Other Equipment Containing Refrigerants. Recovery of refrigerants is to be in accordance with the Clean Air Act Amendments of 1990 and Navy recovery procedures. Specific procedures for the recovery and type of refrigerants (i.e., R-11, R-12, R-22, R-114, R-500, and R-502) are listed below.

Refrigerant recovery from unitary systems (i.e., reach-in refrigerators, drinking fountains, milk dispensers, ice machines, ice cream makers, juice dispensers, air dehydrators, and package air conditioners) should not be accomplished at this time until the scope of work and recovery benefits are better defined.

Ensure all excess and recovered refrigerant and standard cylinders remain internal to the Navy and are not released to non-Navy activities or sent to Defense Reutilization Marketing Office (DRMO) for disposal. All refrigerant turned in to Defense Supply Center (DCR) in accordance with the below guidance will be reclaimed and allocated for Navy use only. (Refer to Navy ODS Advisory 96-01C for turn-in procedures).

a. Selected Shore Intermediate Maintenance Activities (SIMAs) have been equipped with the appropriate refrigerant recovery equipment and are trained in its use. Specific instructions for actual recovery are provided with the recovery equipment.
   1. During the recovery process, DO NOT mix new refrigerants with old refrigerants, and do not mix different types of refrigerants with old refrigerants, and do not mix different types of refrigerants in the same cylinder.
   2. Ensure that the recovered refrigerant cylinder is properly tagged with the information as detailed in Navy ODS Advisory 96-01C.

THIS SECTION ONLY APPLIES TO VESSELS DESIGNATED AS MOBILIZATION ASSETS:

Upon removal of refrigerant from vessels designated as retention assets (Category "B" or "C" Mobilization), perform a system lay-up procedure with the below listed procedures. System lay-up is not required for stricken vessels or vessels to be disposed of upon decommissioning. These procedures are in accordance with Commander, PMS 335D, Naval Sea System Command (COMNAVSEASYSCOM), Washington, DC, letter Serial PMS335D12/2441 of 01 September 1994. PMS335 is now PMS333:

b. Correct all leaks and apply a nitrogen charge to the refrigerant containing portion of the system in accordance with the following: Inactivation requires compliance with the following NSTM S9086-RQ-STM-010 Chapters 510, HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS FOR SURFACE SHIPS and NSTM S9086-RW-STM-010 Chapter 516, REFRIGERATION SYSTEM. Refrigeration plants and central air conditioning systems must have chlorofluorocarbon refrigerant gas recovered. Recover the used refrigerant and lay-up the system in accordance with NSTM S9086-RW-STM-010 Chapter 516, REFRIGERATION SYSTEM and the below listed paragraphs. Leave the lubricating oil in the compressors.

c. For The Respective Naval Inactive Ship Maintenance Office: While the ship is inactive as a Category "B" or "C" Mobilization asset, monitor the nitrogen charge on the condensing unit portion of the system only. Should the nitrogen pressure decline from 5 pounds per square inch, gauge (psig) (after correction for temperature), restore the pressure to 5 psig with oil free, dry nitrogen, and note the situation in the activity records. Establish a schedule for topping off the pressure with nitrogen. Obvious leaks should be repaired. In the event that efforts to restore/retain the charge become futile, the existing system conditions should then be annotated in activity records and further attempts should be terminated. The nitrogen charge in the remainder of the system need not be monitored.

050-3.8.2.1 General System Preservation. Do not use any preservative in the compressor, nor in the interior of refrigerant piping system. Maintain Nitrogen at approximately 5 lb positive pressure in the compressor, condenser, piping, and cooling coil. The water side of the refrigerant condenser automatic water regulating valve must be cleaned as required by paragraph 050-3.8.7, taking care that the refrigerant side of the valve is not opened to the atmosphere during this operation. When handling refrigerant, adhere to the safety precautions listed in NSTM S9086-RW-STM-010 Chapter 516, REFRIGERATION SYSTEM.

050-3.8.2.2 Refrigerator Doors. Wire refrigerator doors in the open position with doors blocked at the outer edge to prevent sagging or remove doors and securely store inside refrigerator.

050-3.8.3 Air Compressors. Ensure compressors are dry. Pull a vacuum and cycle. Preserve unprotected corrodible metal surfaces in accordance with Section 4. Exercise special care and ensure all excess solvent cutback corrosion preventive compound is drained from cylinders by motoring with all drain holes open (both ends if double acting) during application. Preserve electric motor drive ends in accordance with paragraph 050-3.9.1. Ensure solvent cutback corrosion preventive does not come in contact with electrical insulation.

050-3.8.4 Purifiers. Protect lubricating oil and diesel fuel oil and JP5 purifiers with solvent cutback corrosion preventive, grade 2. Where practical, introduce the rust-preventive compound into the purifier bowl while purifier is in operation by pumping compound through purifier pumps into purifier and reclaiming the compound as it is discharged from purifier clean oil discharge pump and the water discharge. The discharge covers must then be removed and the outer surface of bowl and the inner surface of frame coated with compound, either by spraying or by filling the frame with compound until all parts are totally immersed. The compound must then be drained from the frame and covers replaced.

050-3.8.4.1 Purifiers. On the DeLaval-type, remove parts as may be necessary to obtain access to lower frame for coating of all drive parts. On the Sharples-type purifier, ensure that a good coating of compound protects the face of the bowl neck and spindle face under the coupling nut. Remove the drive belt, wrap with grade C paper, and secure to the equipment. Spray or flood the purifier drive part with the compound. Protect purifier motors in accordance with requirements of paragraph 050-3.9. Attach replacement O-rings and gaskets (preserved, packaged, packed, and properly tagged) to the unit.

050-3.8.4.2 Renovation of Corrosion Preventative. Purifiers may be used to renovate grades 2 and 3, solvent cutback corrosion preventive after using it for flushing purposes, but only to remove grit and water. They will not separate lubricating oil from the compound.

050-3.8.5 Oil and Water Heaters. Preserve unprotected corrodible metal surfaces with solvent cutback corrosion preventive in accordance with Section 4.

050-3.8.6 Pumps. Open pump ends and drain. Where applicable, Fog in Grade 2 preservative to reduction gears (if applicable) and bearings. Leave pump ends open.

050-3.8.7 Piping Systems and Valves. Inactivation is to be in accordance with the following: Thoroughly drain all piping and valves. Clean marine growth from interior of salt water piping with particular attention to fire main and other systems to be used for distribution of dry air from the D/H equipment. Flush piping system with fresh water. Refer to Section 4. Gasoline and alcohol piping systems are to be steamed out and thoroughly dried.

050-3.8.7.1 Piping System Controls. Many regulator valves, reducing valves, traps, and other controls in piping systems cannot be thoroughly drained and dried by design without disassembly. Disassemble all units of this type, repair as necessary, and thoroughly dry. Piping systems are to be reconnected where broken for drainage. All drain and other plugs are to be bagged in cloth bas and wired adjacent to where removed.

050-3.3.8.7.2 Watertight Integrity. After draining and reconnecting as required, close valves below the main deck to ensure that watertight integrity requirements are not violated, except as specifically required by the D/H plans to be open for the positive flow of dry air. Particular attention is to be given to the closing and securing of bulkhead stop valves for the following systems.

a. Main and secondary drainage systems.

b. Low pressure steam drains.

c. Suctions from tanks with openings (for dehumidification) below watertight integrity level, such as potable or feed water, fuel oil, and diesel oil.

d. Circulating water.

e. Other systems below watertight integrity level.

NOTE

Some piping systems may not have bulkhead stop valves as such. Freshwater and Feed water suctions, as well as others, may have valves only at or near storage tanks or other remote locations. These valves are to be treated as previously described for bulkhead stop valves.

050-3.3.8.7.3 Stop Valves. Verify that all stop valves are intact and will perform their function.

050-3.3.8.7.4 Sea Connections. Bolting for sea connections is to be checked for conformance with current bolting requirements and ability to perform intended purpose; replace as necessary.

050-3.3.8.7.5 Steam Lines. . Give special attention to ensure that all steam lines are completely drained and inspected for pockets of water in accordance with paragraph 050-6.7. Only the most knowledgeable and competent personnel are to be assigned to the very important task of draining steam lines.

050-3.8.8 Hydraulic Systems.

a. Hydraulic oil systems shall be tested for PCBs and drained with the exception of the anchor windlass. Anchor windlasses are to be maintained in operating condition completely filled with oil normally used in service with all hydraulic leaks repaired.

b. All systems containing FYRQUEL (Fire Resistant Hydraulic Fluid, containing BUTYLATED TRIPHENYL PHOSPHATE) shall be completely drained and FYRQUEL removed from ship.

050-3.8.8.1 Sump Tanks. All oil shall be drained from sump storage tanks and drain lines, and parts protected by thin-film rust preventative compound, grade 2.

Unless there is definite evidence of contamination of the oil from water, dirt, or other foreign matter in the system at the time the ship is inactivated, the oil should not be changed or purified. It will be necessary to operate the equipment for a sufficient period to ensure the separation and bleeding off of all entrapped air.

This requirement does not apply to surface ships in which the power unit bedplate is constructed to form the sump storage tank. In such cases, leave drain lines intact. Fill drain lines and sump tank with the same grade of oil used in the active hydraulic system.

050-3.8.8.2 Expansion Tank. Expansion tanks used in connection with the hydraulic systems listed in paragraph 050-3.8.8 are to be completely filled with oil, and care taken to see that suitable means, such as overflow pipes or relief valves, are provided to protect against expansion due to variation in ambient temperature. Perform periodic inspections to determine the necessity for replacing oil lost from expansion or leakage.

050-3.8.8.3 Ammunition Hoists. Completely drain hydraulic systems for ammunition hoists. All parts shall be suitably protected by thin-film preservative MIL-C-972 in a manner similar to that required for ammunition hoists under the cognizance of NAVSEA. They shall be flushed in accordance with NAVSEA OP 1208.

050-3.8.8.4 Aircraft Elevators. Relieve aircraft elevators of air pressure and transfer all hydraulic oil into one of the elevator pressure tanks, filling not in excess of 95 percent capacity. Store remainder in the elevator supply tank. The inside surfaces of all pumps, valves, and piping used in connection with the elevator systems must be suitably protected by the circulation or spraying of solvent cutback corrosion preventive, grade 2. Apply the foregoing treatment to all interim surfaces of tanks from which hydraulic oil has been removed.

050-3.8.8.5 Phosphate Ester Based Fluid. If the hydraulic systems use phosphate ester based fluid, and the fluid is known to be contaminated:

Lock the elevator in the final inactive position.

Depress ram to decrease the volume as much as possible.

Drain entire system, and then carefully remove residual fluid from all low spots in piping, accumulators, receivers, sumps, pumps, and ram.

Preserve pumps and ram by filling with inhibited phosphate ester based hydraulic fluid, MIL-H-19457 (< 6 months) and MIL-I-22110 (> 6 months to 2 years).

Blank off pumps and ram at closest possible joint and flush each component successively with same batch of fluid to remove as much contaminate as economically possible.

Fill pumps and ram completely with fluid and blank off. Tag each component. The requirement for annual renewal of fluid is waived. Upon activation, the fluid will be discarded.

Include cleaning and flushing the entire system in accordance with MIL-STD-419D in the activation work package.

Remove the cylinder caps from at least one of the platform lockbar air engines on each side of the aircraft elevator and install a close fitting length of schedule 80 steel pipe (largest diameter possible) between the piston follower and the cylinder cap to prevent retraction of the lockbar. The cylinder cap for each affected air engine shall be painted yellow and a number assigned to each affected air engine from the list of internally installed blanks shall be painted on each cylinder cap.

When the elevator is in the fully raised position, weld two strongbacks on the rail bedplates of the hydraulic ram against the ram collar.

Remove the two limiting stop bolts on the control valve rockerarm. Manufacture and install two replacement bolts of sufficient length (approximately 8 inches) to fully lock against rocker arm on each side to ensure that the rocker arm will remain in the neutral position.

050-3.8.9 Miscellaneous Engines and Winches. Follow the instructions of paragraph 050-3.8.8 for telemotor and other hydraulic systems as applicable. Follow the instructions of paragraphs 050-3.9.2.5 and 050-3.9.2.6 for electric motors and control equipment. Remove topside winches and place inside the ship as directed by INACTSHIPMAINTO.

050-3.8.9.1 Steering Engines. The exposed portions of the steering gear rams and Rapson slides must be preserved with solvent cutback corrosion preventive in accordance with Section 4. Rudders must be secured in accordance with section 5-2.7.6 of the U.S. Navy Towing Manual SL740-AA-MAN-010.

050-3.8.9.2 Electric or Steam Driven Winches. Clean electric or steam driven winches and paint all exterior surfaces or preserve with grade 2 solvent cutback corrosion preventive compound. Remove, tag, and stow in D/H space. If this is not practical, flush the interior (steam) side of the winches with grade 2. Since no preservative is to be used in the steam cycle, use extra care to ensure the supply and drain lines are broken and blanked where they enter the ship. An activation work request must be submitted to flush out and remove all traces of preservative before the winch is reconnected to the ships steam system.

050-3.8.9.2.1 Weather Deck Machinery Package all other machinery located on weather decks and in spaces not under D/H in accordance with Section 6. Metal enclosures and dynamic D/H are considered to be the most effective preservation method.

050-3.8.9.2.2 Deck Machinery. Preserve other machinery within the machinery platform on pedestal-type cranes above the weather deck as though exposed to the weather, unless within a weather deck encapsulation.

050-3.8.10 CHT System. Deactivation of the Collection, Holding, and Transfer system (CHT) should be performed in accordance with NSTM S9086-T8-STM-010 Chapter 593 POLLUTION CONTROL. In addition, all cutouts should be removed from the tanks and the tanks cleaned. Gas free the tanks and then open the system to dynamic dehydration.

050-3.9 ELECTRICAL EQUIPMENT

050-3.9.1 General. Inactivate in accordance with the following: Preservation measures are to be accomplished by ship's force to the maximum extent of their capability assisted by such industrial facilities as are made available. Preservation measures include, but are not limited to, the following general measures and those additional measures for specific electrical equipment that are detailed or referred to in this paragraph:

Ship's force inspect and test as necessary to determine the condition of equipment and circuits. Repair, if feasible, or list equipment found inoperable. Clear, if feasible, or list zero grounds in electrical machinery and circuits.

Insofar as practical, remove, tag, and stow electrical equipment not under D/H in a dehumidified space. The tags must include the name of the equipment and its normal installed location. A complete set of mounting bolts and associated hardware required for reinstallation is to be placed in a cloth bag (NSN 8105-00-281-3924) and physically attached to each unit removed. The remaining equipment not protected by D/H must be preserved in accordance with paragraph 050-6.7.

Remove from the ship all easily pilferable articles, such as portable power tools, hand tools, and portable electrical instruments.

Attach suitable tags of noncorrodible materials (e.g., dog tags or bakelite) at the normal installed location of removed items. The tags must indicate the name of item, normal location, and stowed location.

List all items removed from normal location to more secure and/or dehumidified stowage; include the name of each item, its normal location, and its stowed location.

List the location(s) of all pertinent records and drawings.

Replace with standard type sheet brass fixtures all weather exposed electrical fixtures such as jack boxes, switches, junction boxes, and various other electrical outlets that are deteriorated beyond economical repair. Where replacement units of sheet brass or other noncorrodible material are not available, remove the deteriorated fixtures and properly seal the cable ends. Do not reinstall new equipment of the type that will again corrode, but stow replacement items following procurement, properly tagged, in dehumidified spaces. Install sheet brass fixtures and fittings on aluminum bulkheads as shown on NAVSEA standard dwg 9000-56202-73980, section 3, in order to prevent electrochemical action between these two metals.

050-3.9.2 Details of Preservation. Solvent cutback corrosion preventive is injurious to most forms of electrical insulation. Careful supervision must be exercised to ensure that it does not come in contact with any electrical insulation.

a. Preserve corrodible surfaces directly adjacent to electrical insulation by the use of clear-drying insulating varnish as specified in NSTM S9086-KC-STM-010 Chapter 300 ELECTRIC PLANT-GENERAL (9600).

b. Paint all metallic surfaces requiring repainting or touching up in accordance with NSTM S9086-VD-STM-010 Chapter 631, VOLUME 1, PRESERVATION OF SHIPS IN SERVICE – GENERAL (9190).

c. Switchboards, power distribution panels and propulsion control units:

d. Clean the equipment, including bus work and appurtenances, insofar as practical without disassembly of the switchboard or its component parts.

e. Make any necessary repairs and clean; then repaint any surfaces on which the existing paint is chipped, cracked, or show signs of corrosion.

f. Oil and grease all linkages and fittings that normally require lubrication.

g. Clean rheostat buttons and spaces between buttons. Cover buttons on which the brush will rest with barrier paper meeting Military Specification MIL-B-121, (NSN 8135-00-753-4662 for Type I, grade A, 36-inch by 100-yd roll; 8135-00-753-4661 grade A, 36-inch by 100-yd roll). Buttons other than those on which the brush is to rest need not be covered.

h. Ship's service switchboards of all ships must be connected to an outside source of power as required by paragraph 050-6.4.5.2.m. All switches not required to be closed, i.e., normal lighting, supply to power outlets, use in emergencies, or for operation of D/H equipment must be left in the open position. Install tags (NSN 0105-00-634-6000) on those switches that are required to be closed in inactive status. Indicate the purpose of the switch that is closed. Install warning tags of a different color or design on switches, which if closed, would result in damage to equipment. Remove fuses from all but lighting circuits; bag and secure to the unit.

050-3.9.2.1 Electric Cables. Electric cable ends for removed topside equipment must have the individual conductor terminals adequately insulated from each other and from ground to permit proper insulation resistance tests of the circuit.

a. Where the cable does not terminate in a watertight enclosure, properly seal the end according to NAVSEA standard dwg 9000-S6201-73980, section 4, methods 4567, 41011, and 41001. Acceptable alternate methods are 4591, and 4592, 4601, and 4602. Protective coating, MIL-C-15705A, is a satisfactory substitute for MIL-P-18623.

050-3.9.2.2 Clamps and Stuffing Tubes. Remove all corrosion products and clean. Where necessary to ensure watertightness, replace the packing in the gland and tighten gland nuts before painting. Sandpapering or careful wirebrushing is recommended. Metal-conditioning compound may also be used. Paint with two coats of primer, formula 116, or formula 84/47, whichever is applicable, and two topcoats of the same paint used on the surrounding structure.

050-3.9.2.3 Kickpipes. Remove all corrosion products and clean. Where corrosion has not penetrated the kickpipe or adjacent decks, paint with two coats of primer, formula 116 or formula 84/47, if applicable, followed by two coats of gray deck paint, formula 20. Where kickpipes are so closely nested as to preclude proper surface preparation and painting, use metal-conditioning compound to loosen rust and scale, after which remove the maximum amount possible of rust scale by blowing out with air or other suitable means. After treatment is completed, a 50-50 mixture of metal-conditioning compound and grade 1 solvent cutback corrosion preventive NSN 8030-00-244-1299 (5 gallon pail) should be applied to prevent further corrosion.

050-3.9.2.3.1 Cleaning and Preservation Agent. Metal-conditioning compound and a 50-50 mixture of metal-conditioning compound and grade 1 solvent cutback corrosion preventive are acceptable as cleaning and preservation agents for steel armor, clamps, stuffing tubes, and kickpipes for electrical cable. The use of these com-

pounds is predicated on the fact that the compounds are not harmful to materials used for the impervious cable sheath directly below the steel armor; however, the fact that the compounds are detrimental to electrical insulating materials employed inside the cable beneath the sheath must not be overlooked. Care must be taken that these compounds do not get into the ends of the cable where electric insulation is exposed.

050-3.9.2.3.2 Deteriorated Kickpipes. Remove and replace deteriorated topside kickpipes with cable riser box arrangements according to NAVSEA standard dwg 9000-S6202-73980, section 4, methods 41561, 41562, 41571, and sheets 179 and 180. If such repairs are not feasible at the time penetration is discovered, pull the cable back into the ship and tag, patch the deck, and enter the need for completion of the work into the ship's records for completion at the first availability.

Where corrosion has penetrated the wall of the kickpipe or the adjacent deck, remove and replace kickpipes with cable riser box arrangements according to NAVSEA standard dwg 9000-S4202-73980, section 4, methods 41561,41571, and sheets 179 and 180.

050-3.9.2.3.3 Capping Kickpipes. In cases where cable has been extracted along with topside equipment removal, it is preferable to cap and preserve associated kickpipes that are in good condition. The preferred method of capping is through use of a threaded steel cap or pipe plug. Alternatively, use the steel stuffing tube plug method. Wooden damage control plugs are not to be used.

050-3.9.2.4 Minesweeping Cable. Refer to paragraph 050-3.13.

050-3.9.2.5 Rotating Electric Equipment. The following includes ship's service, emergency, and propulsion (diesel, turbine, and motor driven) motors, generators, and motor-generators, and other electric rotating equipment.

050-3.9.2.5.1 Preservation. Preserve turbine or diesel drive ends according to paragraphs 050-3.6.3 and 050-3.6.4 respectively. Do not jack motors or generators after application of preservative compound to the bearings; attach warning tags so stating.

050-3.9.2.5.2 Stowage. Remove topside motors exposed to weather conditions and store below in dehumidified spaces. Attach tag indicating motor identification, and stowed and installed locations. Record repairs required to reactivate in ship's CSMP.

050-3.9.2.5.3 Interior Cleaning. Accomplish cleaning of the interiors of the machines according to instructions in NSTM S9086-KC-STM-010 Chapter 300 ELECTRIC PLANT-GENERAL (9600). The removal of oil and grease from electrical insulation is an emergency repair incident to inactivation, since neglect of this condition will result in further deterioration of the equipment. Inactivation inspection of essential electrical equipment includes disassembly to the extent required to determine the presence of any appreciable accumulation of oil or grease on the insulation. Disassembly of motors in relatively inaccessible locations, such as axial-flow vent motors, may be limited to representative motors at the discretion of the INACTSHIPMAINTO.

050-3.9.2.5.4 Ring-Lubricated Sleeve Bearings. For ring-lubricated sleeve bearings, drain oil from bearings and oil reservoirs. Flush bearings and reservoir with grade 2 solvent cutback corrosion preventive (Section 4), ensuring that the rust-preventive compound reaches all corrodible surfaces of the shaft and bearing. Introduce rust-preventive compound carefully (avoid splashing compound on machine insulation) into inspection hole in top of bearing cap to aid in getting rust-preventive compound to all parts of the bearing and journal.

050-3.9.2.5.5 Forced Feed Bearings. For forced feed bearings, drain lubricating oil system and apply rust-preventive compound according to paragraph 050-3.6.3. For ball bearings, follow instructions outlined in NSTM S9086-KC-STM-010 Chapter 300 ELECTRIC PLANT-GENERAL. Avoid excessive greasing.

050-3.9.2.5.6 Shaft and Coupling Preservation. Apply rust-preventive compound to shafts, couplings, and other exposed exterior machined parts. Do not use preventive compound inside motor housings, except as required by 050-3.6.3.

Where possible to do so without removing the end bell, remove brushes from motor, place in a bag, and tie to motor. Remove collector ring brushes, bag, and tie to motor. Give exposed surfaces of steel collector rings a coat of solvent cutback corrosion preventive, Grade 2.

050-3.9.2.5.7 Motor Brushes. For items such as heat exchangers and oil coolers on motors and generators, apply preservative measures applicable to that particular type of equipment.

050-3.9.2.5.8 Enclosed Machinery. On totally enclosed machines installed in dehumidified compartments, remove inspection plates to permit free circulation of dry air through the machine from the compartment. Secure inspection plates to the machine. On machines provided with exhaust and uptake ventilation systems opening to the weather, seal off weather end of ventilation ducts to preclude entrance of moisture from these ducts. Properly tag closure.

050-3.9.2.6 Controllers. When practical, repair to operational condition. When repair is not possible, document the deficiency in the 3-M System for repair during activation.

050-3.9.2.7 Transformers. Clean and repaint as necessary.

CAUTION

Do not use solvent cutback corrosion preventive on reflectors.

050-3.9.2.8 Searchlights. Remove and tag searchlights (eight and twelve inch; incandescent and high intensity) and ballast boxes. Stow in a dehumidified space secured for sea. Place drums, supports, and operating mechanisms in good operating condition and either place in dehumidified space aboard parent ship or package in place under D/H.

050-3.9.2.9 Electric Heating Devices. These require no special means of preservation other than a thorough cleaning. Stow portable equipment in a dehumidified space.

050-3.9.2.10 Magnetic Minesweeping Equipment. Apply preservation measures outlined above for various electrical equipment to corresponding units of minesweeping gear. Refer to paragraph 050-3.13.

050-3.9.2.11 Lighting Fixtures, Battle Lanterns, Bracket Fans. Lighting fixtures permanently installed, other than those exposed to the weather, require no special means of preservation. Remove battle lantern batteries. If permanently installed, disconnect the relay from the source of power. Remove plug from socket on all others and wrap cord around fan. Disconnect and insulate power cables at bracket fans, battle lanterns, and water fountains.

050-3.9.2.12 Degaussing Installations. Apply preservation measures previously outlined for various electrical equipment, e.g., motor-generators, controllers, and rheostats, to the corresponding units of the degaussing installations.

No special preservation measures are required for degaussing coils located entirely within the hull of the ship under D/H, nor is weekly energizing of the coils, as specified in NSTM S9086-QN-STM-010 Chapter 475 MAGNETIC SILENCING, necessary during the inactive period. Degaussing cables in weather spaces shall be preserved as outlines in paragraph 050-3.9.2.

Clean and paint compass compensating coils and control boxes. Check stuffing tubes, connection box covers, and control box covers for watertightness. Replace gaskets where necessary.

Degaussing connection and through boxes located in dehumidified spaces need no special preservation preparations other than to ensure the boxes are clean and dry and show no evidence of corrosion and that cover gaskets are in good condition.

050-3.10 INTERIOR COMMUNICATION, FIRE CONTROL, SHIP'S INERTIAL NAVIGATION SYSTEM (SINS), AND GYROCOMPASS EQUIPMENT

050-3.10.1 General.

050-3.10.2 Tests and Inspections.

050-3.10.2.1 Test, Operate and Inspect. Test, operate, and inspect all equipment and circuits during inactivation, to determine the need for repair or other corrective action necessary to ensure long-term preservation and satisfactory operation incident to future activation. Conduct tests under as near normal operating conditions as feasible. Correct any circuit connections that are not in conformity with applicable wiring diagrams, or make suitable entries in the appropriate records to explain fully the nature of and need for such circuit connections. Replace missing cable marking tags.

050-3.10.2.2 Insulation Resistance and Temperature. Take and record a complete set of insulation resistance and temperature values for each item of equipment and each circuit. Measure the insulation resistance from each conductor of each circuit to ground. However, only the low reading for each complete connected circuit need be recorded.

050-3.10.2.3 Machinery History Card. Enter the accomplishment and results of the operating tests and inspections on the Machinery History Card for each item of equipment or electrical system, together with a record of the accomplishment of any corrective work incident to inactivation. Inactivation work requests should be prepared using current fleet practice and applicable forms.

050-3.10.2.4 Permanent Records. Record the insulation resistance and temperature values for each item of equipment in permanent records with such additional information as may be necessary to facilitate the taking of comparable readings in the future. Prepare the permanent records in accordance with paragraph 050-3.9.1.

050-3.10.2.5 Recording Instructions. Record the insulation resistance and temperature values together with other pertinent information for cable circuits, as follows: Prepare a record for each interior communication, action cutout, and fire control switchboard and panel, listing each circuit emanating there from. Include in the record the name and number of each circuit; a list of all sub-circuits connected to each of the circuits emanating from

the switchboard or panel, whose insulation resistance can be checked concurrently; a record of the position of each switch necessary to maintain this connection and the location of such switches; a record of the insulation resistance and approximate cable temperature of each such complete circuit connected as shown on the record, as measured at the time of inactivation; a record of the total length of cable included in the complete circuit (refer toNSTM S9086-KC-STM-010 Chapter 300 ELECTRIC PLANT-GENERAL (9600)); and a notation as to what portion, if any, of the complete circuit is in a weather-exposed location, or a space, such as hangar decks of carriers, not subject to dynamic D/H during the inactive status of the ship. Prepare a similar record listing each interior communication and fire control cable whose insulation resistance cannot be checked through one of the aforementioned switchboard or panel circuits, as connected. In addition to the information similar to that required for the circuits emanating from a switchboard or panel, include in this record the location at which the insulation resistance of the listed circuit can be most readily measured.

050-3.10.3 Detailed Preservation.

050-3.10.3.1 General.

a. Superpower reproducers class BM and BF which are too bulky to be removed and stored below decks must be preserved in place, fitted with a desiccant protection. Class small BM reproducers, such as installed in FF's, are less bulky and can be stored below decks under D/H. Stow remaining cable ends in accordance with paragraph 050-3.9.2.1.

b. Clean, repair, and paint all interior communication and fire control equipment (such as switches, telephone jack boxes, indicator lights, pushbuttons cease firing, general alarm, and salvo signal contact makers) other than that specifically mentioned in other sections of this article.

050-3.10.3.2 Compasses:

a. Remove mercury ballistic from compass.

b. Remove mercury from mercury ballistic and seal in glass or earthenware jar.

c. Secure link bearing to mercury ballistic link arm with oil saturated cloth and cover with masking tape to keep oil from drying out of cloth.

d. Leave the mercury ballistic and mercury in the bottom of binnacle and make a cloth cover to cover the entire binnacle. Secure a tag with all nameplace data to the outside of cover.

ARMA MASTER COMPASSES:

a. Remove sensitive element from master compass.

b. Remove mercury from collector ring assembly, and store in clean glass or earthenware jars; label for collector rings.

c. Remove mercury from flotation bowl and store in clean glass or earthenware jars; label for flotation.

d. Place a cushion made from clean rags or tissue paper in floatation bowl. This cushion must be adjusted so that the sensitive element will be at its normal height in relation to the stalk so damage will not occur to the contact pins when the spider is placed on the binnacle.

e. Remove oscillator assembly, clean off excess oil, pack in separate container and place in bottom of binnacle.

f. Place jars of mercury in bottom of binnacle along with oscillator assembly.

g. Replace spider on binnacle and enclose entire binnacle in a cloth cover. Attach a tag with all nameplate data to the outside of cover.

BOTH SPERRY AND ARMA MASTER COMPASSES:

a. Preserve motor-generators as described in paragraphs 050-3.9.2.5.

b. Remove batteries.

c. Preserve control and repeater panels as described in paragraph 050-3.9.2.

d. Remove pelorus stand, SS Alidade stands, and wooden bases. Tag and stow below in same manner and with equipment described in paragraph 050-3.14.9. Seal the cable end according to section 4.

050-3.10.3.3 Dead Reckoning Equipment. Clean equipment insofar as practical without disassembling. Coat all gears, friction disks, rollers, and other moving parts with a thin coat of petroleum.

050-3.10.3.4 Ship's Inertial Navigation System. Remove memory units and stow in an area free of stray magnetic fields (preferably at shipyard). Remove inertial units and stow in containers (heated, if required, preferably at shipyard). Preserve electronic equipment according to paragraph 050-3.11.1.

050-3.10.3.5 Security Alarm Circuits FZ or 4FZ Equipment. For surface ships or submarines to be inactivated, do not remove any wiring or hardware not specifically discussed below. Remove and discard battery from security alarm switchboard. After removing battery, close switchboard door and lock both locks of the switchboard door. Lock door of special alarm connection box closed. Identify all keys and place keys in an envelope marked with secret classification and identified with the ship and with circuit FZ or 4FZ. Remove from the ship technical manuals, drawings, logs or notes (all circuit FZ or 4FZ) and the keys previously discussed. Store all of these data items and keys ashore according to classification each item carries for use again on the ship. Treat the keys as secret. Turn over all classified material to the cognizant INACTSHIPMAINTO Director (refer to paragraph 050-3.14.3).

050-3.10.5.1 Surface Ships to be Scrapped. For surface ships to be scrapped, remove the following equipment if installed: security alarm switchboard(s); special alarm connection box (4FZ only); audible and visual remote or signals type IC/EA, IC/EAP, or IC/EAW with its foul weather cover; and safety wirelead sealing tool. Ship all material as unclassified. For Foreign Military Sales (FMS), removals will be in accordance with SECNAVINST 4900.48 (Series).

050-3.10.5.2 Removed Material. Identify the removed material on Material Identification/Disposition Request, NAVSEA 4410/4 form and submit forms to Naval Inventory Control Point (NAVICP), Mechanicsburg, PA for disposition instructions.

050-3.10.5.3 Battery. Remove and discard battery from security alarm switchboard if switchboard is a type wherein a battery is installed. Consult the circuit FZ or 4FZ equipment technical manual for assistance in locating any battery. After removing battery, lock both locks of security alarm switchboards) with door open. Also open door of special alarm connection box using its special set of keys and lock the lock. Destroy all sets of keys for above switchboards) and special alarm connection box in the prescribed manner for secret material.

050-3.10.5.4 FZ/4FZ Tech Manuals. Turn in the FZ or 4FZ circuit technical manuals, ship's drawings, and any log, notes, or keys therewith to the respective INACTSHIPMAINTO Site Director marked with the appropriate classification. Do not remove any wiring or other hardware of circuit FZ or 4FZ unless specifically directed in writing.

050-3.10.5.5 Submarine Systems (Disposition).

a. Impulse charging manifold box.

b. Impulse charging manifold valve wrench.

c. Torpedo tube breech door locking device.

d. Torpedo tube muzzle door locking device.

e. Manifold valve lock switch.

050-3.10.3.6 Sinuous Course Clock and Cams. Turn in the sinuous course clock to the INACTSHIPMAINTO and cams to the nearest Classified Material System (CMS) or Naval Inventory Control Point (NAVICP), Mechanicsburg, PA.

050-3.10.3.7 Pitometer Log and Sword. If a bellows type control unit, flush the bellows with fresh water, clean the unit and all corrodible surfaces, and preserve with grade 2. The sword for all units is to be cleaned and stowed, preferably in the IC room. Tag the sword mount with the sword location. Blank the flange in accordance with paragraph 050-3.3.5.

050-3.11 ELECTRONIC EQUIPMENT

050-3.11.1 General. The following are general procedures to be used for guidance in the inactivation and preservation of radio, sonar, radar, infrared, and countermeasures equipment.

050-3.11.2 Inside Ship. Refer to equipment instruction books and electronic maintenance bulletins as necessary. Where practical and time permits, service all equipment as necessary to place in good operating condition. This would include inspecting, cleaning, and test operation of all units, as well as the replacement of all damaged or missing parts.

050-3.11.2.1 Fuse Removal. Secure equipment in the usual manner and open power distribution panel. Remove fuses, bag, and attach to equipment. Ground antennas where disconnect switches are provided. Disconnect and stow antenna and remote control panel patch cords. Tag equipment to indicate location of power switches and fuses.

050-3.11.2.2 Motor-Generators. Preserve motor-generators in accordance with paragraphs 050-3.9.2.5.

050-3.11.2.3 Batteries. Remove wet and dry batteries in accordance with paragraph 050-3.15.3.3.

050-3.11.2.4 Corrosion Preventative. Apply solvent cutback corrosion preventative only to unpainted moving mechanical parts and structural members subject to corrosion; never apply to cabling, sockets, and electrical components.

050-3.11.2.5 Dust Covers. Use loose fitting dust covers made of fire retardant paper to protect electronic equipment from dust during inactivation. Depending on the type of equipment installed, some individual equipments may require dust covers made of different materials. These are addressed in separate procedures when applicable (e.g., MK 86 MFCS). In the event dust covers obscure name plate data fill out a tag with name plate data and hang the tag on the equipment to assist in identification. Leave dust covers open at the bottom and sides to permit diffusion of dry air into interior of the equipment. Prior to movement to a INACTSHIPMAINTO, remove those dust covers installed over electronic equipment that are not specifically called for in other inactivation procedures or paragraphs of this inactivation plan.

050-3.11.2.6 Portable Infrared Receivers. Remove all portable infrared receivers and send to the Norfolk Naval Shipyard repair facility.

050-3.11.2.7 1MC Speakers. Remove outside 1MC speakers and store inside secure dehumidified area of ship. Use ″Heat Shrink″ tape or tubing on cable ends for protection. Tag Cables. Label location of the speaker.

050-3.11.3 Outside Ship (Weather-Exposed Material). Replace corrodible hardware with noncorroding material. Use instruction books and electrical/electronic maintenance manuals for reference. Remove all small-sized weather-exposed electrical/electronic equipment. Preserve, tag, and stow below in a dehumidified space. During the ship's inactivation briefing, these items will be identified by the INACTSHIPMAINTO personnel.

050-3.11.3.1 Weather Deck Antennas. Antennae, shall be removed from mast. As applicable, ships force perform PMS/IEM on antennae. Store inside ship in a dehumidified space.

050-3.11.3.2 Preservation. Under the cognizance of the assigned INACTSHIPMAINTO, search antennas will be removed and stowed under shelter on the cognizant ship. The following preservation measures apply:

a. Prepare surfaces in accordance with Mare Island Naval Shipyard Engineered Method 354.006 or 354.007 and coat in accordance with 354.001.
b. Insulate dissimilar metal points of contact with insulating tape (MIL-I-7798) specified in NSTM S9086-VD-STM-010 Chapter 631, VOLUME 1, PRESERVATION OF SHIPS IN SERVICE – GENERAL.
c. Wrap dipole insulators with silver colored, plastic treated, cloth backed tape conforming to PPP-T-60, class I (3M company #390 or equal).
d. For areas that are not painted or are inaccessible, preserve with MIL-C-16173, grade 2 preservative in accordance with procedures contained in section 4.
e. Drain and fill gear boxes and enclosed lubrication systems with preservative oil, MIL-L-2105B, NSN 9150-01-035-5393.

050-3.11.3.3 Large Special Purpose Antenna. Preserve large special purpose antennas such as TACAN and certain ECM antennas that cannot be preserved under D/H in accordance with measures specified in paragraph 050-3.11.3.2 that are applicable to the specific antenna type. Antennas previously preserved in place and those not under D/H need not be relocated except on an opportune basis.

050-3.11.3.4 Antenna Hardware. Place a complete set of mounting bolts and associated hardware required for antenna reinstallation in a cloth bag, physically attached to each unit removed. Ensure activation instructions for the ships concerned contain information as to the location of the removed equipment.

050-3.11.3.5 Exterior Waveguides. If the antenna is removed, install a metal blank, with a gasket and seal with 2 coats of liquid envelope. Seal all exterior drain holes. After arrival at INACTSHIPMAINTO, remove a suitable section in a space under D/H to permit D/H airflow into the waveguide. Wire the removed section nearby.

050-3.11.3.6 Flexible Cable. The term flexible cable applies to a loop of unpainted cable used with revolving gun mounts and antennas. Cover exposed flexible cables with a suitable covering such as grade C paper. Wrap spirally, starting at the lowest point. Where equipment has been disconnected, seal the ends of multi-conductor cables by suitable means. Tape the ends of individual leads and tag prior to sealing the cables.

050-3.11.3.7 Whip and Wire Rope Antennas. The ship's files should contain current copies of the antenna rigging photographs. Correct the antenna rigging plans to agree with the actual installation. In the absence of these plans prepare an isometric sketch of the antenna system for ship's records and include in reactivation instructions. Remove antennas and fittings, clean, check for excessive wear, replace parts as necessary, and stow in a dehumidified space (preferably an electronic space). Identify by tagging antennas and fittings removed, and the bases or mountings from which they are removed. Make proper entries in the reactivation work package and electronics history. Where equipment has been disconnected, seal the ends of the cables after the ends of the individual leads have been properly tagged and taped. Thoroughly clean all insulators and then protect with two coats of strippable coating to provide protection against accidental painting or sandblasting.

050-3.11.3.8 Air or Gas Filled Coaxial Lines. Where air or gas-filled coaxial lines are in good condition, make airtight and check the insulation resistance. Reseal airtight lines when broken because equipment has been disconnected from them. Leave airtight coaxial lines under normal pressure, but do not attempt to keep this pressure up during the time the ship is inactivated.

050-3.11.3.9 Antenna Trunks. Protect weather-exposed exterior surfaces of corrodible antenna trunks with paint or preservative as applied to adjacent hull structure. For units not protected by dehumidification, protect interior surfaces as follows:

a. Apply standard exterior paint to corrodible surfaces accessible to proper surface preservation.
b. Clean inaccessible corrodible interior surfaces as practical and protect by application of Formula 123G or solvent cutback corrosion preventive. Application of metal conditioning compound, grade 1, is recommended for use in removal of scale and rust deposits prior to application of preservative.
c. Positive drainage should be provided by removing inspection plate or cutting hole in antenna trunk external to the D/H blank installed.

050-3.11.3.10 Use of Normal Preservative. Where it is impractical to stow other exposed electronic equipment in a dehumidified space, use normal preservative, i.e., paint, solvent cutback corrosive preventive (Section 4) and packaging (paragraph 050-6.7).

050-3.12 SONAR

050-3.12.1 General. The following is general information for guidance in the inactivation of sonar and associated equipment.

a. Retighten the bolts on the sonar chest inside the ship approximately two weeks after the sea chest has been filled in order to ensure tightness.

b. Provide plans of the cover plates and photographs, if practical, for each ship upon which installed. Note any special precautions and techniques necessary in the activation instructions.

c. Where not already aboard, install a dome vent pipe in the sonar sea chests of all surface vessels equipped with sonar domes. Extend the vent pipe to a height above the draft water line level of the ship in order to prevent the flooding of the ship compartments. (Refer to EIMB (SONAR), NAVSEA 0967-000-0030.) Sonar chests of submarines do not require venting.

d. At reactivation, remove plugs and scrape off sea growth. Periodic scraping of inactive domes is not recommended because of possible damage to the window and paint. Paint, if drydocked, and replace zincs as required.

e. During activation, chip or burn off studs and retaining bars used to secure sonar sea chest cover plates installed in accordance with NAVSEA dwg 56800-347044 (refer to paragraph 050-3.12.2) as flush with the hull as possible to prevent turbulence in the way of the sonar transducers. Repaint disturbed hull areas if ship is drydocked.

050-3.12.2 Sonar Sea Chests. The following emphasizes sonar sea chests preservation:

a. Ranging. Clean thoroughly and paint.

b. Sounding. Clean and paint as for ranging. Bottomside transducers will be removed incident to cleaning and preservation of seachest.

c. Depth determining. Clean the sea chest below the gate valve and paint.

050-3.12.3 Sonar Transducers. Transducers installed within the previous nine months and which operate satisfactorily need not be replaced at the time of inactivation of a ship. During drydockings accomplished thereafter, prior to activation, replace transducers only if the installed equipments do not meet the following electrical requirements:

a. The impedance of magneto-striction transducers are not within 5 percent of the normal value.

b. The impedance of crystal transducers are not within 10 percent of the normal value. Except in an emergency, open transformer coupled transducers only at an established transducer repair facility.

c. Insulation resistance of one megohm or higher and stable when tested with a 500-volt megger.

d. When attached cables at transducer show evidence of hydraulic oil blisters or general deterioration.

050-3.12.3.1 Specific Transducer Types. The following additional instructions apply to the transducer types indicated below:

a. Ranging. Clean thoroughly and paint in accordance with NSTM S9086-VD-STM-010 Chapter 631, VOLUME 1, PRESERVATION OF SHIPS IN SERVICE – GENERAL.

b. Sounding. Clean and paint as for ranging type. In addition, paint that part of the transducer normally inside the ship with one coat of aluminum paint prepared by mixing 2.0 pounds aluminum paint. Install a portable transducer cover plate in accordance with NAVSEA dwg S6800-860065 and EIMB (SONAR), NAVSEA 0967-LP-000-0030. In the case of steel diaphragm, fill the void space between the cover plate and the face of the transducer with solvent cutback corrosion preventive, grade 3. For flush mounted transducers that require

a cover plate (refer to paragraph 050-3.12.3.2), if not already accomplished, provide properly marked stowage clamps or rack in the vicinity of the equipment for holding the cover plates when ships are activated.

c. Depth determining. Preserve as prescribed for the ranging type.

050-3.12.3.2 Cover Plate. . Provide a cover plate for flush mounted transducers as shown in NAVSEA dwg RE78F2223A. For recessed transducers, use only piece 104 as a cover plate as shown on Long Beach Naval Shipyard dwg DE-129-S6713-H1216194A. Make the cover watertight and finish with paint.

050-3.12.4 Sonar Domes. Refer to enclosure provided in the inactivation-planning letter.

050-3.12.5 Depth Recorders. Remove and dispose of the recording paper. Remove the stylus and place in the bag with the fuses.

050-3.12.6 Repair Parts Retain maintenance repair parts in their normal stowage when the space is dehumidified. Move electronic maintenance parts from non-dehumidified compartments to dehumidified compartments, preferably to an electronic space.

050-3.13 MINE COUNTERMEASURES GEAR

050-3.13.1 General. Retain minesweeping gear in the ship except as otherwise specified in this paragraph. Condition the surfaces of all permanently installed minesweeping gear by painting (in accordance with NSTM S9086-VD-STM-010 Chapter 631, VOLUME 1, PRESERVATION OF SHIPS IN SERVICE – GENERAL (9190)) all metallic or fiberglass surfaces (e.g., size 0 plastic float) requiring painting or touching up. Package items subject to deterioration from the weather in place in accordance with paragraph 050-6.7. Stow in a dehumidified compartment or preserve as otherwise specified herein. Stow portable items in a dehumidified compartment.

050-3.13.2 Magnetic and Acoustic Cable.

a. Remove cable from the reel (by reeling it onto a temporary storage reel of suitable drum diameter and capacity), and preserve the reel (and reel house where applicable) by appropriate methods outlined in paragraphs 050-3.3.6 and 050-3.4.1.1 and NSTM S9086-VD-STM-010 Chapter 631, VOLUME 1, PRESERVATION OF SHIPS IN SERVICE – GENERAL (9190) (aluminum alloy). Stainless steel reels are not required to be painted.

b. Coat reel drum and inner surfaces of flanges with adhering strippable coating (except for stainless steel reels).

c. Replace cable on ship reel. Inspect cable for damage as it is reeled and make a record of nature and location of any damage. Put inspection record in a weatherproof envelope and fasten it securely to the reel flange. Lash cable end to reel flange.

d. Replace canvas reel covers on open deck reels.

e. Erect shelter over cable reel (and reel house where applicable) so as to provide shade from direct rays of sun without impeding free circulation of air. Paint top of shelter with a reflective surface (e.g. aluminum paint).

050-3.13.3 Acoustic Minesweeping Devices.

a. A Mark 4(v) Acoustic Device and associated equipment:

(1.) Remove striker unit assembly bedplate complete with striker unit and motor from the sound box.

(2.) Lubricate the hammer with a grade II medium mineral grease satisfying Federal Specification VV G-632, type B, grade II (NSN 9150-00-985-7316). Remove the striker assembly, clean the ball socket, and give it a light coating of grease. Remove the striker sleeve and give the spring and spring holder a liberal application of grease. Grease fittings are provided on the reservoir of the cylinder, on both pillow blocks, and on the housing of the eccentric bearing.

(3.) Cover all exposed chromium plated parts with solvent cutback corrosion preventive, grade 1.

(4.) Coat bright or unpainted parts, such as striker, guides, and adjustment screw, with two coats of solvent cutback corrosion preventive, grade 2.

(5.) Examine all painted surfaces of the assembly and paint or touch up in accordance with NSTM S9086-VD-STM-010 Chapter 631, VOLUME 1, PRESERVATION OF SHIPS IN SERVICE – GENERAL.

(6.) Reinstall striker unit assembly in the sound box.

(7.) Tag device to indicate any parts found defective.

(8.) Ensure that protective cap is installed on device receptacle and on the reel and dock receptacles, as applicable. HAND TIGHTEN ONLY.

b. A Mark 6(b) Acoustic Device and associated equipment

WARNING

Release air pressure from the device prior to removing covers.

(1.) Remove front and top cover plates.

(2.) Rotate flywheel by hand through several revolutions to assure that moving parts are not binding.

(3.) Lubricate hanger shaft bearings with grease conforming to DOD-G-24508, NSN 9G-9150-00-149-1593 or 9G-9150-00-823-8048. Force approximately 1/4 ounce of grease into each pillow blockbearing, one ounce into the large starboard connecting rod bearing, and 1/2 ounce into each port connecting rod bearing. Liberally lubricate all other bearings.

(4.) Inspect all structural parts for defects, including cracks and broken welds.

(5.) Lubricate the eccentric mechanism thoroughly with medium mineral grease satisfying Federal Specification W-G-632 type B grade II.

(6.) Coat bright and unpainted parts with two coats of solvent cutback corrosion preventative, grade 2.

(7.) Examine all painted surfaces on the assembly and housing. Paint or touch up as necessary in accordance with NSTM S9086-VD-STM-010 Chapter 631, VOLUME 1, PRESERVATION OF SHIPS IN SERVICE – GENERAL.

(8.) Reinstall cover plates.

(9.) Tag device to indicate any parts found defective.

(10.) Ensure that protective cap is installed on device receptacle and on reel and deck receptacles, as applicable. HAND TIGHTEN ONLY.

(11.) If a Mark 6(b) manual controller is installed in reel house or on deck, remove controller and stow it in dehumidified space in accordance with paragraph 050-3.9.2.6.

c. A Mark 7 Acoustic Device and associated equipment:

(1.) Thoroughly cleanse the entire unit free of foreign matter. Wipe all exterior areas with a water-soluble cleaning agent and thoroughly flush the interior of the device (not motor) with fresh water. Disconnect the air hose assembly from the manifold of the device and force water into the device through the hose fitting while rotating the rotor of the device by hand. Following this flushing operation, attach the air hose assembly.

NOTE

The device contains bushing type bearings that are designed to operate with only water lubrication. Therefore, do not allow any non-water soluble oil, grease, or cleansing agent to come in contact with the device.

(2.) The motor is oil filled. However, some oil must be removed to release tension on the spring located inside the motor, in general accordance with the technical manual for the motor.

(3.) Coat the entire motor exterior, motor adaptor, and cradle with two coats of solvent cutback corrosion preventive, grade 2.

(4.) Wrap the exposed parts on the drive end of the motor, such as the shaft, key, flexible coupling, singer and hub with vapor barrier material.

(5.) Tag the device to indicate any parts found defective.

(6.) Ensure the plastic protective caps provided with the motor are installed on the three receptacles. Also, provide additional protection for the threads on the motor receptacles by wrapping the caps and adjacent receptacle areas with canvas secured by marlin.

(7.) Preserve the terminal box for the inboard plug of the A Mark 7 type cable in accordance with paragraph 050-3.9.2.10.

050-3.13.4 Minesweeping Gear Handling Equipment. Clean and preserve minesweeping gear handling equipment such as hooks, blocks, flounder plates (MSS), and wire ropes as required and stowed in the as-rigged condition in a dehumidified space. Clean and coat associated plow steel wire rope with graphite grease in accordance with paragraph 050-3.4.2. Clean wire rope fabricated from corrosion resisting steel (MSO MSC). Omit the graphite coating.

050-3.13.4.1 Sweep Wires. Have sweep wires and depressor sweep wires in minesweepers, as well as the wires on the towing winch and float davit winch in MSO, remain stowed on the winch drums. Preserve the winch and wires as follows:

a. Remove wires from winch drums and preserve the winch by touching up bare surfaces with paint in accordance with NSTM S9086-VD-STM-010 Chapter 631, VOLUME 1, PRESERVATION OF SHIPS IN SERVICE – GENERAL (9190).

b. Clean and coat wires where applicable as set forth above. Rewind wires on drums, lashing end to drum to prevent movement. Conditioning of MSL sweep/depressor wires (and similar wires for MSO/MSC support) stowed below in MCS is not required.

c. Remove motors from minesweeping reels and winches and stow in dehumidified space. Wrap reel or winch shaft at motor connection with vapor barrier material.

050-3.13.4.2 Small Items of Portable Gear. Clean and preserve small items or portable gear such as electrode floats, wire rope pendants, chain assemblies, metering devices, position buoys, cutters, beacon lights (less batter-

ies), repair parts, and tools, as required and stow on board under D/H. Remove manila rope and small items from the ship in accordance with instructions cited in paragraph 050-3.15.3.3.

050-3.13.4.3 Large Items of Portable Gear. Large items of portable gear, such as kiteotters (less bridles), floats, cradles, remain on deck. Paint all metallic surfaces and the size 0 plastic float body, requiring painting or touching up, in accordance with NSTM S9086-VD-STM-010 Chapter 631, VOLUME 1, PRESERVATION OF SHIPS IN SERVICE – GENERAL (9190). Remove trunnion bolt at float bail, apply thin coat of grease and replace. Wrap bail-trunnion connection with vapor barrier material.

050-3.13.4.4 Batteries. Remove batteries from flashing beacon lights or from bin storage and dispose of. Remove cartridges for explosive minesweeping cutters to stock. Complete descriptions of the Mark 13 cutter and explosive units are given in Operation and Maintenance of Mine Countermeasures Equipment (formerly NAVSEA 250-530).

CAUTION

The Mark 13 cutter is a high explosive device; hence, all safety- precautions, and applicable ordnance regulations indicated in the publication shall be strictly observed when handling this cutter.

050-3.13.4.5 Reconnaissance and Surveillance System. Remove the Reconnaissance and Surveillance System C Mark 1 Mod 0 (SHADOW GRAPH) (if installed) and place in storage under the Type Commander's Allowance List. The Minefield Marker F Mark 2 Mod 0 (37 Khz marker), containing a battery and an explosive squib, shall be given special storage consideration in accordance with the Integrated Logistics Support Plan for the C Mark 1.

050-3.14 MISCELLANEOUS EQUIPMENT, SYSTEMS AND DOCUMENTATION

050-3.14.1 Tools, Test Equipment, and Accessories. Remove batteries from test equipment. Stow test equipment and tools in a secure space on board. Stow or hang headphones, chest microphones, patch cords, and other operational accessories in dehumidified spaces in their customary location, readily available for use.

050-3.14.2 Material History. Record all work as required by the 3M system. Have these records remain with the equipment at all times and transfer with equipments when the equipment is serviced or overhauled by a repair activity so that the repair activity may note the work done. Make notations of the condition of all material, repairs made, preservation measures taken, and any special precautions necessary to place the equipment in operation. Make special notes of any equipment, maintenance repair parts, or tools moved from their normal location.

050-3.14.3 Technical Manuals. Inventory technical manuals listing the following information: short title, subject, changes entered, and note whether books are preliminary, temporary, or final. Centrally stow these manuals in alphabetical or numerical sequence or by equipment for which they have been provided. Retain unclassified manuals on board available for use. Classified technical manuals will be inventoried and handled as directed by the INACTSHIPMAINTO Director.

050-3.14.4 Teletypewriter Equipment. Clean, lubricate, and service as necessary to place in good operating condition. Remove ribbon and dispose of it. Coat the pinion and shaft and all updated steel parts, such as springs, the exposed area of the main shaft, and the transmitting cam, with lubricating grease, as applicable. Leave equipment in or move to a dehumidified space.

050-3.14.5 Portable Storage and Primary (Dry) Batteries. Remove all batteries not required for current use from the ship and turn in to the nearest naval shore establishment for survey in accordance with NSTM S9086-KR-STM-010 Chapter 313, PORTABLE STORAGE AND DRY BATTERIES. Turn in batteries that have never been filled with electrolyte for stock at the nearest naval shore establishment.

Remove primary (dry) batteries from all dry battery power equipment, including testing instruments. Remove all dry batteries in serviceable condition from the ship and turn in to the nearest supply activity for survey and disposition. Discard those not serviceable.

050-3.14.6 Ordnance Equipment. NAVSEA OP 1208 and 3300 contain ordnance preservation guidance. For ordnance equipment surface exposed on weather decks, follow the procedures in these publications. Close all turrets airtight. They will be maintained under D/H. For equipment located within the skin of the ship, apply corrosion preventatives per OP 1208/3300 without disassembly.

NOTE

Long-term retention (mobilization) assets are provided additional guidance as an enclosure to this inactivation plan.

050-3.14.7 Gauges and Thermometers. Cover all instruments with glass faces with 1/4 inch fire retardant plywood or 16 gauge sheet metal wired (fastened) securely in place. Gauges containing mercury must be removed. (Refer to Table 050-9-1, item 1.t).

050-3.14.8 Electrical Instruments. No special preservation other than a dehumidified atmosphere is needed. Cover glass with a piece of plywood wired securely in place. Remove batteries according to paragraph 050-3.14.5.

050-3.14.9 Magnetic Compass and Pelorus Equipment. Remove magnetic compasses, corrector and heeling magnets, flinders bars, and peloruses from their mountings and store in a dehumidified compartment properly secured to prevent pilferage or removal of fluid from alcohol-filled compasses. Prior to storage, preserve exposed corrodible metal surfaces with grade 2, solvent cutback corrosion preventive. Tag compasses and peloruses in sufficient detail to show their condition and the installed location of the instruments. If the instruments are removed from the ship, include the ship's name and hull number on the tag. In addition to the above, tag the normal installed locations of the compasses and peloruses and note on tags where the equipment is stored. Make an appropriate entry in the activation work package.

050-3.14.9.1 Binnacles and Plywood Stands. Store binnacles and plywood stands in the pilothouse or another compartment not exposed to the weather. Repaint painted surfaces, if necessary, for adequate preservation. Apply shellac or varnish to the interior of plywood and fiber binnacle stands. Coat all unpainted corrodible metal surfaces with solvent cutback corrosion preventive, grade 2.

050-3.14.9.2 Pelorus Stands Pelorus stands should be treated as outlined in paragraph 050-3.10.3.2. Repaint painted surfaces, if necessary, for adequate preservation. Coat unpainted metal with solvent cutback corrosion preventive, grade 2. Do not remove bench marks for purposes of cleaning and preservation.

050-3.14.10 Timing and Optical Equipment. Remove chronometers with their gimbal cases from all ships being placed in inactive status and turn into the nearest chronometer pool. Remove clocks, wrist and pocket watches, and stopwatches from all ships being placed in inactive status and turn in to the nearest supply activity. Although these instruments are handled as equipment in need of repair, exercise care in their handling to prevent unnecessary damage before being repaired and returned to stock. Exceptions can be made for clocks to be retained in spaces not inactivated on ships used for accommodation purposes and dead reckoning tracer clocks that remain in place in accordance with paragraph 050-3.10.3.3.

050-3.14.11 Whistles and Sirens. Where feasible, remove whistles and sirens and stow in a dehumidified space. Blank the supply and drain lines. Remove insulation surrounding steam and drain lines exposed to weather. Preserve exposed piping as described in paragraphs 050-3.3.6 and 050-3.8.7.

050-3.14.12 Spring-Balanced Armored Hatch Covers. All spring-balanced armored hatch covers are to be in good operating condition with all safety devices installed, INACTSHIPMAINTO will set hatch material closure condition for D/H system after ship is received.

050-3.14.13 Roller Curtains. If feasible, remove roller curtains and place in a dehumidified space. Blank the opening. If curtains must be left in place, preserve as follows:

a. Follow lubrication instructions in the technical manual. Operate doors periodically to maintain freedom of all moving parts.
b. Thoroughly clean deck guide into which the curtain bottom bar fits and pack with heavy grease (NSN 9150-00-823-8047 for 35 lb pail) to prevent water from collecting.
c. Wire brush accessible surfaces and paint as specified in paragraphs 050-3.3.6.
d. If surfaces of moving and interlocking parts are difficult to coat with sufficient paint for preservation while allowing for movability, wire brush and coat them with a mixture of solvent cutback corrosive preventive, grade 1, and Metal Conditioning Compound, Military Standard 15373 (SHIPS). Grease fittings, normally greased in service, during the inactivation period, as necessary to prevent corrosion of bearing surfaces.

050-3.14.14 Ventilation Systems. Clean in accordance with approved PMS procedures. Blank external openings to prevent entry of moisture into dehumidified spaces, using methods explained in paragraph 050-6.5.5.

NOTE

Observe PCB requirements when working/removing ventilation ducting.

050-3.14.14.1 Ventilation Systems. Inspect ventilation screens open to the weather; clean and repair as necessary. Reinstall screens in place after repair or replacement when the vent duct is blanked externally. Where removal of the screen is required for installation of blanks or where the installed blank is not external to the screen, do not reinstall screen but stow in a suitable location under D/H. Tag all items removed and make appropriate entries in stowage plan activation work package, or other ship's records to identify both stowage location and location for reinstallation.

050-3.14.14.2 Cleaning Ventilation Systems and Motors. Cleaning Ventilation Systems and Motors. Clean internal ventilation systems and associated motors in accordance with existing PMS.

050-3.14.15 Galley and Equipment. All galley equipment shall be cleaned and laid-up in accordance with PMS-IEM instructions. Spot paint any scratched or corroded surfaces.

050-3.14.15.1 Miscellaneous Bright Metal Items. All bright metal parts of kettles, steamjackets, and coffee urns, such as spigots, handles, and interiors, should be cleaned and dried as indicated above, with one exception; do not wire brush interior surfaces. Where paint is deteriorated preserve the paint with solvent cutback corrosion preventive, grade 2, linseed, or soybean oil. Thorough cleaning and drying is the only preservation required for noncorrodible metal surfaces.

050-3.14.15.2 Tables, Drawers and Cupboards. Clean thoroughly and dry tables, drawers, enclosed locker spaces, and cupboards as indicated above. Preserve corrodible surfaces by application of solvent cutback corrosion preventive, grade 3. Noncorrodible metal surfaces require no preservation treatment except thorough cleaning and drying.

050-3.14.15.3 Galley Cutlery, Crockery and Hand Held Equipment. Galley knives, forks, spoons, spatulas, hand equipment, mess gear, and crockery will be offloaded and redistributed as directed by the Type Commander, or turned into a supply activity for disposal.

050-3.14.15.4 Wood Surfaces. Clean all wood surfaces, including bottom, thoroughly with soap and water and then apply paraffin conforming to the requirements of Fed SpecVV-P-121. Damaged meat blocks will not be repaired. If replacement is necessary, note in the activation work package. Survey wood dressers, worktables, and other wood furniture aboard steel ships if repairs are required.

050-3.14.16 Workshop Machines and Other Power Tools. Preserve corrodible surfaces and electrical parts in accordance with Section 4 and paragraph 050-3.9.1. Secure traveling carriages of lathes or other machines to prevent movement. Remove and store grinding wheels in a drawer or bin in the shop. Remove drive belts from equipment, and tie to equipment. Drain, flush, and preserve gear boxes with grade 2 preservative compound.

050-3.14.17 Compressed Gas Cylinders, Portable. Remove all portable gas cylinders, whether filled or empty, except CO_2 cylinders required for firefighting purposes.

050-3.14.18 Carbon Dioxide Fire Extinguishers. Inasmuch as flammable materials are normally removed as a part of inactivation, the maintenance of a fixed flooding system protecting such spaces is normally not required. Inactivate as follows:

a. Disconnect and off-load all fixed C02 cylinders.

b. Post warning tags at the tripping device indicating that the system is inoperative.

050-3.14.18.1 Spaces With Flammables. When all flammables have not been removed, such as aboard accommodation ships, the fixed flooding system protecting any such space must remain operative. Blank piping from selector valves to other spaces that do not contain flammables. Stencil or tag cylinders of systems required to be maintained operative WEIGH EVERY 6 MONTHS and maintain appropriate records.

050-3.14.18.2 Portable Fire Extinguishers. Retain portable fire extinguishers only in numbers and locations designated by the INACTSHIPMAINTO to afford fire protection. Portable fire extinguishers designed for such use shall be weighed quarterly and recharged as required. Remove dry chemical extinguishers and turn in to a supply activity for storage ashore. Fire extinguishers retained on board must have a hydrostatic test within the last 5 years.

050-3.14.19 AFFF.

a. Drain AFFF distribution piping; secure all valves in their OPEN (to the atmosphere) position. PIPING FLUSH IS NOT REQUIRED!
b. OPEN all low point drain cocks and secure them in the OPEN position; break flanges lose as necessary to enhance drainage of low points and leave them OPEN to the atmosphere to facilitate further system dry out.
c. As a safety precaution, segregate tank from system by blanking.
d. Disposal of drained AFFF/sea water affluent should be handled and disposed of as hazardous waste.
e. Observe all personnel safety procedures associated with AFFF including the potential for release of toxic levels of Hydrogen Sulfide (H_2 S) gas. As an additional precautionary measure, ensure that all personnel involved with the breaking and drainage of AFFF System piping are outfitted with an approved self-contained breathing apparatus. Test for the presence of toxic atmospheres as required by NSTM S9086-CH-STM-030 Chapter 074, VOLUME 3-GAS FREE ENGINEERING.
f. Remove compressed gas bottles IAW Table 050-9-1 of the inactivation plan.
g. Remove hoses from reels and redistribute as directed by TYCOM.

050-3.14.20 Probe Fueling Equipment. Stow the following probe fueling equipment in a D/H space aboard ship:

a. Probe with Trolley, 3C 2040-00-850-5144.
b. Receivers, 3C 2040-00-850-5146.
c. Swivel Arms, 9C 2040-00-851-9467.
d. Hose Assembly, 9C 4720-00-933-1454.
e. Cover Plate, 9C 2040-00-851-9474.

050-3.14.21 Catapults and Arresting Gear. Catapults and arresting gear shall be laid-up/preserved in accordance with NAWCADLKE-05-SR-0001 (Preservation Requirements for Aircraft Launch and Recovery Equipment.)

050-3.14.22 0_2 N_2 Plants. These procedures are based on the premise that the plant is aboard a ship that will be kept at a low humidity internally during the lay-up period, and that prior to lay-up the plant was in operable condition.

(1.) Cold Box Portion.
Do not use any preservatives, oils, or greases in the cold box portion of the plant. Regenerate (reactivate) all dryers and desiccant beds in the plant in the manner described in the applicable technical manual.

(2.) Defrost or Derime.

Carry out a normal plant defrost or derime as outlined in the applicable technical manual, but continue defrost or derime for 48 hours in order to heat all of the cold box insulation and drive out as much moisture as possible from the insulation. During defrost or derime procedure, cause heated air to flow through insulation to carry out the evaporated moisture.

(3.) Freon.
The freon refrigeration unit shall be inactivated in accordance with paragraph 050-3.8.2.

(4.) Air Compressors.
Lay up the air compressors associated with the oxygen-nitrogen plant in the same way as is specified for other high pressure air compressors.

(5.) Sea Water Systems.
Drain seawater from all sea water systems. Rinse systems with fresh water to remove any residual salt water. Drain fresh water and completely dry the systems by passing heated air through them. Leave dry sea water systems open to the ship's atmosphere by opening vent and drain valves.

(6.) Vacuum Gauges.
If vacuum gauges on oxygen or nitrogen tanks have batteries in them, remove and discard them.

(7.) Liquid Oxygen and Nitrogen.
Break the vacuum on liquid oxygen and liquid nitrogen storage tanks using dry nitrogen. Do not pressurize the annular insulation space. When the annular space has been brought up to atmospheric pressure close all valves leading to the vacuum.

(8.) Vacuum Pump.
Close the manual valve between oxygen or nitrogen storage tank and operate the vacuum pump with the ballast valve (in the base of vacuum pump) wide open. Continue vacuum pump operation for 10 minutes and then close ballast valve and turn off motor. The air entering the vacuum pump way of the ballast valve will evaporate any moisture from the vacuum pump oil. Wipe up any oil, grease, or water that may be around any part of the plant. Preserve the terminal box for the inboard plug of the A Mark 7 type cable in accordance with paragraph 050-3.9.2.10.

050-3.14.23 Repair Parts, Tools, Consumable Supplies. Off-load consumables as directed by the Type Commander and the INACTSHIPMAINTO, except for materials required for inactivation. Inspect tools not off-loaded and redistributed. Preserve corrodible surfaces in accordance with section 4. Repair parts will be retained and suitably preserved unless off-loaded by the Inter-Service Supply Support Operations Program (ISSOP) as excess.

050-3.14.24 Special Clothing, Life Jackets, Mattresses, and Flameproof Bedding Covers. Remove special clothing form the ship, turn in to a supply activity ashore or as directed by the Type Commander.

Turn in life jackets, mattresses, pillows, covers, and linens to a supply activity ashore, or as the INACTSHIPMAINTO directs.

050-3.14.25 Gas Masks. Turn in gas masks to the nearest supply activity ashore for disposal.

050-3.14.26 Office, Supply Department and Printshop Equipments, Safes, and Combination Locks. Remove from the ship all office labor saving devices, cash registers, typewriters, time stamps, adding, calculating, duplicating, copying, addressograph, graphotype and shredding machines, Varity per composing machines, laundry and ice cream machinery, and barber shop chairs and furnishings, when portable, and store ashore or redistribute as directed by the Type Commander. If retained, store under D/H in a secure space aboard ship or in a location specified by the INACTSHIPMAINTO. Survey equipment beyond repair.

050-3.14.26.1 Combination Locks. Set all combination lock tumblers to the standard combination 50-25-50 at the time of inactivation and during the inactivation period of the ship. This allows easy resetting of combinations as all locks will have the same initial setting. Set the standard combination by following the manufacturer's instructions and lock the combination lock with the door or drawer in the open position. This will permit easy access to the back of the combination lock in the event this is necessary. If the combination cannot be set to the standard combination, attach present combination to the lock.

050-3.14.26.2 Keys. Keys for locks to all spaces must be properly identified, tagged, and stowed in a central location. It is imperative that this record be maintained complete throughout inactivation and during the inactive life of the ship.

050-3.14.26.3 Print Shop Equipment. In general, clean print shop and photolithographic equipment and store in dehumidified areas with special preservation measures as follows:

a. Photographic lenses are considered highly pilferable items and secure stowage should be provided.
b. Compressor equipment and temperature controllers should be preserved in accordance with instructions for refrigeration equipment.
c. Remove rubber rollers from printing presses, clean, and store in a cool, dark place, so suspended by the spindle that the inking surfaces are not in contact with each other.

050-3.15 ALLOWANCES

050-3.15.1 Requirements. All non-equipment related materials, consumables, operating space items, non-controlled equipage, and certain items of controlled equipage will be redistributed as directed by the Type Commander or turned in to the nearest supply activity. Other miscellaneous items not to be retained onboard are listed in paragraph 050-3.15.3.3. All repair parts and special tools will be retained on board in the variety and quantity covered by current allowance lists.

050-3.15.2 Inventory Upon Inactivation. Prior to a ship being withdrawn from active status, repair parts, equipage, and supplies must be checked and such articles as are missing or unfit for use recorded for information of activating crews in accordance with paragraph 050-3.15.3.3. This inventory will normally be conducted by the Intra-Fleet Supply Overhaul Team after decommissioning.

050-3.15.3 Stowage. Keep repair parts, special tools, and equipage retained on board in regular stowage places, except that all loose articles and those to be struck below for better preservation must be stowed under cover in a space protected by D/H. Topside equipment installations, that cannot be protected in place from the weather, may be stowed below decks in dehumidified spaces or elsewhere in accordance with OPNAVINST 4770.5, GENERAL INSTRUCTIONS FOR INACTIVE SHIPS AND CRAFT, and current NAVSEA instructions.

050-3.15.3.1 Items Required Aboard. The following items permitted to be stowed below decks in dehumidified spaces are listed as typical examples:

a. Running riggings.
b. Radar antennas.
c. Anchor chains.

d. Searchlights (12 inch).

e. Arc lamps (from 24 inch and 36 inch searchlights).

f. Electric heating devices.

g. Repair parts, hull, machinery, electrical ordnance, and electronics.

h. Portable lights and fixtures.

i. Wind direction and intensity transmitters and indicators.

j. Engine order, rudder angle, steering telegraph, course telegraph, and propeller revolution telegraph.

k. Propeller revolution indicators.

l. Underwater log indicators.

m. Battle announcing equipment, including intercommunicating units.

n. Dial telephones.

o. Sound-powered telephone headsets and handsets.

p. Teleplotters.

q. Target designation, bearing and range indicator.

r. Interior units of interior communication instruments.

s. Superpower reproducers (class small b1 reproducers).

t. Radio antennas (except on submarines).

u. Pedestals.

v. Reflectors.

w. Rochelle salt projectors.

x. Watertight enclosures.

y. Waveguide sections.

z. Insulation on topside steam and drain lines.

aa. Minesweeping gear (portable) and topside items subject to deterioration from the weather.

ab. Gauges and thermometers.

ac. Gyrocompass equipment, dead reckoning equipment, self-synchronous alidade equipment, magnetic compasses, and peloruses.

ad. Optical instruments.

ae. Navigational instruments.

af. Ordnance equipment as prescribed by NAVSEA OP 1208.

ag. Radar repeaters.

ah. Winches.

ai. Ready service boxes and lightweight metal boxes or lockers, such as gun tool boxes and telephone boxes.

aj. Sky lookout chairs, bridge wing chairs, and other weather deck seating units.

ak. Brake bands and associated equipment on topside machinery that is not packaged.

al. Radiophone units.

am. Electronic remote control units.

an. Valves, ventilation ducts, heating coils, and associated piping.

050-3.15.3.2 Relocation of Items Required Aboard. All items that are relocated for stowage must be properly preserved and identified with an attached stamped metal tag that indicates the exact location from which it was removed prior to stowage. A complete set of mounting bolts and associated hardware required for reinstallation is to be placed in a cloth bag and physically attached to each unit removed. The location from which an item is removed is to be tagged with a metal tag dipped in solvent cutback corrosion preventive, grade 2, and secured in place by nonferrous wire; similarly, tag replacement material and its normally installed location. Make appropriate entry in the ship's CSMP file, activation work package, and stowage plan indicating both the stowed and installed locations. Stowage for maximum security of easily pilferable articles, such as navigation and optical instruments, and similar items is as specified by the INACTSHIPMAINTO.

050-3.15.3.3 Items Requiring Removal. The following items are considered to be dangerous, perishable on a 3-year basis, or have been specifically designated for removal from inactive ships:

a. Gasoline and alcohol, except for quantities determined by the INACTSHIPMAINTO to be required by those ships or craft ICIR or ISIR.

b. Primary (dry) batteries and secondary (wet) portable storage batteries.

c. All gas and dry chemical cylinders.

d. Plastic fire clay (ND Spec 32-R-1).

e. Paints, paint removers, thinners, and linseed oil.

f. Dangerous and semi-safe materials, as listed in NSTM S9086-WK-STM-010 Chapter 670, STOWAGE, HANDLING & DISPOSAL OF HAZARDOUS GENERAL USE CONSUMABLES, except as follows:

(1.) Fuel oil, diesel oil, and lubricating oil as required by paragraph 050-3.5.

(2.) Freon gas as required by paragraph 050-3.8.2.

(3.) Hydraulic oil as required by paragraph 050-3.8.8.

g. Electrolyte for filling or adjusting acid in cells of portable storage batteries.

h. Used portable storage batteries not required for current use; uncharged batteries that have never been filled with electrolyte.

i. Band instruments and other musical instruments including organs and pianos.

j. Medical items, narcotics, alcohol, alcoholic liquors and flammables.

k. Ammunition

l. Acids, cyanide, carbon tetrachloride, liquid and paste wax, decontamination chemicals and equipment, pesticides.

m. Automotive vehicles.

n. Tires for jeeps, tractors, and other vehicles out of use.

o. Packaged lubricating oil and greases.

p. Infrared receivers.

q. Rubber insulating tape, NSN 9Q-5970-00-188-5482.

r. Luminous materials, NAVSEA Specification 17-L-18, luminous plastic sheets, NAVSEA Specification 17-L-26, luminous radioactive tubing, NAVSEA Specification 17-L-18 (INT), luminous tape, non-radioactive, and synthetic rubber cement, NAVSEA Specification 52-C-3 (INT), luminous devices containing radium.

s. Provisions (including abandon ship rations).

t. Ship's store stock.

u. Clothing and small stores stocks.

v. Packaged fuel and lubricants.

w. Photographic supplies to include printing paper, inks (printing, lithographic, and developing), printing ink varnished, dryers and waxes, lithographic chemicals, adhesives, cements, cleaning solvents, cellulose tape, and other supplies that may deteriorate. Disposition instructions for photographic equipment shall be requested for NAVAIRSYSCOM Code AIR-539, citing condition code in accordance with NAVAIRINST 10700.2A. All film projectors (except microfiche readers) and VCR equipment and tapes.

x. Chemical defense protective clothing.

y. Divers air hose.

z. Boats, CO_2 inflatable.

aa. Detector kit, chemical agent.

ab. Desalter kits.

ac. Small arms.

ad. Portable 2F/7H radiac equipment.

ae. Quartz fiber dosimeters.

af. Office labor saving devices.

ag. Portable electronics test equipment.

ah. Portable electric and pneumatic powered tools.

ai. Portable submersible pumps.

aj. P-250 (Except as required by tow).

ak. Vaneaxial (red devil) fans.

al. Items containing rubber products.

am. Special Clothing.

an. Mattresses, flame proof bedding covers, pillows, linen.

ao. Silver service presentations.

ap. Ecclesiastical material.

aq. Timekeeping devices.

ar. Gas masks.

as. Photographic equipment.

at. Material handling equipment.

au. Small boats and engines.

av. Welfare and recreation equipment and supplies.

aw. Bathythermographs.

ax. Lifejackets.

ay. Cordage.

az. Procedures for removal of certain meteorological materials are covered n OPNAVINST 4770.5, and OPNAVINST 4440.4.

ba. Flags and bunting.

bb. Fire hose.

bc. Fuel hose.

bd. Pneumatic fenders.

be. Inflatable boats.

bf. Diver dress.

bg. Life floats containing rubber.

bh. Oxygen breathing apparatus.

bi. Non-Equipment related materials, consumables, operating space items, non-controlled equipage.

bj. Landing force equipment.

bk. All night vision equipment on board decommissioning ships are to be returned to the following address: Receiving Officer, NAVSURFWARCENDIV Crane, 300 Highway 361, Crane, IN 47511-5001. NAVSURFWARCENDIV Crane OC is Code 80PM13, TEL DSN 482-5842 or COMM (812) 854-5842.

050-3.15.3.4 Items Not Required Aboard. Accessories, technical manuals, and instruction books are to accompany all transferred equipment where applicable, and related repair parts are to be off loaded to the nearest naval supply activity ashore. The remaining authorized allowance of equipment, repairs, special tools, and equipage will be retained on board the inactivating ship. Record all items that have been removed and that will be required upon activation for information of activation crew, but deficiency requisitions of removed or missing items upon inactivation will not be prepared.

050-3.15.4 Halon 1301 Agent Refer to Section 9, Table 050-9-1, Item 1.e for instructions

SECTION 4

CORROSION PREVENTION

050-4.1 GENERAL INFORMATION

050-4.1.1 Corrosion Prevention. Solvent cutback corrosion preventive is intended for use on metal surfaces as authorized in this section. It is not to be used on metal surfaces directly adjacent to electrical insulation, the interiors of steam piping systems (including heaters, boilers, and turbines), or metal surfaces protected by paint, galvanizing, or by electrodeposited platings. It is required that machinery and equipment so preserved be left in assembled, ready-to-run condition except as otherwise provided in specific instances. The preservative used must

meet this condition. Paint is a superior preservative coating and should be applied to metal surfaces exposed to the weather where such use will not diminish the readiness of equipment.

NOTE

"LIQUID A" is recommended for preserving all interior surfaces of machinery normally lubricated with oil and the interior surfaces of tanks permanently ballasted for long term lay-up. "NAS" is recommended for preserving exterior surfaces of machinery such as exposed hydraulic cylinder rams, rapson slides, etc. Systems with special preservation requirements such as those that use water-based hydraulic fluids should still be preserved using established procedures. Also where it is still considered necessary to have a hard film, use MIL-C-16173 Grade 1. If the surface of the item being preserved is exposed to the weather, recommend using "NAS" rather than "LIQUID A" because of better UV ray resistance. Table 050-4-1 provides stock numbers for fluid film products.

050-4.1.2 Precautions On Use. All grades of solvent cutback corrosion preventive and petroleum solvent cleaners are flammable materials. Continued exposure of personnel to the vapors given off by the compounds may be a health hazard. Safety precautions as outlined in paragraph 050-4.3 should be taken to minimize the personnel hazards of these materials. Read the Material Safety Data Sheet for each compound before use. Specific safety precautions for use by surface ships are contained in Section C of OPNAVINST 5100.19, NAVOSH Program Manual for Forces Afloat.

050-4.1.2.1 Indiscriminate Use of Preservative Compounds The indiscriminate use of preservative compounds on stainless steel, painted surfaces, and other nonferrous surfaces results in unnecessary work of removal incident to reactivation, and so should be avoided.

050-4.1.2.2 Solvent. Solvent cutback corrosion preventive will damage rubber, electrical insulation, varnishes, tapes, and fabrics and should not come into contact with them at any time (refer to paragraph 050-3.9 for instructions on the preservation of corrodible surfaces adjacent to electrical insulation).

050-4.2 CORROSION PREVENTIVE COMPOUNDS

050-4.2.1 Types of Compounds. Corrosion preventive compounds ate covered by MIL-C-16173E, Compound, Corrosion Preventive, Solvent-Cutback, Cold Application and MIL-L-21260, Lubricating Oil, Internal Combustion Engine, Preservative and Break-In. Except for Grade 1, MIL-C-16173, the compounds covered by these specifications are fluid solutions applied at ambient temperatures. At temperatures of 2°C (35°F) or below, MIL-C-16173E compounds may become excessively viscous, and solid constituents tend to separate from their solution, resulting in stratification. This condition may be corrected by warming, agitation, or both.

050-4.2.2 MIL-C-16173E Compounds. The compounds covered by MIL-C-16173E are essentially a combination of two major elements: a solvent that evaporates, and a blend of semisolids that are left behind as a thin, tenacious protective film. These films are essentially nondrying, except for grade 1, that does dry hard in about 4 hours. Even grades 2, 3, and 5 may eventually harden until it is extremely difficult to remove these compounds (particularly after long exposure periods) from small orifices or areas through which removers cannot readily flow.

050-4.2.2.1 Use in Engines. For low speed engines (less than 1,500 rpm), MIL-C-16173E compound is permissible, but for high speed engines (1,500 rpm and over) only MIL-L-21260) preservative oil should be considered. Fuel injection components should be treated only with Grade 30, MIL-L-21260) during periods of preservation. The correct preservation procedures for the basic engine unit, fresh and seawater systems, fuel oil systems, valve mechanisms, and the transmission should be followed as specified in MIL-E-24455, Engines, Diesel, Propulsion and Auxiliary, High Speed, Naval Shipboard, paragraph 5.1. (Also, refer to 050-3.6.4.)

050-4.2.2.2 Description of Grades. The flashpoint of solvent cutback corrosion preventive is approximately 38°C (100°F). It must therefore be applied cold. Refer to Section 2 of NSTM S9086-SN-STM-010 Chapter 541, SHIP FUEL AND FUEL SYSTEMS for safety guidelines. When using materials authorized by this paragraph, local air quality control regulations must be addressed. A description of the various grades of corrosion preventive compounds follows:

a. Grade 1.
   This is an asphalt base compound intended for use on ferrous or nonferrous metal surfaces subjected to all conditions of weather. It may also be applied to equipment under cover, when specifically ordered. The film dries hard to the touch in about 4 hours, and maximum protection is obtained about 2 days after application. Removal of the film upon activation is usually not required. Do not use this grade in lubrication or cooling systems, steam piping, or in watersides of boilers.

b. Grade 2.
   This amber colored compound is for use on ferrous and nonferrous metals when extended protection is required for interior or exterior surfaces of machinery and equipment not exposed to the weather. After the solvent evaporates, the resulting film remains soft for about 4 months. It may be recoated 12 hours after application. This compound mixes readily with lubricating oils, but very long periods] of flushing may be required if the compound has aged over an extended period of time (refer to paragraph 050-4.2.2.8.1). Removal after short periods is usually readily accomplished with either petroleum solvents or vapor] degreasing compounds.

c. Grade 3.
   This compound is intended for use on ferrous and non-ferrous metals. It leaves a very thin non-drying film upon evaporation of the solvent; its ingredients have a greater affinity for metals than water has, thus giving water-displacing characteristics to the film. For this reason grade 3 is used id water contact areas such as in the interiors of water jackets. A disadvantage of grade 3 is that it will not be completely removed by the circulation of steam or hot water, particularly after it has aged for a long period of time. Additional coats may be applied about 6 hours after initial application, however, this provides no particular benefit.

d. Grade 5.
   This is much like grade 3, and is used for the same purposes. The reason for using it is ease of removal upon reactivation. Low-pressure steam or hot water is usually entirely effective. This property makes grade 5 particularly valuable for magnesium or aluminum surfaces where boil-out with an alkaline solution would be destructive to these metals.

050-4.2.2.3 Characteristics and Stock Numbers. Table 050-4-1 summarizes the characteristics of solvent cutback preservatives. Table 050-4-3 provides stock numbers for all commonly used preservatives.

050-4.2.2.4 Application. The compounds are applied by spraying, dipping, flushing, or brushing, as appropriate. Spraying and dipping are the preferable methods, because these methods produce more uniform coatings, that are neater in appearance, and cracks and crevices are penetrated. Normally it is not necessary to disassemble apparatus for application to interior surfaces, accomplish by flushing or by fogging (spraying) through access openings. A high-pressure spray, creating a fog, will satisfactorily coat the interior of gears, cylinders, and boil-

ers. For equipment with inaccessible interior surfaces, the fog or spray has a tendency to follow the normal vapor paths, and remote areas may not be coated with the preservative. Take proper precautions to ensure the compressed air is dry and that water is not being mixed with the preservative. Dipping is best for small articles, such as repair parts, tools, bolts, and nuts. Flushing should be used for the interior of lubricating systems to protect shaft journals.

050-4.2.2.5 Application Precautions. While means of application may differ, depending upon physical characteristics of machinery or equipment concerned, individual procedures in each case must be such as to bring the compound into intimate contact with the metal to be protected, so that a continuous film is formed. It is also important that all excess compound be drained. Failure in this respect may result in, leaving pools of compound, that in time solidify and can cause damage when operation of machinery is resumed. While a single unbroken film will provide adequate protection, it is advisable to apply two coats, to ensure through coverage. It is important that application to weather exposed surfaces be made in good, dry weather that must include the drying time between coats. Inclement weather, within 12 hours of outside applications, will necessitate the reapplication of compound preceded by measures to ensure a clean dry surface. If the bare hand touches an article preserved with the compound, corrosion may occur unless the part is cleaned where touched and the compound is reapplied. Rotating machinery shall not be jacked after preservation (paragraph 050-8.6.3.1); to do so damages the preservation coating. If the machinery is operated, the compound shall be reapplied to wearing surfaces.

Table 050-4-1 Fluid Film Products National Stock Numbers (NSNs)

CONTAINER SIZE	FLUID FILM LIQUID A	CONTAINER SIZE	FLUID FILM NAS
1 GALLON; 4 GAL/CTN	8030-01-386-3877	12 OZ BT; 12 BTS/CTN	8030-01-381-6357
5 GALLON PAIL	8030-01-387-1051	1 GALLON; 4 GAL/CTN	8030-01-386-3871
55 GALLON DRUM	8030-01-387-1065	5 GALLON PAIL	8030-01-387-1070

Table 050-4-2 Characteristics of Solvent Cutback Corrosion Preventatives

MIL-C-16173 Grade	Product Description	Use	Application Method	Removal Method
Grade 1, hard film	An asphalt compound dissolved in a petroleum solvent dries to a hard, thin varnish like film: hard enough to handle in about 4 hours	Protection of non-critical metal items stored outdoors or when a dry to touch film is desired. Not to be used on equipment requiring removal of film for operation. Use for such items as bolts, chains, and turnbuckles.	Dip, spray, or brush.	Not usually required. May be removed by vapor degreasing with petroleum solvents.

Table 050-4-2 Characteristics of Solvent Cutback Corrosion Preventatives - Continued

MIL-C-16173 Grade	Product Description	Use	Application Method	Removal Method
Grade 2, soft film	An amber colored compound that remains soft. Mixes with oil. Must be applied cold because of low flash point.	Extended under cover protection for interior or exterior metal stir-faces of machinery and instruments with or without supplemen-tary barrier materials. May be used outdoors if temperatures do not reach the melting point of the film.	Dip, spray, or brush at room temperature.	Petroleum solvents or vapor degreasing
Grade 3, soft film, water displacing	A solvent dispersed compound that depos-its a thin, non-drying film having water dis-placing properties.	Used where fresh or salt water must be displaced from corrod-ible surfaces and cor-rosion stopped. For interior surfaces of machinery; protects exposed surfaces for limited period, but protects critical bare steel surfaces for extended periods when properly packaged	Dip, spray, or brush exterior surfaces; flood, fill, or slush interior surfaces. Apply at 40° F or higher.	Vapor degreasing or petroleum solvent. If present in Steam-sides of machinery, it may be necessary to boil Out with Alkaline Solution as final step.
Grade 5, low pressure steam removable film	A solvent-dispersed compound that depos-its a thin, easily removable film as the solvent evaporates.	Same as for grade 3. Used in lieu of grade 3 where chemical boil out cannot be used for removal.	Same as for grade 3.	Vapor Degreasing, Petroleum Solvents, Hot water or Low steam Pressure.

Table 050-4-3 Antiseize Compounds, Cleaning Compounds and Preservatives

Title	Current Specification or Designation	Current Stock Numbers	Container Size and Type
Antiseize Compounds			
Antiseize Compound, High Temperature -	M1L-A-907	8030-00-251-3980	1-lb can or plastic tube
Sealing Compound, Pipe Joint and Thread	TT 5-1732	8030-00-286-5453 8030-00-515-2251	5-lb can 1-qt can
Tape, Antiseize, Polytetrafluoroeth lene, with Dispenser	MIL-T-27730	8030-00-889-3534 8030-00-889-3535	1/4-in wide 1/2-in wide
Thread Compound, Antiseize, Graphite-Petrolatum	MIL-T-5544	8030-00-087-8630	1-lb can

Table 050-4-3 Antiseize Compounds, Cleaning Compounds and Preservatives

- Continued

Title	Current Specification or Designation	Current Stock Numbers	Container Size and Type
Thread Compound, Antiseize, Zinc Dust-Petrolatum	MIL-T-22361	8030-00-292-1102	8-oz tube
Cleaning Compounds			
Chromium Triode, Technical (Chromic Acid)	O-C-303	6810-00-893-7465 6810-00-174-1818 6810-00-264-3939 6810-00-264-6517	1-lb bottle (crystal) 1-lb bottle (flake) 50-1b drum (flake) 5-lb can (flake)
Cleaning Compound, Solvent, for Bore of Small Arms and Automatic Aircraft Weapons	MIL-C-372	6850-00-224-6658 6850-00-224-6663 6850-00-249-8029 6850-00-753-4806	1-qt can 1-gal can 5-gal can 55-gal drum
Cleaning Compound, Solvent Grease Emulsifying,	P-C-444		
Type I		6850-00-965-2331 6850-00-559-2836	5-gal can 55-gal drum
Type B		6850-00-285-6056	5-gal can
Cleaning Compound, Aircraft Surface	MIL-C-43616	6850-00-180-5943 6850-01-045-7929 6850-01-045-7930 6850-01-045-7931	5-gal can 15-gal drum 55-gal drum 16-oz aerosol can
Corrosion Preventive, Finger Print Remover	MIL-L-15074	8030-00-281-2338 8030-00-252-8300 8030-00-252-8301	1-gal can 5-gal can 55-gal drum
Dry Cleaning Solvent	P-D-680	6580-00-264-9038 6850-00-285-8012	5-gal pail 55-gal drum
Ethyl Alcohol (For Ordnance Use) Grade 1 and Grade 2	MIL-E-463	6810-00-264-6614	1-gal can
Fuel Oil, Diesel, Marine	MIL-F-16884	9140-00-273-2377 9140-00-255-7764 9140-00-273-2378	Bulk 5-gal can 55-gal drum
Inhibitor, Corrosion, Liquid Cool- in System	O-I-490		6-oz can
Isopropyl, Alcohol, Type A	TT I-735	6810-00-286-5435 6810-00-543-7915	1-gal can 55-gal drum
Kerosene	VV K-211	9140-00-242-6748 9140-00-242-6749 9140-00-242-6751	Bulk 5-gal can 55-gal drum
Corrosion Removing and Metal Conditioning Compound (Phosphoric Acid Base)	MIL-C-10578		
Type II (Wipe off)		6850-00-174-9672 6850-00-656-1292	1-gal bottle 5-gal plastic Drum
Type III (Inhibited)		6850-00-854-7952	5-gal plastic Drum

Table 050-4-3 Antiseize Compounds, Cleaning Compounds and Preservatives

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Title	Current Specification or Designation	Current Stock Numbers	Container Size and Type
Metal Cleaner, Silicate Soap	MIL-M-7752 ISOPREP	6850-01-150-7938	125-lb drum
Remover, Paint and Varnish	MIL-R-7751		450-lb drum 45-lb drum
Soap, Laundry Bar	P-S-591	7930-00-965-4868	Box (60 1/2-lb Bars)
Sodium Carbonate, Anhydrous, Technical	O-S-571	6810-00-262-8567 6810-00-233-1715	25-lb drum 100-lb drum
Sodium Hydroxide, Technical	O-S-598	6810-00-174-6581 6810-00-270-8177	100-lb drum 500-gm container
Sulphuric Acid, Technical	O-S-809	6810-00-227-1845 6810-00-286-6022	5-pt bottle 750-lb jar
1, 1, 1-Trichloroethane, Technical	O-T-620	6810-00-292-9625 6810-00-664-0387 6810-00-664-0388 6810-00-551-1487	1-qt can 1-gal can 5-gal can 55-gal drum
1, 1, 1- Trichloroethane, (Methyl Chloroform) Stabilized	MILT 81533	6810-00-476-5612 6810-00-476-5613	5-gal can 55-gal drum
Trichloroethylene, Technical Type II	O-T-634	6810-00-678-4418 6810-00-184-4794 6810-00-184-4800	1-gal can 5-gal can 55-gal drum
Nonlubricatin preservatives			
Compound, gun slushing	MIL-C-18487	8030-00-272-8530 8030-00-264-2063	35-lb pail 400-lb drum
Corrosion Preventive, Petrolatum, Hot Application Class C (Soft Film)	MIL-C-11796	8030-00-285-1570	35-lb pail
Corrosion Preventive, Solvent Cut-Back (Cold Application)	MIL-C-16173 (ESGARD PL-2)		
Grade 1		8030-00-231-2345 8030-00-244-1299 8030-00-244-1300	1-gal can 5-gal pail 55-gal drum
Grade 2		8030-00-244-1297 8030-00-244-1298 8030-00-244-1295	1-gal can 5-gal pail 55-gal drum
Grade 3		8030-00-244-1296 8030-00-244-1293 8030-00-244-1294	1-gal can 5-gal can 55-gal drum
Grade 4		8030-00-526-1605 8030-00-526-1604	5-gal pail 55-gal drum
Grade 5			55-gal drum
Corrosion Preventive Compound, Water Displacing, Ultra Thin Film	MIL-C-81309		
Type I		8030-01-041-1596	16-oz aerosol
Type II		8030-00-938-1947	16-oz aerosol

Table 050-4-3 Antiseize Compounds, Cleaning Compounds and Preservatives

- Continued

Title	Current Specification or Designation	Current Stock Numbers	Container Size and Type
Neat's-Foot Oil	C-N-200	8030-00-597-6105 8030-00-244-1033	1-pt can 1-gal can
Preservative Coating, Canvas	TT-P-595		
1, 1, 1-Trichloroethane, Technical	O-T-620	6810-00-292-9625 6810-00-664-0387 6810-00-664-0388 6810-00-551-1487	1-qt can 1-gal can 5-gal can 55-gal drum
1, 1, 1- Trichloroethane, (Methyl Chloroform) Stabilized	MILT 81533	6810-00-476-5612 6810-00-476-5613	5-gal can 55-gal drum
Trichloroethylene, Technical Type II	O-T-634	6810-00-678-4418 6810-00-184-4794 6810-00-184-4800	1-gal can 5-gal can 55-gal drum
Nonlubricatin preservatives			
Compound, gun slushing	MIL-C-18487	8030-00-272-8530 8030-00-264-2063	35-lb pail 400-lb drum
Corrosion Preventive, Petrolatum, Hot Application Class C (Soft Film)	MIL-C-11796	8030-00-285-1570	35-lb pail
Corrosion Preventive, Solvent Cut-Back (Cold Application)	MIL-C-16173 (ESGARD PL-2)		
Grade 1		8030-00-231-2345 8030-00-244-1299 8030-00-244-1300	1-gal can 5-gal can 55-gal drum
Grade 2		8030-00-244-1297 8030-00-244-1298 8030-00-244-1295	1-gal can 5-gal can 55-gal drum
Grade 3		8030-00-244-1296 8030-00-244-1293 8030-00-244-1294	1-gal can 5-gal can 55-gal drum
Grade 4		8030-00-526-1605 8030-00-526-1604	5-gal pail 55-gal drum
Grade 5			55-gal drum
Corrosion Preventive Compound, Water Displacing, Ultra Thin Film	MIL-C-81309		
Type I		8030-01-041-1596	16-oz aerosol
Type II		8030-00-938-1947	16-oz aerosol
Neat's-Foot Oil	C-N-200	8030-00-597-6105 8030-00-244-1033	1-pt can 1-gal can
Preservative Coating, Canvas	TT-P-595		
Olive drab		8030-00-290-4382	1-gal can
Deck gray			1-gal can

Table 050-4-3 Antiseize Compounds, Cleaning Compounds and Preservatives

- Continued

Title	Current Specification or Designation	Current Stock Numbers	Container Size and Type
Deck gray			5-gal can
Haze gray			1-gal can
White			5-gal can
Unpigmented			24-oz spray
Sodium Chromate, Anhydrous Technical	O-S-588	6810-00-240-2119 6810-00-264-6714	1-lb bottle 100-lb drum
Lubricating preservatives			
Lubricating Oil, Internal Combustion Engine, Preservation and Break-in	MIL-L-21260		
Grade low		9150-00-111-3199	5-gal can
Grade 30W		9150-00-111-0209 9150-00-111-0210	5-gal can 55-gal drum
Grade 50W		9150-00-111-0211	5-gal can

050-4.2.2.6 Preparation. Prior to application of the preservative, surfaces must be thoroughly dry and clean. In addition to drying, metallic surfaces must be thoroughly cleaned of all, dirt, oil, grease, scale, rust, fingerprints, or marine growths. Oil and grease may be removed by use of a solution of steam cleaning compound. Heavy contaminations of dirt, oil, and grease, that are not removed by steam cleaning compound, may be removed by using a grease-cleaning compound (P-C-444), solvent emulsion diluted with water, or kerosene depending on the degree of contamination. Manual methods such as wire brushing, chipping, and polishing with emery cloth should be used as necessary to remove rust and scale, if cleaning materials suggested above do not affect this removal. If immediate cleaning is not required or practical, removal of corrosion products may be facilitated by application of metal conditioning compound. Fingerprints on bare metal may be removed by immersing, sloshing, or washing the item in fingerprint remover (MIL-L-15074) for not less than two minutes. Cleaned parts should not be handled with bare hands. This remover will provide temporary protection against corrosion until the prescribed preservative can be applied. Wearing of clean nylon or oil resistant rubber gloves is required to keep contamination at a minimum.

050-4.2.2.6.1 Steam-Cleaning Compound. Steam-cleaning compound is a concentrated dry mixture of alkaline chemicals and wetting agents. For steam-gun cleaning, a concentration containing one or two ounces per gallon of water is recommended. For tank cleaning, a hot solution (185°F) containing four ounces of compound per gallon of water is used.

050-4.2.2.6.2 Grease-Cleaning compound. Grease-cleaning compound is a concentrated material to be diluted with water or kerosene depending upon the degree of contamination. When diluted with water (55 gallons of water to 45 gallons of concentrate) an emulsion is formed. Preheat to 150°F before use. When diluted with kerosene (1 gallon of compound to 7 to 9 gallons of kerosene, fuel oil, or similar distillate), the resulting solution is ready for use as a degreasing compound. Apply by spraying, by brushing, or by dipping and soaking. A water rinse will remove the compound and the emulsified grease and oil.

050-4.2.2.6.3 Steam-Cleaning Compound Insoluble Residue. The steam-cleaning compound made into a water solution remains fluid above 35°F, forms an insoluble residue in soft or hard water, and has no effect on magne-

sium and aluminum alloys, steel, or bronze. The grease-cleaning compound does not flash at temperatures up to and including its boiling range (200-207°F), remains fluid at temperatures as low as 8°F, is stable in soft water, and has no effect on steel, aluminum alloy, or bronze.

050-4.2.2.6.4 Steam-Cleaning Compound Reuse. The steam-cleaning compound solution may be reused depending upon the amount of contamination. Water may be added to the solution in order to make up loss by evaporation. The solvent emulsion cleaner may be reused until it separates into two layers. It is then no longer suitable for cleaning. This condition is not ordinarily reached until the emulsion has taken up at least 50 percent of its own volume of oil. Usable emulsion that has been depleted due to losses such as evaporation may be replenished by the addition, with vigorous stirring, of one quart of water or kerosene to each gallon of emulsion. The emulsion must be disposed of as oily waste, or by draining off the lower layer of water and combining the upper oily layer with other old oils and sludges for removal from the activity by sale to refiners.

050-4.2.2.6.5 Safety Precautions. While steam cleaning compound solution is alkaline, it is far less hazardous than equivalent concentrations of caustic soda. The only safety measures necessary during its use are to wear safety goggles, especially when spraying, and to avoid splashing the solution onto the skin. In the event that some does come in contact with the skin, it may readily be rinsed away with no ill effects. It should not be allowed to remain on the skin for any length of time.

050-4.2.2.6.6 Solvent-Emulsion Cleaner. Although solvent-emulsion cleaner does not flash at any temperature up to and including its boiling range (200-207°F), observe the same safety precautions with this material as with other flammable solvents. When stored in closed tanks or long periods prior to use, ensure there is as little air space as possible above the surface of the fluid. It is unnecessary and undesirable to use the emulsion at temperatures higher than 150°F, since no appreciable increase in its efficiency is obtained and there is loss of volatile constituents. Closed spaces, such as tanks, cleaned with the diluted emulsion should be thoroughly rinsed with water and blown out with air in order to remove kerosene vapors. The tank should be tested for the presence of combustible or explosive vapors before any welding, chipping, or other operation that cause sparks or heat is performed. The emulsion is alkaline and contains kerosene; therefore, personnel using it should be provided with protective clothing and class A, type II air-supplied respirators when the emulsion is used as a spray in confined spaces and tanks. Kerosene vapor is both toxic and flammable in relatively high concentrations, and it is mandatory that adequate ventilation be provided when the emulsion is used in all confined spaces.

050-4.2.2.7 Flushing. When corrosion preventive compounds are applied by flushing, they may be added to and reused, but contamination reduces protective qualities. Grade 2 compound shall be reused only after dregs and contaminants have been removed and dilution by lubricating does not exceed 5 percent. Grade 3 compound can be reused as long as the emulsion separates on setting and water can be drawn off.

050-4.2.2.7.1 Used Compound. Flush through with used compound and follow up with a flushing of new compound. Lubricating oil purifiers may be used to renovate the used compound for removal of dirt, grit, or scale.

050-4.2.2.7.2 Lubricating System. When flushing a dirty lubricating system of a turbine, diesel engine, or reduction gear with rust preventive compounds, exercise care to ensure that any foreign matter that may collect on screens and strainers is removed before considering the treatment completed and the machinery made ready for future service.

050-4.2.2.8 Removal. The residual film left by grade 1, thin-film rust-preventive compound should not require removal except where cleaning is necessary for reapplication or when the surface is to be painted. Long aging may cause difficulty in removal. In these instances special solvents and procedures must be applied.

050-4.2.2.8.1 Interior. In the interior of certain lubricating oil systems, the residual film left by grade 2 solvent cutback corrosion preventive must be removed upon reactivation. This preservative dissolves in oil in the presence of water causing the oil to emulsify, rendering it unfit for service use (for example, steam turbine lubricating systems). Apply the methods described Section 11 during reactivation. In the absence of water (for example, lubrication system of diesel engines), small amounts of grade 2 will not adversely affect the lubricating properties of the oil.

050-4.2.2.8.2 Current Instruction. Current instructions prohibit the use of solvent cutback corrosion preventive on the interior of steam condensate and feed piping systems. However, ships inactivated in the past may have been preserved with compound in these systems. The residual film left by grades 3 and 5 solvent cutback corrosion preventive in the interiors of steam, feed, and condensate piping, and boilers will require removal during reactivation. It has been found that the grade 3 compound hardens with age and cannot be effectively removed in a reasonable time with steam and hot water and requires special cleaning methods as described in Section 11.

050-4.3 SAFETY PRECAUTIONS

050-4.3.1 Fire and Explosive Hazard. All grades of solvent cutback corrosion preventive and petroleum solvent cleaners are flammable materials and it is mandatory that extreme caution be exercised in their use. Read the Material Safety Data Sheet prior to use of any corrosion preventative compound.

050-4.3.1.1 Definitions. Definition of terms used herein:

a. In way of. Within, or on the exterior boundary of, spaces containing flammable or explosive materials, or anywhere in the vicinity of such materials or vapors.

b. Within. In addition to its obvious meaning, the term within also includes work performed from outside of a space but that involves flame cutting, welding, or riveting through the plating, or that involves the possibility of heating the inside face of the plating or any other metal within the space.

c. The exterior boundary. The outer face of the plating surrounding a space, or any metal work immediately contiguous thereto.

d. In vicinity of. Any location inside or outside the ship where flammable car explosive materials are stowed or where dangerous amounts of the materials or vapors there from may collect due to broken containers, overflow, seepage, air currents, or other causes shall be considered in the vicinity of the materials that are the source of danger. This term includes the two immediately above but the more specific terms are used when applicable.

050-4.3.1.2 Flash Point. The flash point of solvent cutback corrosion preventive (grades 1, 2, 3, and 5), fingerprint remover, and petroleum solvent cleaners is approximately 100°F. Determine the flash' point of all other flammable preservative compounds, cleaners, and metal conditioners prior to use. The flash point of a liquid is the lowest temperature at which it gives off vapor near the surface of the liquid or within a vessel in sufficient quantity to form flammable mixtures with the air. NSTM S9086-SN-STM-010 Chapter 541, SHIP FUEL AND FUEL SYSTEMS describes methods for determining flash point.

050-4.3.1.3 Prevention. For a better understanding of the prevention of fire and explosion of petroleum base liquids and vapors and other semi-safe and dangerous materials, personnel concerned with supervision and application of these substances, or concerned with supervision and performance of hot work in the vicinity of operations involving these substances, shall carefully read applicable sections of NSTM S9086-CH-STM-030 Chapter 074, VOLUME 3-GAS FREE ENGINEERING.

050-4.3.1.4 Compliance. Comply with the requirements of NSTM S9086-CH-STM-030 Chapter 074, VOLUME 3-GAS FREE ENGINEERING and this manual before starting any operations involving the use of solvent cutback corrosion preventive or petroleum solvent cleaning fluids, or before starting any operations involving hot work in way of spaces where these materials are being or have been used, or before any persons enter any closed or poorly ventilated spaces. Carefully note the definitions in NSTM S9086-CH-STM-030 Chapter 074, VOLUME 3-GAS FREE ENGINEERING, especially the definition of Hot Work, in this connection.

050-4.3.1.5 Work Spaces. Verify that working spaces, including the inside of voids, sumps, blisters, double bottoms, and similar confined areas are vapor-free and explosion-free and adequately ventilated, using portable equipment as necessary. Refer to paragraph 050-4.3.1.8.

050-4.3.1.6 Non-Sparking Shoes. Non-sparking shoes (rubber boots, overshoes, or shoes having no exposed ferrous metal) shall be worn by all personnel working in or entering a compartment or space in which preservation measures are being carried out involving the use of flammable preservatives or cleaning compounds or in an area that has not been determined to be vapor-free and explosion-free.

050-4.3.1.7 Clothing. Clothing of personnel engaged in or working near an area in which preservatives or cleaning compounds are being sprayed may become saturated with preservative material. In this event the clothing may constitute a fire hazard, and personnel are not to be permitted to continue work until they have changed their clothing. Refer to paragraph 050-4.3.2.1.

050-4.3.1.8 Open Flames. The lighting, use, or carrying of lighted cigarettes, pipes, or cigars is not permitted on a ship in or on which solvent cutback corrosion preventive petroleum solvent cleaner, or other flammable materials are being sprayed or applied. In the open air, operations that involve open flames or sparks will not be conducted within the area and in any way of the mist caused by spraying of preservative compound oar other flammable materials, and in no instance within 20 feet of the point of application. Personnel working aboard ships undergoing preservative or cleaning measures involving the use of flammable materials are not permitted to carry matches or lighters of any kind on their person. Welding, oxyacetylene burning, chipping, or grinding, use of ferrous hand tools, or any other source of open flame or spark is not permitted in the way of or within the same compartment or space or adjacent area in which solvent cutback corrosion preventive or other flammable materials are being sprayed or applied. After flammable materials have been used, the above precautions apply, and none of the above named operations shall be permitted until such time as the compartment, space, and adjacent area are declared vapor-free and explosion-free.

050-4.3.1.9 Portable, Explosion-Proof Electrical Apparatus and Equipment. Operate only portable, explosion-proof electrical apparatus and equipment, including portable blowers, in or in the way of a compartment or working space, during or following application of flammable preparations until the area has been determined to be vapor-free and explosion-free. In addition, while spraying solvent cutback corrosion preventive or other flammables, verify that switchboards, open lighting, and other equipment not explosion-proof is secured and tagged with a warning sign indicating operation is secured until the compartment or working area is determined to be vapor-free and explosion-free. Sparking of an electric motor or flashing of a circuit breaker can cause a serious accident. Only vapor proof, nonexplosive type light fixtures with non-sparking guards shall be used to illuminate

a compartment or working space in which petroleum solvent cleaners, and other flammables with a flash point below the ambient temperature, are being or have been used, until it is determined that the area is vapor-free and explosion-free.

050-4.3.1.10 Sheets of Paper, Cloth, Or Other Combustible Materials. Sheets of paper, cloth, or other combustible materials should not be used as drip cloths or to protect surfaces (such as furnace brickwork) from solvent cutback corrosion compound being sprayed in the vicinity. Combustible materials saturated with preservative are a serious fire hazard. If such cloths must be used (i.e., if greaseproof paper sheets or metal shields are unavailable) they shall be changed frequently and the contaminated material removed from the ship to a safe place. Ensure that flammable liquids draining off nonabsorbent sheets do not accumulate.

050-4.3.1.11 Firefighting Apparatus. Ensure appropriate firefighting apparatus, including charged waterlines, is available and ready for use in the working space near the immediate vicinity of personnel using flammable preparations. If this is not practical, as in the case of some types of boilers, then a fire watch shall be stationed at the access to the working space. Exercise care to prevent the firefighting equipment from being covered with flammable preparations.

050-4.3.1.12 Open Top Containers. Do not use buckets or other open top containers to handle, store, or dispense preservative compounds or flammable cleaning preparations.

050-4.3.1.13 Cables. Cable having a sheathing that can spark on striking an object is not to be used on portable equipment in a space or compartment where preservative preparations or flammable cleaning compounds are being used.

050-4.3.2 Health Hazard. Follow the specific safety precautions for use by surface ships contained OPNAVINST 5100.19 (Series), NAVOSH Program Manual for Forces Afloat. Working spaces shall be adequately ventilated using all the safety precautions outlined in paragraph 050-4.3.1 and the following paragraphs.

050-4.3.2.1 Prevention. Take care to prevent clothing from becoming saturated with the preservative or cleaning preparations. When this does happen, take the following precautions:

a. Remove and launder saturated clothing; it constitutes a possible health and fire hazard.

b. Have personnel report to the medical officer for examination.

c. Health and fire hazards can also accrue because of prolonged exposure to spraying operations. Change and launder clothing daily.

050-4.3.2.2 Protective Cream. Apply protective cream (NSN 8510-01- 167-5723) carefully and thoroughly to all parts of the body exposed to contact with vapors or preservative or cleaning preparations.

050-4.3.2.3 Protective Gloves. Wear protective gloves when applying preservative cream or when using cleaning fluids in any manner. Wear impermeable gloves when using chlorinated solvents. Wear respiratory protection in confined areas to protect against low concentration of vapors. In high concentrations, however, the minimum protection should not be relied upon in the handling and hazards of chlorinated solvents, alcohol, and like materials. Personnel working in cramped quarters or poorly ventilated spaces should also wear the maximum protection specified.

050-4.3.2.4 Respirator. A cartridge type respirator is to be worn by personnel engaged in spraying in the open air and also by all personnel engaged in the brushing, flushing, or dripping of solvent cutback corrosion preventive.

050-4.3.2.5 Respiratory Protection Devices. Respiratory Protection Devices. For respiratory protection devices and proper cartridge selection refer to the following:

a. ANSI STD Z88.2 – 1992, American National Standard for Respiratory Protection.

b. 29CFR1910.134.

c. Chapter 15, OPNAVINST 5100.23F, dated 15 July 02, Navy Occupational Safety and Health (NAVOSH) Program Manual.

SECTION 5
CATHODIC PROTECTION

050-5.1 OVERVIEW

050-5.1.1 Purpose. This section details cathodic protection requirements for corrosion control of underwater areas of inactive ships. A properly installed and maintained cathodic protection system, in conjunction with the prescribed underwater hull coating system, will effectively control corrosion of all wetted surfaces of the hull.

050-5.1.2 Background. The type of cathodic protection described in this section and generally applicable to all inactive ship berthing areas is termed impressed current cathodic protection. With this system, conventional AC power is rectified to DC and is distributed through anodes to the exterior underwater portions of the hull. In contrast to this method, in situations where an inactive ship is berthed where no shore power is available, a galvanic anode (sacrificial) system may be installed to provide the desired protection. The latter system requires no external power source, as it uses an active metal (such as zinc or magnesium) that will corrode in place of the hull. Instructions for the installation of such a system can be provided by NAVSEA on an individual case basis. A request for instructions should include ship type, class, proposed berthing location and arrangement, proximity to other ships and structures, and seawater resistivity (or a seawater test sample, including water temperature at the time the sample was taken). For general consideration and in the discussion following, the following cited resistivity classification shall be used:

Classification	**INACTSHIPMAINTO**
Saltwater Sites	Bremerton, WA
(Mean water resistivity less than 100 ohm- centimeters.)	Pearl Harbor, HI
Freshwater Sites	Philadelphia, PA

In addition to this chapter, training films MN-10146A and MN-10146C provide information on the principles of cathodic protection.

050-5.2 CATHODIC PROTECTION EQUIPMENT AND MATERIALS

050-5.2.1 General. The impressed current cathodic protection system for inactive ships consists of four major components: anodes, power supply, current distribution system, and reference electrode (for automatic hull

potential control system only). A discussion of this equipment is provided here. In addition, a list of materials required to support the system is included in Table 050-5-1.

Table 050-5-1 Material and Equipment Requirements For Installation of Cathodic Protection System

Item	Specification/Commercial Designation	NSN or MFG Number
1. Manual control power supplies for saltwater sites:		
a. Rectifier, 20 amperes, 12V maximum	MIL-P-21454	6130-00-807-9513
b. Rectifier, 75 amperes, 12V maximum	MIL-P-21454	6130-00-542-6146
c. Rectifier, 130 amperes, 12VDC maximum	MIL-P-21454	6130-00-542-6144
2. Manual control power supplies for freshwater sites:		
a. Rectifier, 20 amperes, 48V maximum	MIL-P-21454	6130-00-542-6143
3. Anodes, platinum-niobium wire		
4. Electric cable (Use SHOF-type for all underwater leads):		
a. SHOF 23	MIL-C-915/6	6145-01-201-9531
b. SHOF 60	MIL-C-915/6	6145-01-201-9532
c. SHOF 150		6145-00-643-0640
5. Connector splice (For connecting wire anodes to electric cables)		5940-00-258-5890
6. Overlap conductor to fit:		
a. SHOF 23		5940-00-228-7912
b. SHOF 60		5940-00-240-3434
c. SHOF 100		5940-00-240-3435
d. SHOF 150		5940-00-240-3446
7. Terminal lug	MIL-E-16366	5940-00-197-8770 5940-00-230-0543
8. Power Cable Splicing Kit	82-A or 82-A1	5970-00-982-1383
9. Copper sulfate crystals	FED SPEC O-OC828	6810-00-281-2035
10. Potentiometer-voltmeter	MIL-P-22715	
11. Silver chloride reference cell	Englehard No. 33428	Electrocatalytic, Inc. E. Newark, NJ
12. Clamp-on ammeter	Type AX Co. 1. Scale 0-50 ampere 2. Scale 0-200 ampere 3. Scale 0-600 ampere	Columbia Electric Mfg. Cleveland, OH
13. Digital Multimeter	Fluke Model 77	BN
14. Diodes	Designated in mfg manual	Electrocatalytic, Inc.
15. Reference electrode	Designated in mfg manual	Electrocatalytic, Inc.
16. Reference cell	Designated in mfg manual	Electrocatalytic, Inc.
17. Feeder line disconnected	Designated in mfg manual	Electrocatalytic, Inc.
18. Heat shrinkable tubing		Raychem, Inc.
19. 3/8 inch CRES bolt		5306-00-543-5571
20. 3/8 inch aluminum stud		5307-00-638-0084
21. CRES shake proof (Star lock washer)		5310-00-984-7042

Table 050-5-1 Material and Equipment Requirements For Installation of Cathodic Protection System - Continued

Item	Specification/Commercial Designation	NSN or MFG Number
22. Aluminum terminal	Burndy	Cat. No. K4-294
23. ORES locking nut		5310-00-768-0318
24. GE-RTV-11		8030-00-180-6201
25. Steel flat washer		5310-00-595-5095
26. Aluminum terminal connector	Burndy	Cat. No. KA-2U
27. U clamp		5940-00-228-7912

050-5.2.2 Anodes. Anodes for C/P systems are manufactured from platinum-niobium. These anodes contain up to 2 percent silver and up to 7 percent antimony. They operate by forming a brittle, chocolate-brown peroxide coating. A current of at least 0.5 ampere per anode is necessary to maintain the coating once it has formed. Because of the fragile nature of the coating, precautions should be taken to avoid excessive handling and flexing of the anodes; if the coating flakes off, the life of the anode is significantly reduced. All new installations (fresh, brackish, and saltwater) shall be installed using platinum-niobium anodes. Anode types cannot be mixed on a bus ring. Under no circumstances shall the deteriorated lead anodes be disposed of by dumping them into the sea. The latest type of anode, platinum-niobium, is designed for use in all berthing sites. These anodes are in the form of wire, about 0.1 inch in diameter and consist of niobium that is thinly plated with platinum. They may be ordered either as a unit made up with the proper cable, or in 50-foot lengths from which anodes of various lengths can be made. The anode wire can provide approximately 1 ampere per linear foot. Details for making the junction to the anode cable are provided in paragraph 050-5.4.3.

050-5.2.3 Power Supply. Power supplies can be manually controlled or automatically controlled. The automatic control system can be the hull potential control type or the current control type. Rectifier output voltages vary according to the water resistivity. Saltwater sites have power supplies with a capability of at least 15 volts output. Power supplies at brackish water sites are capable of at least 24 volts output. However, automatic hull potential control equipment with only 15-volt capacity can be used at brackish water sites. Sufficient anodes must be installed to provide adequate current output during periods when fresh water runoff increases the water resistivity. Power supplies for freshwater sites shall have capability for at least 48 volts output. In all power supply rectifiers, the positive and negative terminals shall be clearly and permanently marked in order to diminish any chance of reversing connections inadvertently. Reversal of these connections can cause severe damage to the hull. All power supplies can be used with any type of anode. Repair parts should be requisitioned from the Navy Inventory Control Point, Mechanicsburg, PA. Complete identification of the desired part is essential.

050-5.3 AUTOMATIC CONTROL

050-5.3.1 Hull Potential Type. The hull potential type of automatic controller power supply consists of the components and general arrangement shown in Figure 050-5-1. This power supply is designed for saltwater sites; however, it can be used at brackish water sites if a sufficient number of anodes are installed to provide adequate current output during periods of high water resistivity. This type of power supply has a high current output capability, and is intended for use in multiple ship arrangements, except where very large hulls are being protected. The power supply operates in the following manner:

a. The reference cell senses the hull polarization potential.

b. The control circuit compares this voltage to the preset value of the desired hull potential (usually 0.85V) and provides the difference signal to the saturable reactor.

c. The saturable reactor uses the signal potential difference to control the voltage to the step-down transformer.

d. The transformer reduces the 440-volt input to the anode voltage level, less than 20-VAC.

e. The rectifier section converts the 20-VAC to DC. It is possible to select several anode voltage levels to accommodate multiple ship nests where each ship has a different requirement.

050-5.3.1.1 Constant Current Type. The constant current type of automatic controller power supply consists of the components and general arrangement shown in Figure 050-5-2. This power supply is intended for brackish and freshwater applications. It is similar to the hull potential type described above, except that the voltage across the output shunt is measured, not the hull potential. This voltage is thus a measure of the current output, and the control circuitry is designed to maintain a constant current output, even with changing resistivity of the water at the site, to match the value of the current that is set into the controller. This type of control is necessary in fresh and brackish water because it is not possible to monitor hull potential voltages without shutting off the current. The IR drop in the water will distort the potential reading, rendering it unusable for control purposes.

050-5.3.2 Reference Electrode. Reference electrodes are used only with the hull potential control type of power supply. This is usually the silver or silver chloride type, described in MIL-P-15736/9. Only this electrode or an equivalent intended for continuous use with controlled equipment should be used. Other reference electrodes intended for instruments do not have sufficient output for this equipment. The proper electrode has at least 10 square inches of silver-chloride-coated silver mesh as the active electrode surface.

050-5.4 INSTALLATION

050-5.4.1 General. The basic installation of cathodic protection on inactive ships can be accomplished in either of two ways, as nests of ships bonded together or as isolated ships. If the former method is used, the large size automatic control power supplies are used. For the latter, either small capacity manual control or automatic control power supplies may be used. Under no circumstance should an isolated ship be moored in a nest of bonded ships. Stray current corrosion can occur on the isolated ship if it lies in the path of the waterborne current that flows between the anodes and the hull of the unprotected ship. For any individual ship, whether berthed in a bonded nest or in isolated berthing, the distribution bus ring arrangement and the anode installation is identical. A sectional floating drydock should be treated as a bonded nest for purpose of cathodic protection. Under no circumstances should a boat or craft with an aluminum hull be nested or bonded with steel hull craft or near cathodically protected piers or seawalls. Instructions for an aluminum hull will be provided by NAVSEA on a case basis.

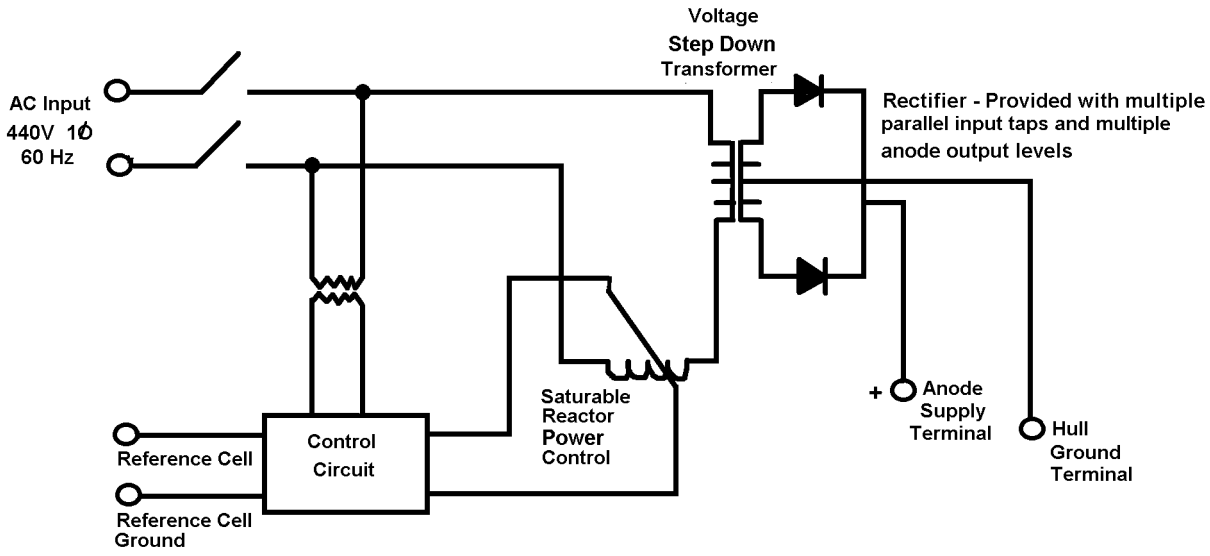


Figure 050-5-1. Hull Potential Control Circuit

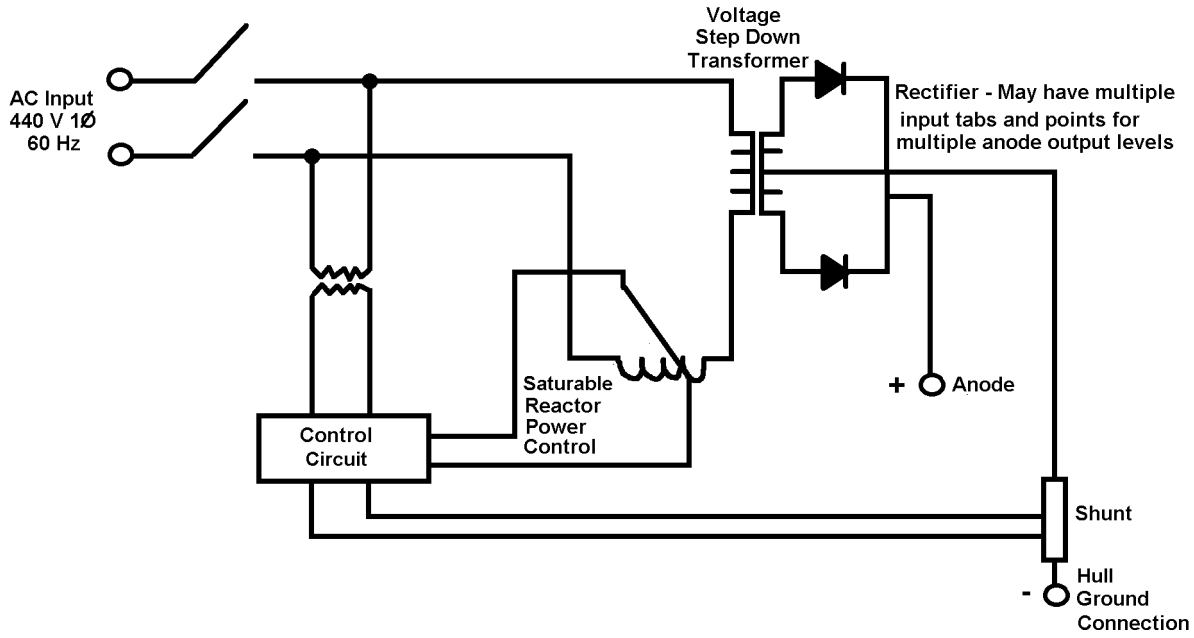


Figure 050-5-2. Constant Current Control Circuit

050-5.4.2 Design Criteria.

a. Number of anodes for an individual ship.
b. Type of anode material.
c. Number of distribution bus rings.
d. Whether to bond ship in a nest or singly.

e. In case of nested ships, to install power supply on pier or on deck.

f. If bonded, number of ground bonds between ships, and between ships and pier.

g. Type and size of power supply.

050-5.4.2.1 Number of Anodes The number of anodes required depends on the current required to provide protection and on the resistivity of the water at the site. More anodes are generally required for a given size ship in fresh or brackish water than in salt water. A minimum of four anodes in saltwater and six anodes in brackish or fresh water shall be installed on each ship. Otherwise provide at least one anode to port and one to starboard for each 100 feet of length in saltwater and for each 75 feet of length in fresh or brackish water. The placement of the anodes determines the current distribution. The total current required depends upon the underwater hull area, the condition of the coating system and whether the site is salt, brackish, or fresh water. To estimate the area of the immersed hull, use the following formula:

S = 1.7(L*D) + Vdis/D where:

S= underwater hull area
D = draft of the ship
L = length of the ship
Vdis = Volume displacement (displacement in tons x 35 cubic ft per ton)

Using this hull area, refer to the proper line in Table 050-5-2 for the estimated number of anodes required. If this number is used and desired polarization potential levels cannot be attained, additional anodes will have to be installed. The designed current capacity for one anode is 5 amperes, but up to 10 amperes will not damage the anode. For short durations (less than 2 days) even 15 amperes is acceptable. The practical upper current limit in fresh water is about 2 amperes per anode because of the high anode to water electrical resistance that occurs in fresh water

050-5.4.2.2 Anode Material. A discussion of anode materials is provided in paragraph 050-5.2.2. In general, wire type (platinum clad niobium) anodes will be installed in newly inactivated ships. There is no objection to mixing ships having different types of anodes together in the same nest, but anodes of different types must not be mixed on the same bus ring. Where anodes of different types are used in the same nest, the instructions of paragraph 050-5.4.3 apply.

050-5.4.2.3 Number of Bus Rings. The number of bus rings will depend upon the size of the ship being protected. The maximum number of anodes that may be installed on a single bus ring is 20. If the required number is greater than 20, the total number should be split between two separate bus rings.

Table 050-5-2 Design Criteria For Number of Anodes

Underwater Hull Area (Square Feet) (Metallic Surface)	**Estimated Current Requirement (Amperes at 0.85V polarization)**		**Anodes Required**		**(Minimum)**	
			Fresh/Brackish		**Sea Water**	
	Coating Condition		**Coating Condition**		**Coating Condition**	
	Good	**Poor**	**Good**	**Poor**	**Good**	**Poor**
Less Than 12,000	10	25	6	13	4	5
12,000 - 30,000	25	50	13	25	5	10
30,000 - 50,000	40	80	20	40	8	16
50,000 - 70,000	60	100	30	50	12	20
70,000 - 90,000	80	120	40	60	16	24
90,000 - 120,000	100	150	50	75	20	30
120,000 - 150,000	120	180	60	90	24	36

050-5.4.2.4 Mooring Techniques. The technique of mooring a ship depends upon the site, size of the ship, available mooring equipment, anticipated movements of the ship, and whether or not the nest or pier is already bonded. For efficient use of the large capacity automatic control power supplies, ships having less than 30,000 square feet of hull area should be bonded in nests and connected to a single power supply. Ships bonded in a nest should be reasonably close together and physically adjacent to each other; that is, without being separated by an unbounded hull or structure. Isolated ships may not be moored in the nest, but ships or nests that are separately protected may be moored adjacent to a bonded nest without fear of damage.

050-5.4.2.5 Power Source Location. Determination of the location of power supplies usually depends upon the likelihood of danger to the equipment or tampering with adjustments if placed on the pier. If ship movements are anticipated, it is recommended that a pier site be used and watertight breakaway connectors be used for the bus ring feeder leads. Do not use breakaway connectors for ship bonds or rectifier ground returns because the resistance in the connector will reduce the effectiveness of the bond. A pier location offers the advantage of easy inspection, but has the disadvantage of requiring a longer cable lead to the bus ring.

050-5.4.2.6 Bonding Techniques. Adjacent ships in a nest must be ground bonded with a SHOF 150 cable to ensure proper corrosion protection and avoid the possibility of stray current damage. The minimum number of bonds is 2; one near the forward end of the ship, within the forward 1/4 of the ship's length, and one near the stern. For ships longer than 400 feet, an additional bond should be used approximately midway between the other two. As a general guide, provide isolation of mooring lines only if hull potentials cannot be maintained. Usually an exceptionally high current level to maintain the proper potential indicates that current is leaking to the pier, to metallic piping ashore, or to another ship. When this is the case, take appropriate steps to isolate the hull until the current is within normal limits.

050-5.4.2.7 Supply. The type of power supply, whether automatic control or manual control, will depend upon availability of equipment, but the recommended procedure is to nest the ships and install automatically controlled equipment. Constant current control is best suited to fresh and brackish water sites while hull potential control is well suited to saltwater sites. Large ships, even though nested, will require individual power supplies. DO NOT FAIL TO BIND ALL SHIPS IN A NEST EVEN THOUGH SEPARATE POWER SUPPLIES ARE USED.

050-5.4.3 Anode Installation. Installation on the bus ring is the same for all types of anodes. Use proper connectors on the bare conductors, and make the joint watertight with insulation putty and vinyl electrical tape. For all anodes, adhere to the following precautions:

a. Do not install anodes in contact with mud. Rapid anode deterioration will occur.

b. Do not install anodes in a way that will allow contact with the hull. Shorts to the hull can cause paint damage, local corrosion, and damage to the power supply and leads.

c. Do not install different type anodes on the same bus ring or on the same power supply tap. All of the current will flow from the anode with the largest surface area.

d. Do not install anodes partially submerged in the water. They are not effective in this position.

050-5.4.3.1 Wire Anodes. Platinum plated niobium wire can be used at all berthing sites. The standard anode assembly is a 5-foot length of wire with an attached pigtail of cable at one end. The wire and the cable-to-wire-splice should be housed in a 6-foot length of 2-inch diameter PVC pipe to prevent the wire from shorting to the hull. The pipe shall have at least 2 one-inch holes per foot of length to facilitate proper current distribution. The

pipe may be coated with antifouling paint and shall be suspended from the ship by a light nylon or other non-conducting cord. The anode to cable splice shall be as follows:

a. Cut anode wire to 5 feet, plus or minus 3 inches.

b. Cut a length of SHOF-23 cable to suit.

c. Strip insulation from cable end to about 2 inches.

d. Slip a connector (refer to Table 050-5-1 for ordering information) over the anode wire and push the anode wire 2 inches into the cable strands.

e. Slip the connector over the strands and crimp three times. For greater security and improved electrical contact, the joint may be soldered.

f. Make the joint weathertight utilizing power cable splice kit (refer to Table 050-5-1 for ordering information).

Suspend anodes vertically in the water as low as possible, preferably so that the top of the anode is at keel depth (Figure 050-5-3). Where this is not possible because of shallow water, the anodes should be suspended in a horizontal position as shown in Figure 050-5-4.

050-5.4.3.2 Spacing. Outriggers should be used to suspend anodes from ships with high freeboard or in berthing areas open to the wind. Outriggers hold the anodes away from the hull so that they won't short circuit against the hull if the ship starts to roll in rough weather. For a detailed view of the outrigger, see Figure 050-5-5. Spacing of anodes should conform to the minimum guidelines discussed under design criteria, paragraph 050-5.3.2. They should be evenly spaced about the hull in order to provide an equal current distribution. In all cases, anodes shall be installed near the propellers. A method for determining anode spacing is shown in Figure 050-5-6.

050-5.4.4 Distribution Bus Ring. The bus ring is installed about the ship to ensure even current output from anodes. The arrangement of the distribution bus ring is shown in Figure 050-5-7, including the feeder line from the power supply. This arrangement is necessary for all systems: manual, automatic constant current, and automatic hull potential control - whether on an isolated or a nested ship.

050-5.4.5 Bonding of Ships Ship bonding is discussed in paragraphs 050-5.4.5.1 through 050-5.4.5.3.

050-5.4.5.1 Ship Bonding. The basic bonding arrangement of nested ships is shown in Figure 050-5-8. SHOF 150 cable is used for bonding. For ships over 400 feet in length a third bonding cable is used midway between the other two. The ground lead is connected to the ship's hull by a stud welded to the structure or by a bolt through an accessible plate on the structure. The contact surfaces should be clean, bare, and sanded to bright metal. Resistance of the connection should be less than 0.001 ohm measured with a meter having an accuracy to 0.1 mini-ohm.

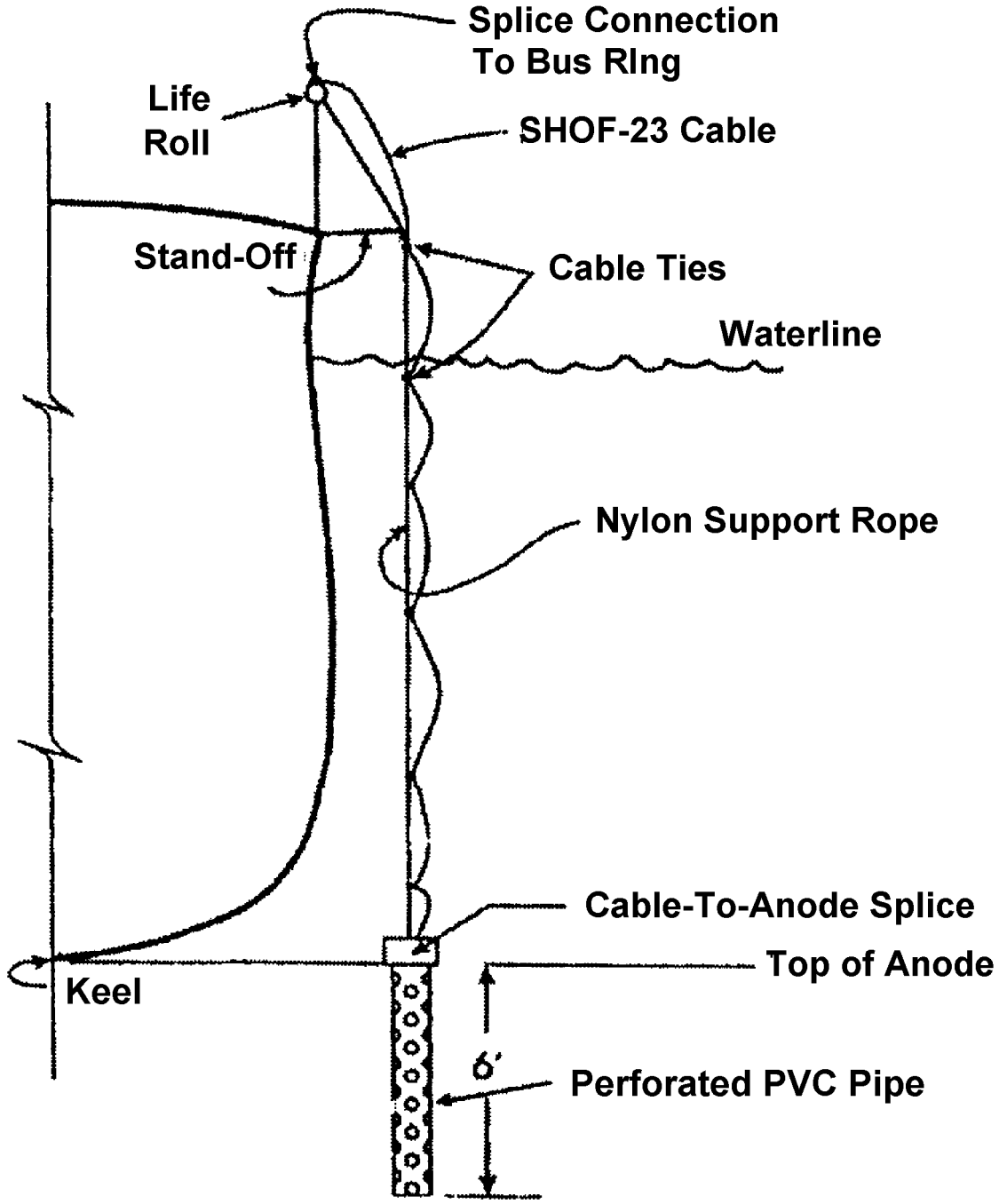


Figure 050-5-3. Anode Installation

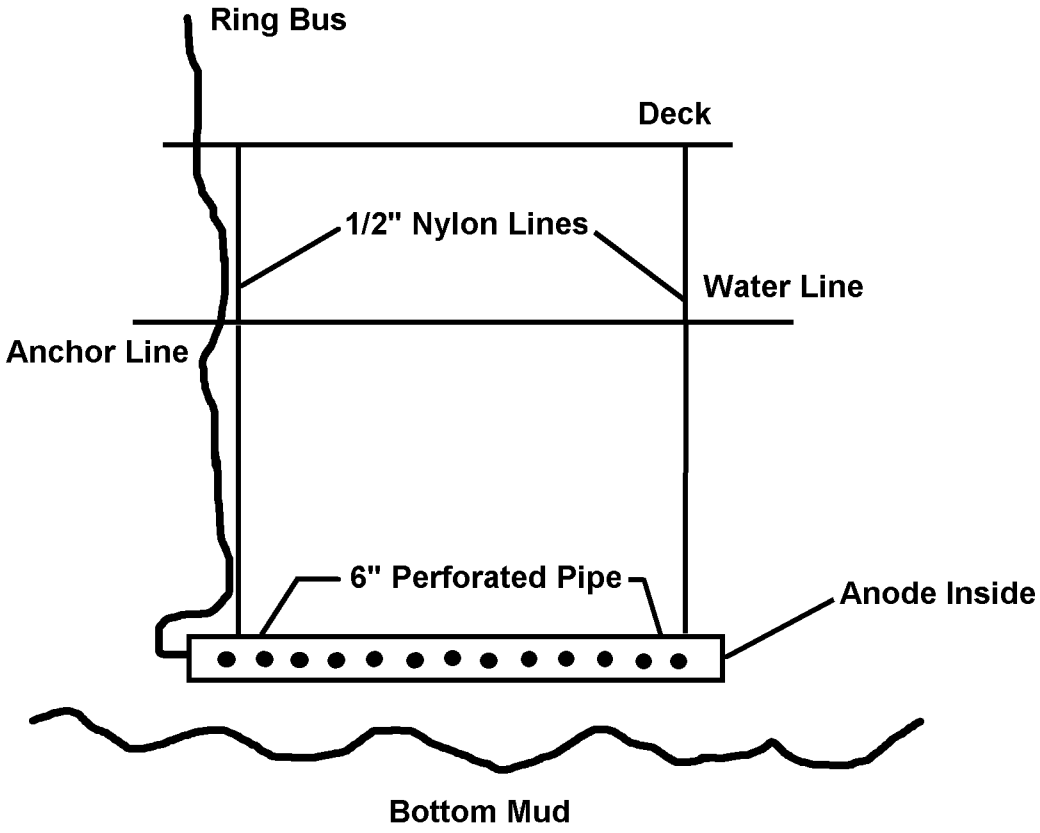


Figure 050-5-4. Horizontal Anode Suspension

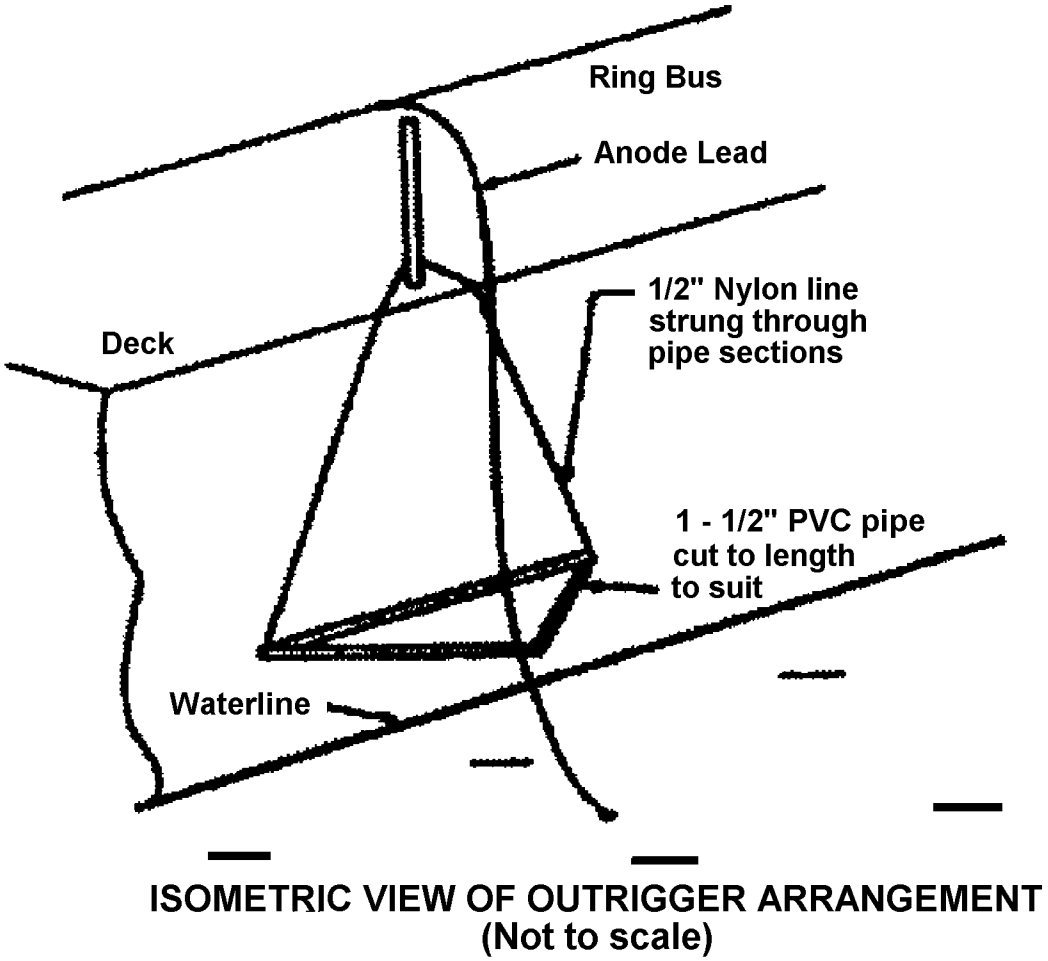


Figure 050-5-5. Outrigger Arrangement

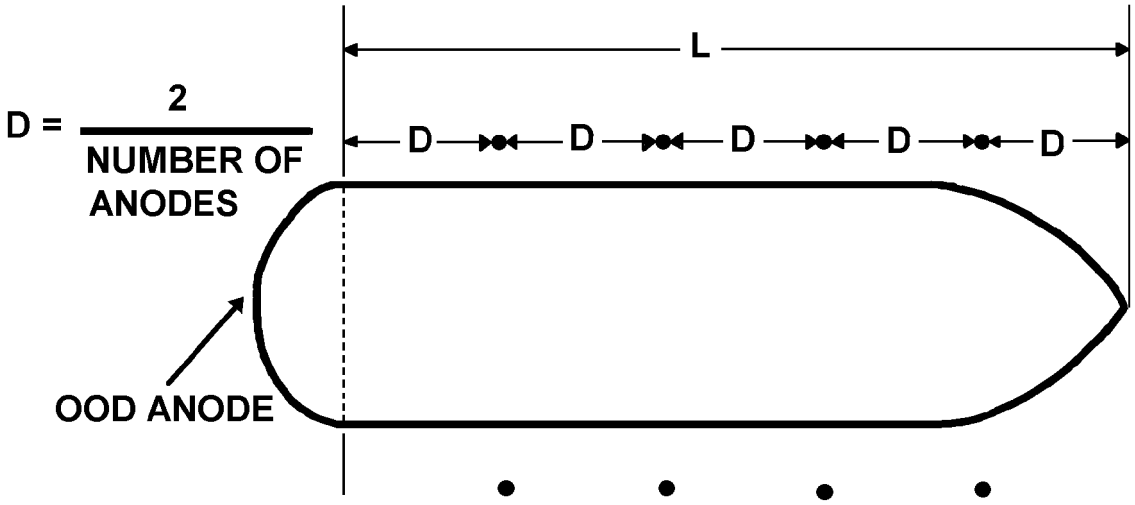


Figure 050-5-6. Anode Spacing

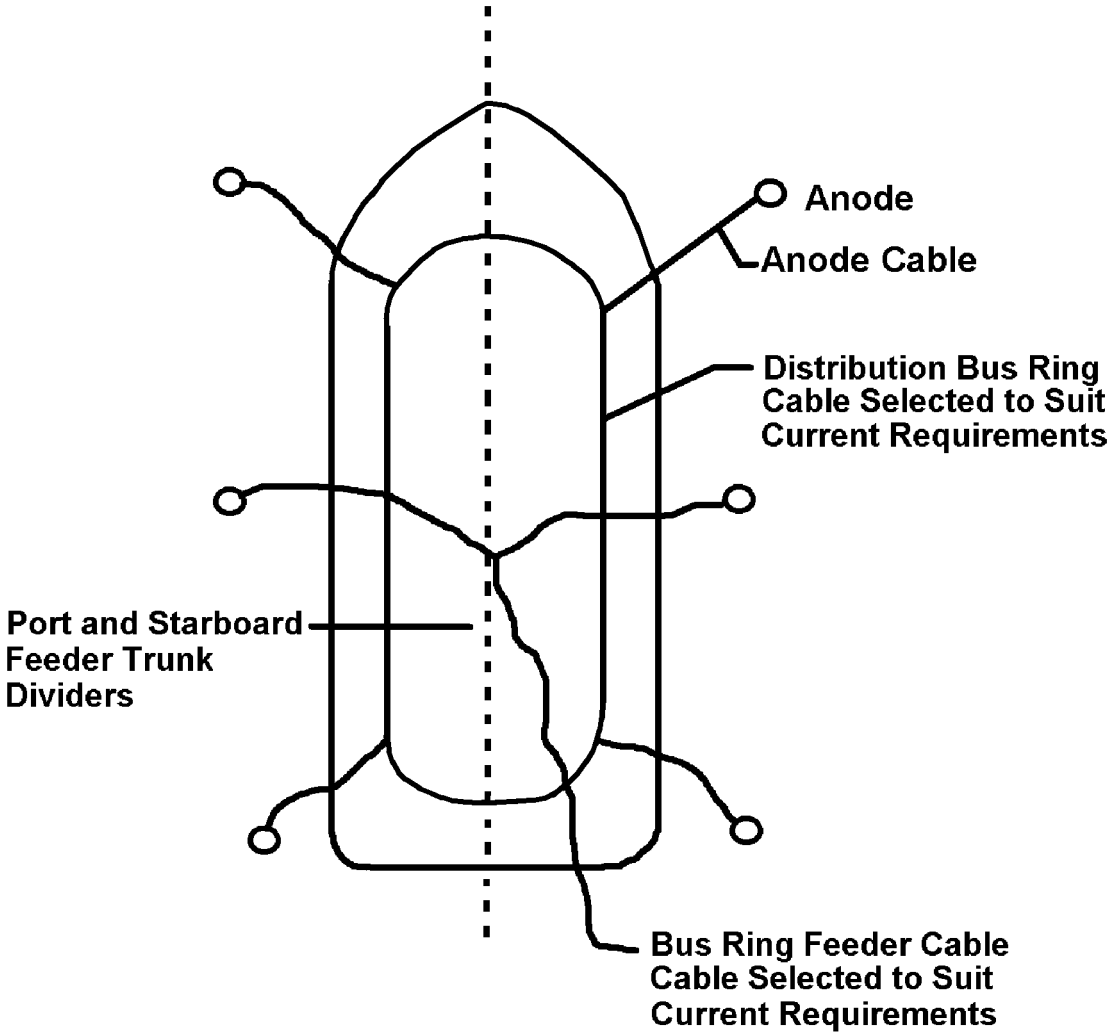


Figure 050-5-7. Anode Bus Ring

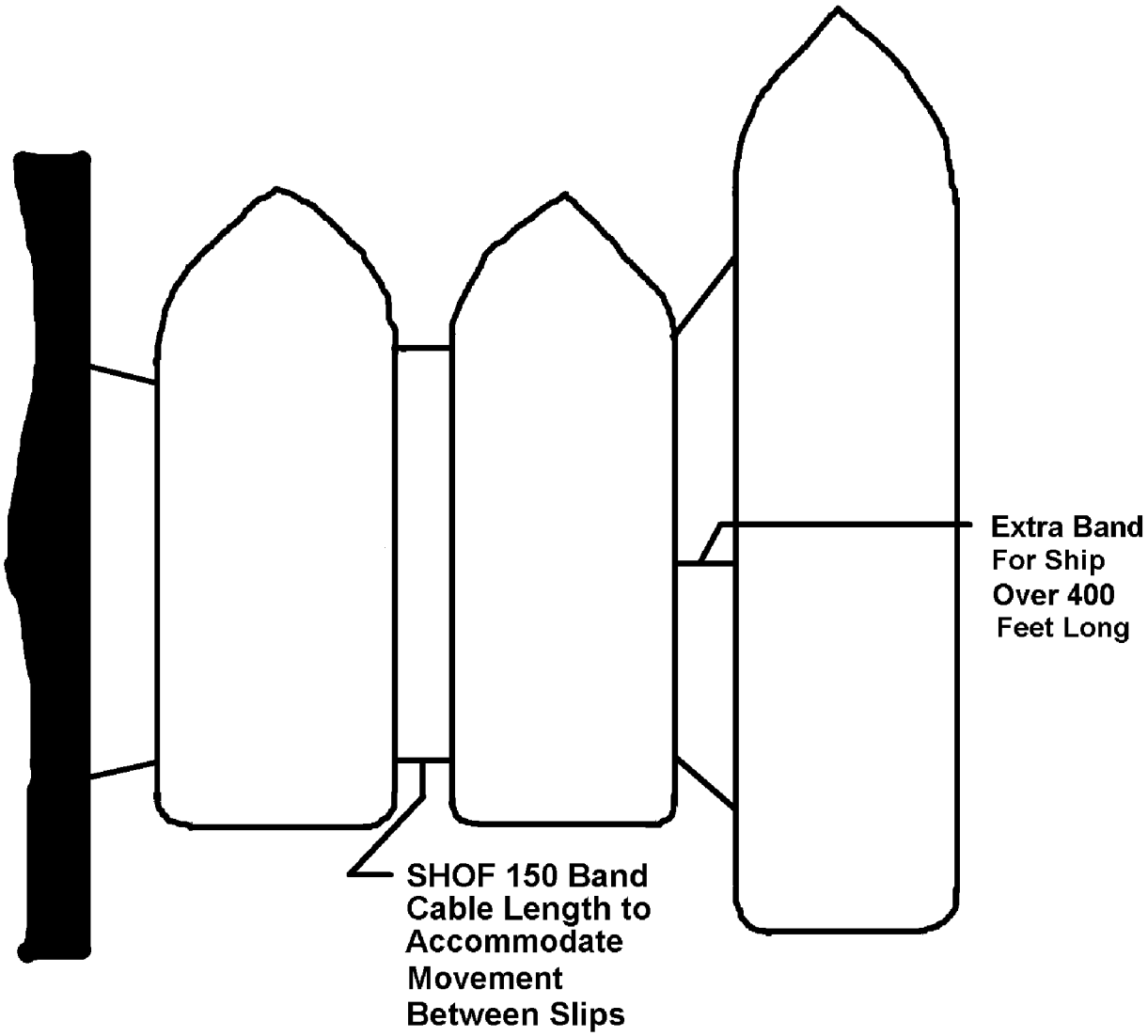


Figure 050-5-8. Ship Bonding Diagram

050-5.4.5.2 Berthing. Do not berth unprotected ships in the same nest with protected ships. However, if unavoidable circumstances result in the temporary nesting (1 month or less) of an unprotected ship with protected ships, take appropriate measures to ensure that the unprotected ship is electrically bonded to the protected nest by heavy cable or wire rope (SHOF-150 or larger). Provide additional power supply capacity or more anodes, if required; to carry the added load; this is usually not required in a temporary arrangement. Normally, unprotected ships are to be located at least 50 feet from protected ships.

050-5.4.5.3 Separating Camel Bonding. Separating Camel Bonding. Metallic camels located between protected ships may be damaged by stray currents flowing from the anodes through the camel and then to the hull. To pre-

vent this damage, the camels must be electrically bonded to the ship. They will thus be protected in the same manner as the ship. Metallic camels are bonded as follows:

a. Check the resistance between all pontoon sections. If it is zero, the entire camel can be treated as one unit. If resistance is found, bond each pontoon section to the others by running a wire rope along the camel and welding it to each camel section. Ensure that the wire rope is of sufficient length to allow for pitching or rolling during bad weather and is fastened securely enough not to snap loose.

b. Attach a minimum of two wire ropes between each camel and the ships the camel touches. Attach the wire rope to the ship either by direct welding or through the use of suitable terminals. The terminals in turn should be end-welded to the ship and camel. Paint the connection after assembly.

c. To keep the camel from coming into contact with the pier, use old rubber tires or similar insulating bumpers to fender the camel between the inboard ship and the pier. Check the potential of the camels after the ship has attained the hull potential required for proper protection. If the potential on the camel is low, install additional bonding cables until the potential matches that of the ship to which the camel is bonded. The amperage and number of anodes specified for the ship is sufficient to protect the included camels without adding to either.

050-5.5 AUTOMATIC CONTROL EQUIPMENT

050-5.5.1 GENERAL. Constant current and hull potential control equipments are installed in the same manner; however, the hull potential type requires a control reference cell. The reference cell must be suitably located and grounded. Information in Table 050-5-3 provides guidance in selecting cable sizes and terminals for use in connecting automatic control equipment to the power supply. The low (L), medium (M), and high (H) positive terminals are marked on the power supply. The reference cell lead for hull potential control equipment is provided with the power supply, but extensions may be made as required by using watertight connections and SHOF-3 cable. This connection must be separate from that used as the ground connection for the rectifier. Make the ground for the reference cell using SHOF-3 cable and connect to the ship being used for reference measurements.

Table 050-5-3. Guide For Cable Size and Tap Settings

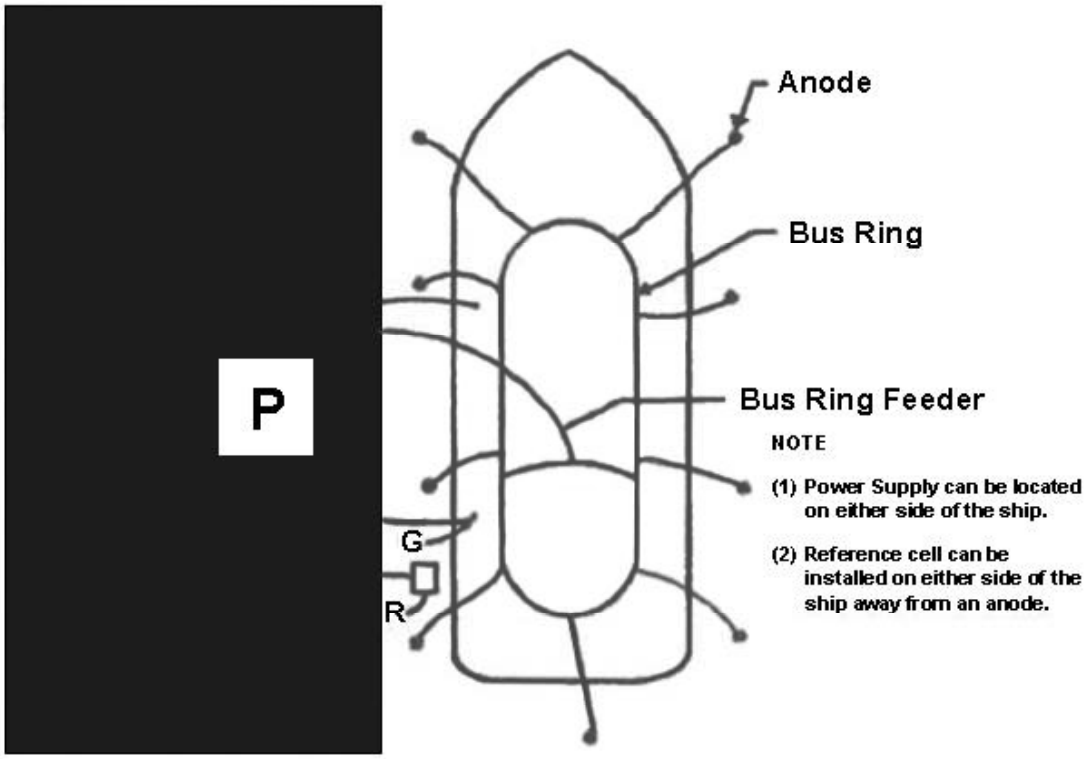
Guide For Cable Size and Tap Settings	**Feeder Line CablE**	**Ground Return Cable**	***Guide To Tap Setting**					
			Seawater Sites and all Fresh-Water Equipment			Brackish Water Sites with Hull Potential Equipment		
			Number of Ships			Number of Ships		
			1	2	3 or More	1	2	3 or More
U to 30,000	SHOF-23	SHOF-60	L	M	M	L/M	M	H
30,000 to 70,000	SHOF-60	SHOF-150	M	M	H	M	M	H
70,000 to 120,000	SHOF-150	Double	M	H	-	M	H	-
120,000 and over	Double SHOF-150**	Double SHOF-150	H	-	-	H	-	-

050-5.5.1.1 Single Ship Installation. Protection of a single ship is straightforward. The basic installation with the power supply located on the pier is shown in Figure 050-5-9, however, the power supply could be located aboard the ship just as well.

050-5.5.1.2 Nest Installation. Automatic equipment is usually installed in a nest of bonded ships, as shown in Figure 050-5-10. A power supply located on the pier is illustrated but the unit can be mounted on one of the ships if a suitable pier location is not available. Install the reference cell on a center ship in the nest away from the bow or stern. The precise location of the reference cell is normally determined by trial and error; this must be representative of the average hull potential conditions for all underwater hull areas of the entire nest and not be near an anode.

050-5.6 OPERATION

050-5.6.1 General. Corrosion of the underwater hull is virtually eliminated when the hull is maintained at a potential of 0.80 volts with respect to silver-silver chloride (or 0.85 volts with respect to copper-copper sulphate) reference cell. Because current is not uniformly distributed throughout the hull, variations in hull potential between 0.80V and 1.2V are to be expected. However, hull potentials outside this range are not acceptable and require adjustments in equipment or anode arrangement to correct hull potential to the proper value. Potential less than 0.08V will cause corrosion to take place; hull potential over 1.2V will cause excessive current, thereby wasting power and eventually damaging the hull paint coating. Uniform current distribution to all anodes on a bus ring is necessary for successful operation of the system. Check the current to each anode using a clamp-on ammeter. If the current is zero, or is significantly less than that to other anodes on the bus ring, check for poor connections or loss of the anode, and take proper corrective action. If current output to the anode is greater than the upper limit of 5 amperes, add anodes to the bus ring until the current per anode is within limits. If the anode current is too low to give a reading on the clamp-on ammeter, take several turns of the anode cable through the meter clamp until a reading can be taken, then divide the meter reading by the number of times the cable runs through the clamp to give actual current.



P - Power Supply
G - Reference Cell Ground (Not applicable to constant current equipment)
R - Reference Cell (Not applicable to constant current equipment)

Figure 050-5-9. Automatic Control Equipment, Single Ship Installation

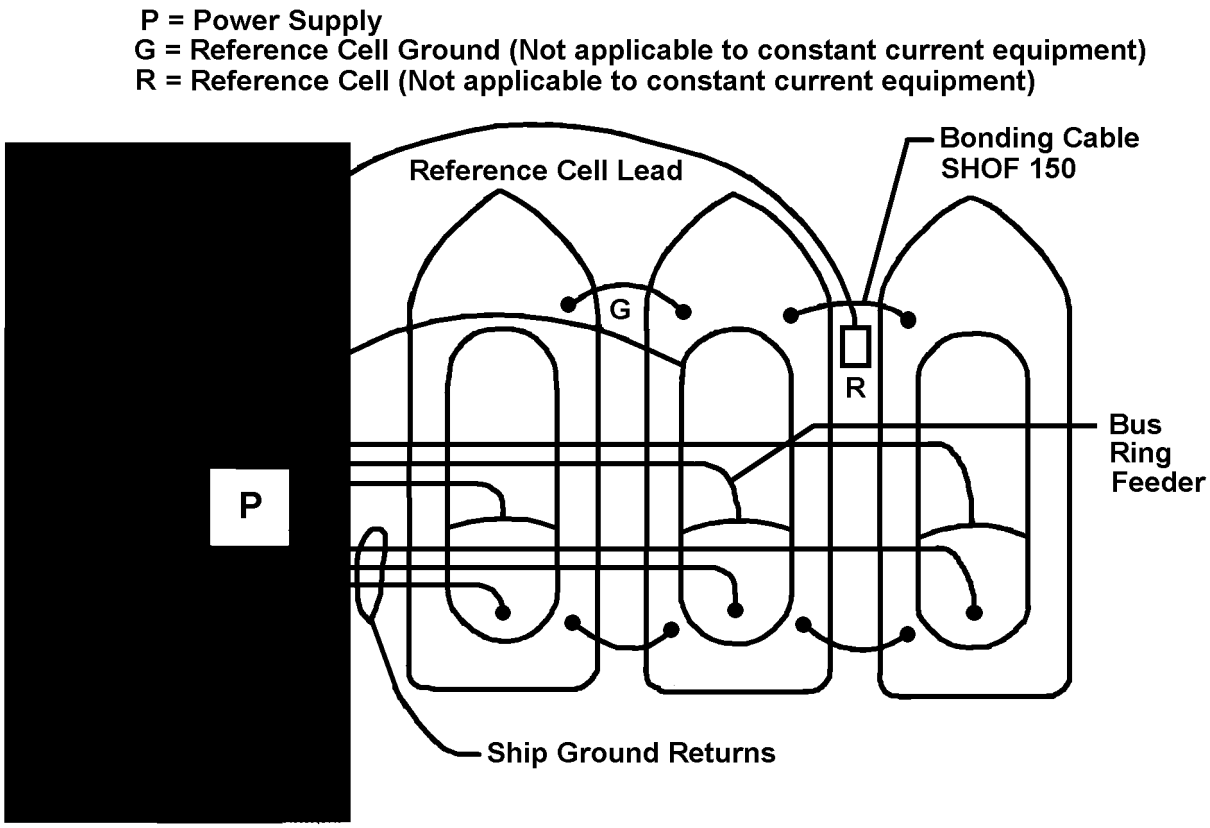


Figure 050-5-10. Automatic Control Equipment, Nest Installation

050-5.7 EQUIPMENT ADJUSTMENT

050-5.7.1 Hull Potential Type. Initial adjustment of automatic hull potential control equipment involves the following:

a. Setting a hull polarization potential (usually 0.85 to 0.90 volts) into the control device and making daily hull potential surveys. After each survey the system is adjusted so that a uniform hull polarization potential is established about all ships in the nest. This may be done by relocating or adding anodes, by moving the reference electrode, or by changing anode supply voltage, alone or in combination. Adjustments are not required if the potential is within the 0.8 to 1.2 volt range between the highest and lowest reading. Record the setting of the hull potential adjustment and the resulting level of polarization. At brackish water sites, readings must be made with the power off. Locate the reference electrode as far away from the anodes as possible to avoid IR drop error in hull potential readings.

b. Operation of the system after the initial adjustment has been completed should consist of the following (maintain a log for each power supply):
   1. Weekly. Check hull potential meter on the power supply. Hull potential should be at center zero (or an indicated value on some units) and be logged along with the set value. Check output voltage and current and enter in the log. Shorts in the circuit, indicated by abnormally high current and low voltage, and opens, indicated by low current and high voltage, demand immediate corrective action.

2. When ships are moved or added to the nest, take potential surveys and make appropriate adjustments to controls.

050-5.7.1.1 Constant Current Type. Initial adjustment of automatic constant current control equipment requires the following:

a. Setting an estimated current level into the control (refer to Table 050-5-3), and making daily hull potential surveys. Each survey provides data for changing the system arrangement until a uniform hull polarization potential is established. This is accomplished in the following ways: by adjusting the output current level, by relocating or adding anodes, or by changing the power supply anode terminal voltage level. The measured polarization levels around the ship or throughout the nest must fall within the 0.8 to 1.2 volt range. The polarizations measurements should be made with no anode current flowing and should be taken immediately after securing the rectifier. Record the final current and voltage settings. Mark the final current setting at that value thereafter. Measure polarization immediately after securing the power supply.

b. Operation of the system after initial adjustments have been completed is as follows (a log should be maintained for each power supply):
   1. Weekly. Check and log output current and terminal voltage. Short circuits will be indicated by high current and low voltage; open circuits will be indicated by low current and high voltage. If found, correct immediately.
   2. When the nest is changed by moving or adding ships, adjust the system as necessary to ensure uniform hull polarization potentials about the nest.

050-5.8 MAINTENANCE

050-5.8.1 General. Maintenance of a cathodic protection system is divided into hull potential measurements and maintenance of the cathodic protection equipment. A troubleshooting chart (Table 050-5-4) is provided to simplify maintenance, installation, and adjustment procedures.

Table 050-5-4. Troubleshooting Cathodic Protection Systems

Problem	Possible Cause	Recommended Action
1. Power supply fuses, or circuit breaker opens frequently.	1. Too many ships on one power supply.	1. Check current output requirements.
	2. Short from anode or bus ring to hull.	2. Inspect anode leads; check resistance.
	3. Excessive current drain to adjacent structures.	3. Reduce current drain by isolating hull or nest.
2. High or low potential on some ship test locations.	1. Uneven current output from anodes.	1. Check anodes and connections.
	2. Stray current from outside sources.	2. If verified, notify NAVSEA Code 03ML
	3. Incorrect anode power supply tap.	3. Adjust power supply taps to balance system.
	4. (Automatic hull potential control.) Reference electrode out of water or defective.	4. Check reference electrode against standard; replace if required.
3. Uneven current outputs from anodes on same bus ring.	1. Anode lost, broken, or buried.	1. Inspect anode; replace if required.

Table 050-5-4. Troubleshooting Cathodic Protection Systems - Continued

Problem	Possible Cause	Recommended Action
	2. Break in anode cable or junction.	2. Clean connection; check resistance between anodes and feeder line.
	3. Break in bus ring.	3. Check resistance of sections of bus ring.
4. Loss of power supply output.	1. Rectifier diode burned out.	1. Replace with spare.
	2. Electronic control inoperative.	2. Refer to manufacturer's instruction manual. Send to factory for repair if necessary.

050-5.8.2 Ship Hull Potential Measurements. The measurement of hull potential is the most effective method of measuring the performance of a cathodic protection system. This measurement uses a stable reference cell to establish the voltage difference associated with the difference in location in the galvanic series of the hull being tested and the metal in the reference cell. Make the hull potential measurements as shown in Figure 050-5-11 using a high impedance voltmeter. The voltmeter should be set on the 1.2 or 1.5-volt DC scale. Routine readings every 2 weeks are made at the locations shown in Figure 050-5-12. Usually the cell is connected to the positive terminal of the test equipment and the hull being measured is connected to the negative terminal of the test equipment. Since the magnitude of the difference is what is sought, the fact that this method of connecting the cell results in a negative sign is usually ignored. The type of cell selected will depend upon the water resistivity at the site.

050-5.8.2.1 Fresh Water Sites. Only a copper-copper sulfate reference cell (Table 050-5-1, item 9) and a potentiometer-voltmeter (Table 050-5-1, item 11) is to be used at fresh water sites. Make all readings at these sites with the ship or nest cathodic protection system off, and within 1/2 hour of securing the power supply.

050-5.8.2.2 Saltwater and Brackish Water Sites. A silver-silver chloride reference cell (Table 050-5-1, item 12) used in conjunction with a voltmeter is to be used at saltwater sites. Take readings with the cell suspended over the side by hand to a depth of at least 5 feet below the waterline. The distance to the anodes is not significant when readings are taken with the current off. Hold the cell about 1 foot away from the side of the ship on which the potentials are being read. During the initial adjustment period and quarterly thereafter, the hull potential measurements should be taken at approximately 50-foot intervals about the ship and at both ends. At fresh and brackish water sites it is necessary to turn off the CP rectifiers immediately prior to making the potential measurements to avoid significant errors introduced by IR (Hull Potential) voltage drops.

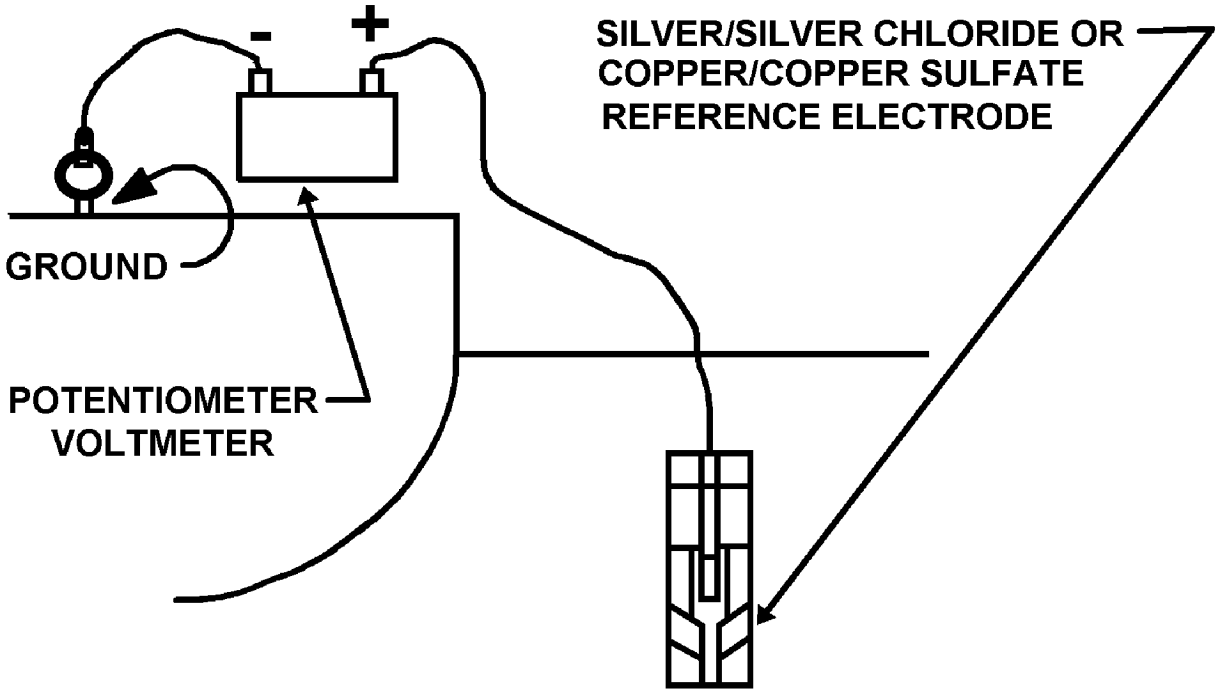


Figure 050-5-11. Hull Potential Measurement

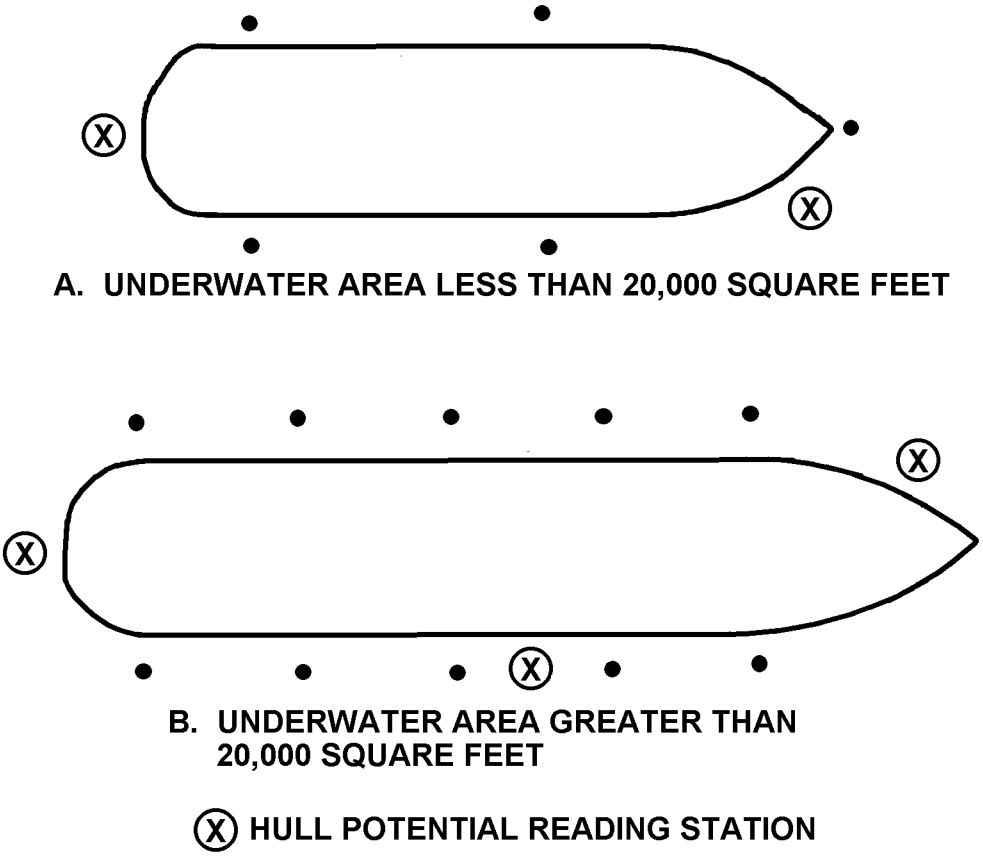


Figure 050-5-12. Hull Potential Reading Stations

050-5.8.2.3 Copper-Copper Sulfate Reference Cell Maintenance. Prior to use, check the batteries in the potentiometer-voltmeter to verify condition. This is done by turning the switch on and the potentiometer until the maximum voltage is registered. If the voltage is more than 1.30 volts, the batteries are good; if not, replace the batteries. In handling the cell, ensure the cell is not inadvertently shorted to the hull through the lead wire. If this happens, clean the cell before taking any measurements. Before and during use, ensure the wooden disc is thoroughly wetted, and that the rubber cap has been removed before taking any readings. Do not depend upon the cable connection to the binding post on the meter to support the cell. Hold securely, or tie off in a suitable manner. To keep the strain off the connection at the cell, loop the cable around the upper body of the cell and secure with plastic tape. Detailed instructions for the cell are as follows:

a. The solution in the cell should be saturated copper sulfate in distilled water. It is considered saturated as long as there are excess copper sulfate (CuS04 $5H_2$ O) crystals in the cell.

b. Thoroughly clean the cell and refill with fresh copper sulfate crystals and distilled water every two weeks. This frequent change is required to ensure that there is no seawater contamination in the solution that would greatly affect the accuracy of the cell reading. To clean and refill the cell:
   1. Unscrew the electrode assembly from the plastic tube.
   2. Throw away the old solution and crystals.
   3. Scrape the copper electrode with a nonmetallic abrasive such as sandpaper.
   4. Flush the electrode assembly and tube thoroughly with tap water and finally with distilled water.
   5. Refill tube with new copper sulfate crystals (Table 050-5-1, item 10) and fresh distilled water.
   6. Reassemble the cell.

NOTE

Do not use the cell for taking measurements at least three hours after the cleaning and refilling operation. Shake vigorously before using to ensure uniform dispersion of the solution throughout the cell. The rubber cap should always be removed from the cell before potential measurement's are taken.

7. The electrical connection between the electrode and the cable should be checked with an ohmmeter. Measure the resistance between the copper electrode and the far end of the connecting cable. Open or loose connections will be indicated by high resistance.
8. To prevent leakage or dilution of the solution or drying out of the wood disc when not in use, the cell should be stored in a jar or beaker containing saturated copper sulfate solution. Additional distilled water should be added to the beaker frequently to replace the loss by evaporation. The rubber cap furnished with the cell will help prevent leakage and drying out of the cell, but this cap way be distorted or lost. For this reason the cell should be kept in the solution regardless of whether the rubber cap is used.
9. Maintain a spare cell in the shop, in operating condition and keep in a beaker of solution. Make comparisons between the standard cell, the service cell, and the meter prior to taking potential measurements. Error between cells should not exceed 0.02V. If the error is greater than this, thoroughly clean and refill both cells with fresh solution, then compare again.

050-5.8.2.4 Silver-Silver Chloride Cell. No additional preparation is required; however, it is recommended the cell be washed off after each use with clean freshwater, preferably distilled. During handling, avoid damaging the cell. No maintenance is required, but make a monthly check using the spare cell kept in the shop as a standard. For this comparison, use a beaker of seawater, if desired. Connect the service cell to the positive terminal of the potentiometer-voltmeter, as usual, and connect the control cell to the negative terminal. The difference between the two cells is not to exceed 0.02V. If values greater than this are obtained, check the control cell against another cell, or send both the control cell and the service cell to a shipyard chemical laboratory to determine which of the two cells is defective.

050-5.8.3 System Maintenance. Whether it is manually controlled or automatic, the cathodic protection system will require some maintenance. The schedule provided below is a minimum requirement because environmental conditions at some sites may necessitate additional maintenance checks. The log; for automatic power supplies should include the results of all maintenance actions. (Many of the checks listed here are performed as a part of the operating routine for the equipment and will not have to be individually scheduled.)

a. Semi-Annually. Read power supply meters and check system for shorts and opens; perform required corrective action.

b. Quarterly.

(1.) Perform a hull potential survey taking measurements at 50-foot intervals and at each end of the ship. If any hull potential readings about the ship fall outside the 0.8 to 1.2-volt range from the highest hull potential to the lowest, make adjustments as required to restore proper potential limits.

(2.) Check the current to each anode using a DC clamp-on ammeter to ensure anode performance. Do not disturb anodes unless some problem exists as shown by abnormal current readings (paragraph 050-5.8.2).

(3.) Check reference cells against shop standard cell.

(4.) Check the potentiometer-voltmeter against a standard Weston cell or a battery with a known voltage. If zero adjustments do not correct inaccurate meter readings, the unit should be repaired or replaced.

(5.) Annually.

a. Check power supply ammeters and voltmeters against a suitable calibrated meter.

b. Remove dust and debris from power supply enclosures; note general condition.

c. (Automatic hull potential control only.) Check reference electrode on the unit against a standard cell. Replace electrode if an error greater than 0.05 volt exists compared to the standard silver-silver chloride reference cell.

d. Clean all exposed terminal connections, ship bonds, rectifier connections, ground return connections by sandpapering.

c. Every 5 years. (Automatic hull potential control only.) Replace reference electrode.

050-5.8.4 Aluminum Hull Cathodic Protection. The preceding cathodic protection criteria shall be used, where applicable, for aluminum hulls except as follows.

050-5.8.5 Berthing. Aluminum-hulled ships shall not be moored in the same nest with steel-hulled ships, nor shall a steel-hulled ship be moored in a nest of aluminum-hulled ships. Aluminum-hulled ships shall be moored only with nonmetallic lines to ensure that the hull is electrically isolated from the pier and other ships. Aluminum hulled ships shall not be moored by a cathodically protected seawall.

050-5.8.6 Preparation For Storage. Many aluminum-hulled craft are equipped with small zinc anodes installed in sea chest intakes. These anodes shall be inspected, and if less than 1/2-inch maximum thickness exists, they shall be replaced even if the sea chest is to be sealed following an air tightness test (2 psi air tightness test with a zero pressure drop in 1 hour). For sea chests located below the waterline and without anodes, a cap arrangement allowing space for installation of a ZEP-6 inch diameter, a ZHS-23, or ZSS type anode on the cover plate shall be provided to seal the sea chest. The anode attachment shall be in accordance with NAVSHIPS drawing 805-921865 except that aluminum studs, CRES lock nuts and CRES shake proof (star) type lock washers shall be used. On PG ships, overboard discharges located above the waterline shall be capped and subjected to 2 psi airtightness test criteria with a zero pressure drop in 1 hour.

050-5.8.7 Underwater Hull Cathodic Protection. C/P of the aluminum underwater hull areas will be different for fresh and brackish water or saltwater sites.

a. Saltwater sites. (Puget Sound, Pearl Harbor and Hampton Roads). At saltwater sites, zinc anodes mounted on short, large cross-section cables shall be used to protect the hull. Six anodes (three port and three starboard) shall be installed and evenly distributed about the ship. Anodes shall be installed as shown in Figure 050-5-13. The cables shall be installed to allow the anodes to be submerged approximately 6 feet. The required galvanic anode ground connection to the ship shall remain at the main deck in order to shorten the cable length and reduce the resistance in the line. The anode shall be kept out of the mud since electrical continuity to the carrying cable will be lost if the anode weight is removed from the cable.

b. Freshwater site. (Philadelphia). At freshwater sites, a magnesium anode system shall be used to provide protection.

CAUTION

Magnesium anodes sha11 not he used at saltwater sites, as serious hull corrosion can result.

Prior to installation of magnesium anodes, the hull shall be hydro-blasted or underwater brushed to remove all white calcareous deposits on the underwater hull, and particularly in areas near the installed anodes already located on the ship. Anodes type MOB-50 of MIL-A-21412 or equivalent commercial type shall be installed. This type anode shall be installed as shown in Figure 050-5-14. For hydrofoils and PG aluminum hulls, the ship shall be fitted with one anode at each end of the ship. The anode shall be kept out of the mud since electrical continuity to the carrying cable will be lost if the anode weight is removed from the cable.

050-5.8.8 Maintenance. Measurement of hull potentials of aluminum-hulled ships shall be made monthly. Readings shall not be taken within 15 feet of an anode. The acceptable hull potential range for an aluminum hull is -0.92 to -1.1 volts to a reference cell. If hull potentials cannot be maintained in the required range, the following corrective action shall be taken. If the hull potential is in the -0.75 to -0.92 volt range, additional anodes (up to double the recommended quantity) shall be installed until the entire hull is within range. If the hull potential is in the -1.1 to -1.25 volt range, readings shall be taken within 15 minutes subsequent to all anodes being pulled from the water. If the hull potential is in acceptable range with the anodes out of the water, (current off readings), the system should be used as is. If the current off reading still indicates potentials in the 1.1 to -1.25 volt range, anodes (up to one-half of the recommended quantity) shall be pulled from the water and left on the main deck. If the system is out of the acceptable range and cannot be corrected as indicated, NAVSEA 03M1 should be notified for further guidance.

050-5.8.9 Inspection. Annual inspection of the anodes and all electrical connections shall be made. Connections shall be inspected or otherwise tested to ensure low resistance connections (that is, less than 0.01 ohms). White calcareous deposits on underwater components do not indicate deterioration and need not be removed. The underwater aluminum connector shall be inspected for corrosion underneath the white calcareous deposits. If the pitting is greater than 1/8 inch, replace the connector.

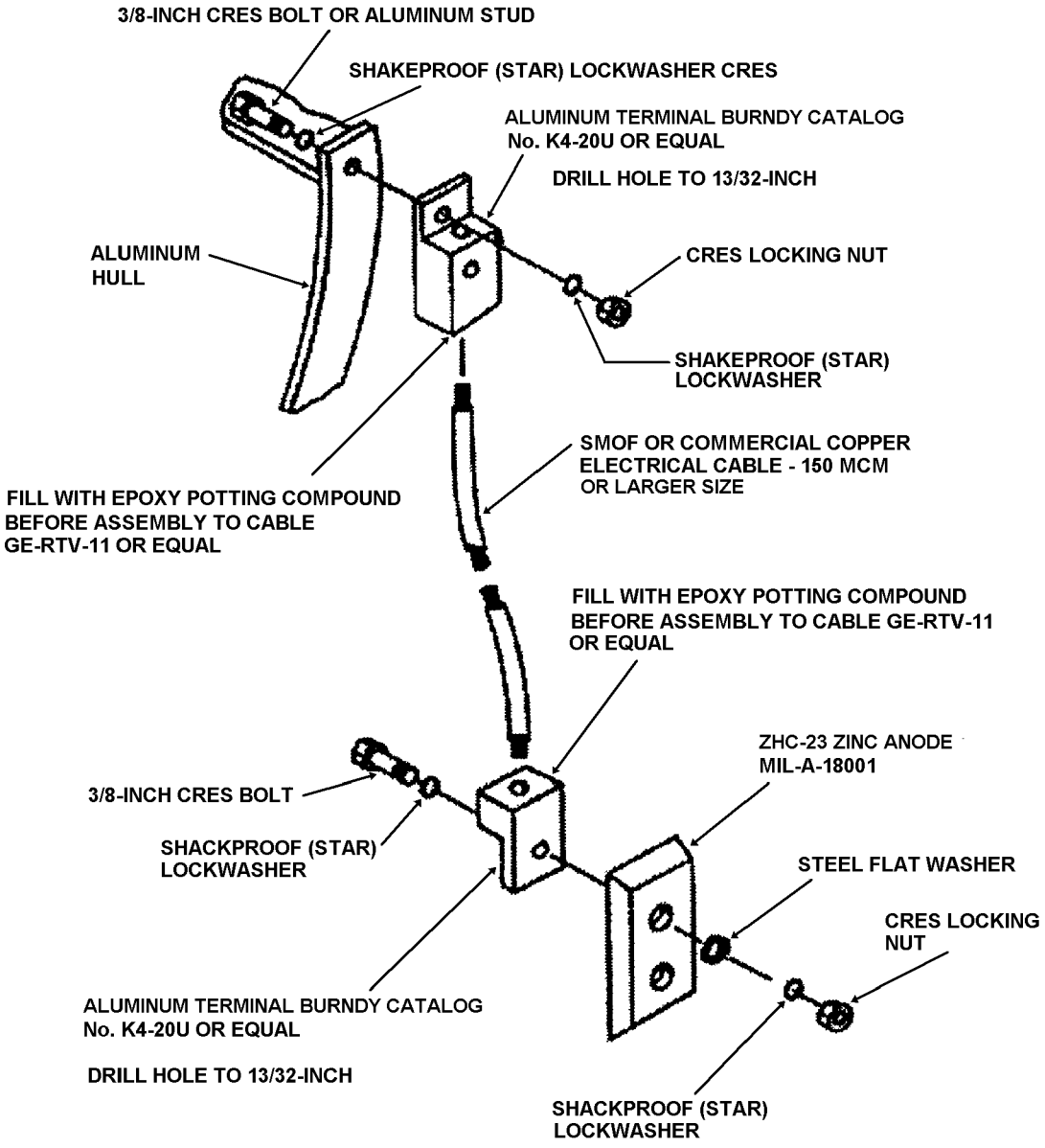


Figure 050-5-13. Anode Suspension, Aluminum Hull, Salt Water

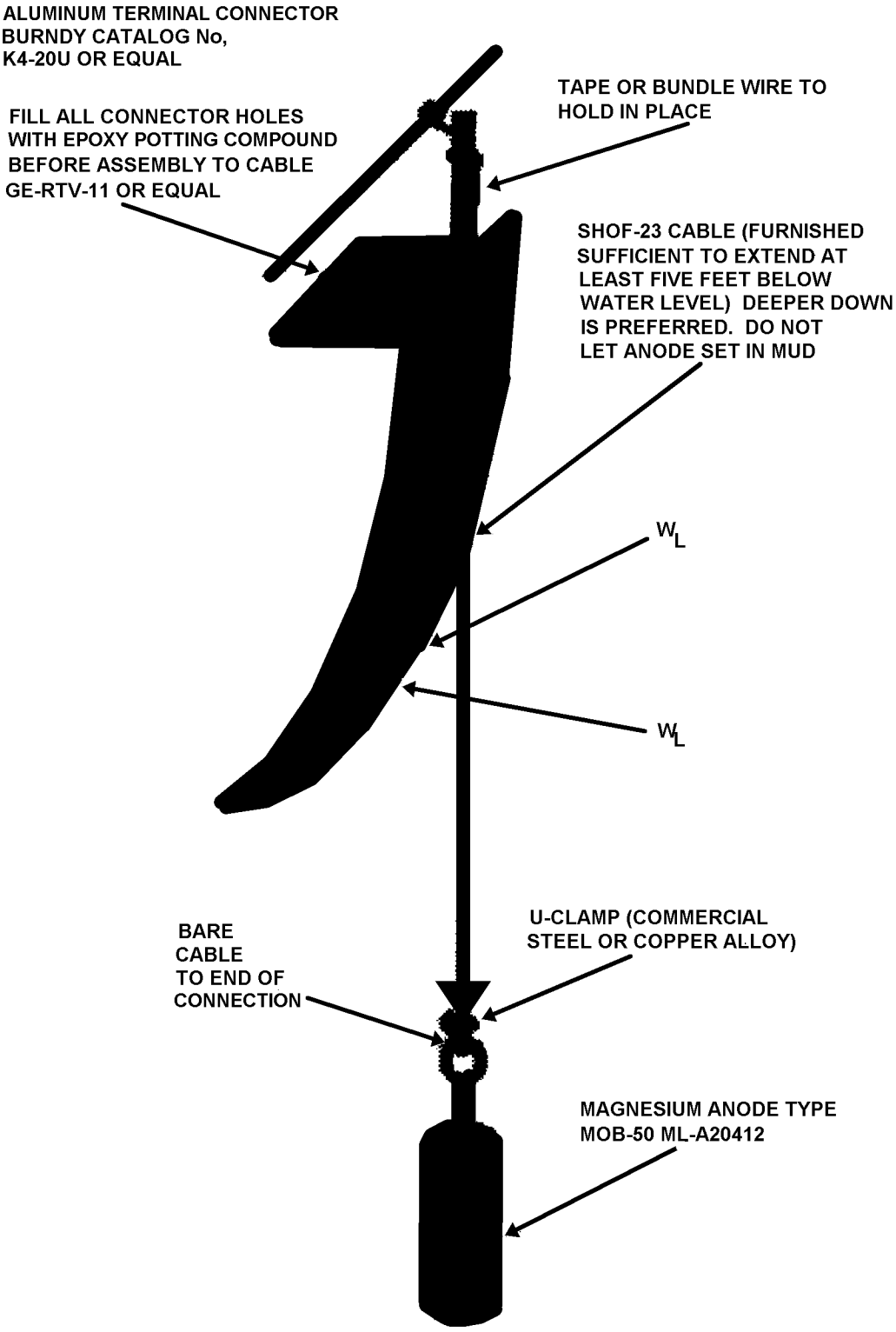


Figure 050-5-14. Anode Suspension, Aluminum Hull, Fresh Water

SECTION 6
PRESERVATION BY DEHUMIDIFICATION

050-6.1 INTRODUCTION

050-6.1.1 Overview. The inactivation program over the years from Red Lead Fleet after World War I to Operation Zipper after World War II has shown that dehumidification (D/H), the process of reducing the amount of moisture in the air, is the single most important factor affecting the interior condition of inactive ships and is the best way to economically maintain the ship's interior in a condition of readiness for 20 years or more. The best grease and paint developed cannot effectively prevent corrosion, mildew, and mold in the ship's interior in the presence of moisture. By limiting the amount of moisture, the most serious forms of deterioration can be halted. In addition to prevention of deterioration, secondary advantages also accrue. Electrical windings and cables become dried out and show higher ground resistance; heavy coats of rust on structures dry out and become powdery or brittle so that they fall off or can easily be removed; rats, mice, and other vermin eventually die because of lack of water; and, since the ship is nearly airtight and remains closed up during the entire preservation period, the entry of dust and harmful industrial vapors is halted. With the development of the desiccant D/H machine, dehumidification (or the removal of moisture from air) became a practical means of preservation of materials in the interior of ships. D/H not only preserves materials and equipment installed in a ship, but spaces so treated may be used to store items dismounted from the top side of the ship as well.

050-6.1.2 Preservation By D/H. The preservation of ship's interior by D/H is based on the fact that the amount of moisture content and atmospheric condition directly affect corrosion of metal, the growth of mold and mildew, and general deterioration of equipment and material. From experience, if the interior of the ship is kept at 40 percent relative humidity (RH) (plus or minus 5 percent) at any ambient temperature, the equipment and material inside the ship are retained in good condition. Corrosion of ferrous metal is slowed, and growth of mold and mildew is prevented. Since some materials shrink or lose strength when under D/H, some precautions are necessary. Materials listed in paragraph 050-3.15.3.3 should be off-loaded.

050-6.1.2.1 Moisture Source in D/H ship. The effectiveness of D/H depends on maintaining low RH in the interior of the ship (not more than 45 percent at any ambient temperature), which means that extreme care must be taken to prevent moisture from entering the ship. Sources of moisture are: rain water, seawater, water vapor in the air, and moisture in material. Knowledge of the sources of the moisture to be removed is essential in D/H planning. In an initial D/H period, air moisture and material moisture content in the interior of the ship are in constant exchange with each temperature change. Diffusion takes place between material and air until a balance is reached. During the inactive period, some moisture enters the ship through the seams, faulty seals, and cracks by infiltration, breathing, and diffusion of outside air, or by water seepage. Infiltration is caused by wind (a positive pressure on the windward and a negative pressure on the leeward).

050-6.1.2.2 Breathing. Breathing is caused by temperature changes that increase (or decrease) the pressure of the air volume inside the ship. Accordingly, breathing will be greater in summer than in winter, due to a sharp day and night temperature gradient in summer.

050-6.1.2.3 Moisture Circulation in D/H ship. D/H air circulation is important to the removal of moisture in the D/H zone. The mixing of air in compartments by D/H air circulation equalizes the moisture content in the zone.

050-6.1.2.3.1 Air From The Dehumidifiers. Air from the dehumidifiers, with a very low moisture content level, is generally at a slightly higher temperature following contact with the surface of the desiccant container. These temperature differences and the pressure differences created by the dry air fan causes air circulation in the zone. The D/H air circulation is also influenced by outside air temperature and seawater temperature around the ship hull. In winter, outside ambient air temperature is generally lower than seawater in the north. The lighter and warmer air heated by water near the hull of the ship will rise as the heavier and colder air sinks to the bottom. This beneficial warming and cooling increases D/H air circulation in winter; but in summer the opposite temperature effect occurs, creating no benefit in D/H circulation.

050-6.1.2.3.2 Vapor Pressure Differential. Vapor Pressure Differential. Aside from air circulation, the vapor pressure differential of air between compartments also assists in equalizing the moisture content of air in the D/H zone. The water vapor in air with high RH (high vapor pressure) will migrate to the compartment with lower RH by diffusion. Experiments have shown the value of diffusion. Any compartment for which it is inconvenient or impractical to arrange for dry air circulation may be allowed to dry by diffusion to an adjacent dry compartment through an opening as small as a manhole. The understanding of vapor diffusion enables some flexibility in determining the number and location of D/H air outlets.

050-6.2 CONSIDERATIONS IN DESIGN OF D/H SYSTEM

050-6.2.1 General. D/H is applied to inactive Navy Vessels where preservation of the interior is necessary based on the disposition of the vessel. D/H is to be installed on mobilization assets, foreign military sale candidates and those logistics support assets that are retained for at least three years. D/H will be maintained on vessels that are redesignated from mobilization assets to donation candidates.

050-6.2.2 Economy. As the budget for inactivation and maintenance of the ship is limited, maximum cost effectiveness must be emphasized in the inactivation of the vessel. The number of D/H machines to be installed should be determined based on D/H machine capacity and vessel size. Design of the topside D/H enclosures should be made simple, easy to install and remove, and be reusable. The air bleed points in steam propulsion plants under D/H should be adapted for D/H air distribution. The dehumidifier should be located conveniently for repair and maintenance.

050-6.2.3 Flood Prevention Safety. A primary safety factor in distribution of the D/H air is to maintain the watertight integrity level to the maximum extent possible. The D/H distribution system and the path of return air shall be designed in such a manner as to preclude progressive flooding. The watertight integrity level is generally established as four feet above the berthing waterline of an inactive ship. In some ships, where the four-foot rule cannot be applied, the berthing draft plus the changed draft due to flooding of the largest section determines the watertight integrity level. A D/H design that violates the watertight integrity level is not to be installed even with a flood alarm system.

050-6.2.4 Fire Safety. Sealing material, electric wiring and equipment, and enclosure material must be selected not only for their function but must also be selected for their fire-safe properties. The low humidity condition, the existence of combustible materials, and the unmanned condition of the inactive ship all tend to increase the fire hazard.

050-6.3 ENTERING AND LEAVING DEHUMIDIFIED SPACES

050-6.3.1 Maintaining Humidity. In order to help maintain the desired humidity within the ship, dehumidified spaces should be treated similar to refrigerated spaces; that is, spaces may be open as necessary during the passage of personnel or material but they are to be closed immediately. Never allow doors and hatches opening into dehumidified spaces from the outside to stand open; it is mandatory that personnel close the space upon entry and exit. Accesses between zones that are to be closed are shown on the D/H diagram and are to be clearly labeled DEHUMIDIFICATION BOUNDARY KEEP CLOSED. Hold open or ajar all others (except where required to be closed for security purposes) to permit proper air circulation.

050-6.3.2 Voids, Tanks, and Similar Spaces. Voids, tanks, and similar spaces that have been sealed closed for some time may contain dangerous gases or be deficient in oxygen and should be entered only in accordance with instructions contained in NSTM S9086-CH-STM-030 Chapter 074, VOLUME 3-GAS FREE ENGINEERING.

050-6.4 D/H METHODS

050-6.4.1 Methodology. There are several ways of removing water vapor from the air. The methods in use aboard inactive ships involve the use of a dry desiccant that absorbs moisture from air. To be continuously effective, D/H must involve the alternate processes of exposing the desiccant to moist air until the desiccant has become saturated, and then removing moisture from it so that the desiccant can be reused. When these two processes are performed automatically by D/H equipment, the procedure is called dynamic dehumidification. When the desiccant container has to be removed manually from the dehumidified space to another location for reactivation, the procedure is called static dehumidification.

050-6.4.2 Initial Drying Period. In addition to moisture vapor in the air, some surfaces and materials in a space expel moisture as the relative humidity of air decreases and as temperature of the surface increases. When D/H of the space is first started, the water vapor in the air is rapidly reduced. After this initial drop, further reduction in RH will tend to be lower as the ambient water vapor removed by D/H equipment is replaced by water vapor given off by surfaces and materials within the area. This process will continue until the prescribed percent RH is reached in the space and surfaces and materials within the space are in equilibrium with the new RH. Some materials will take longer to reach equilibrium than others, but the greater part of the water vapor will have been removed in from 3 weeks to 3 months. This period is called the initial drying period.

050-6.4.3 D/H Equipment. The heart of a dynamic D/H system is the D/H machine, also called a dehumidifier. During successive phases of the operation of the D/H machine, a charge of desiccant absorbs water from the air passed through it; this is flushed with heated outside air to drive off the water. During the drying phase, the air is taken from and returned to the space being dried; during the recharge cycle, air is taken from and returned to the outside atmosphere. In addition to the desiccant container, a D/H machine is comprised of an electric heater for recharge, fans, valves, ducts that carry the air, and a control arrangement that automatically starts and stops the machine and protects against casualties. A D/H machine can be set to operate continuously or to operate at the command of external time or humidity actuated controls. For inactive Navy ships, commercial D/H machines are procured with the approval of INACTSHIPOFF.

050-6.4.4 Distribution of Dry Air. As a general principle, dry air is delivered to the areas most remote from the D/H machine. With proper arrangement of open doors, hatches, and other openings, the air then flows back to the D/H machine on a predetermined path through the various ship spaces.

050-6.4.4.1 General. Dry air is distributed from the D/H machine to the dehumidified spaces through flexible hose installed with the D/H machines, fire mains, and other installed piping and passages. Ship's ventilation ducting should only be used where flexible hose is not feasible and then only where access holes are cut in the duct. Ship's ventilation duct must not be broken at the flange due to possible PCB containing gaskets. Flexible hose is also used to deliver dry air to the top of superstructure spaces and topside weapons systems. A length of hose is necessary in topside packages only if the inlet and outlet air connections to the packages are not sufficiently separated to permit proper diffusion of air within the enclosure. Each compartment need not be in the path of a direct flow of dry air. Diffusion of dry air into adjacent areas will take place even in the absence of a positive flow of air and will be adequate for proper D/H if the compartment is separated from a compartment having a dry air supply or a compartment in the path of the return air, by not more than two bulkheads, each having an opening equal to or larger than a manhole. Diffusion of dry air from the ship into topside packages will not be adequate for D/H and booster blowers must be installed to ensure positive circulation.

050-6.4.4.2 Piping. D/H piping serving the main steam propulsion plant shall be designed to supply dry air to both zone spaces and boilers within the zone. Connect a minimum dry air supply of 250 cfm into the water drum, water wall, and screen headers of the boiler or into the main steam piping.

050-6.4.5 D/H Drawings. Ship D/H drawings are developed by Inactive Fleet personnel utilizing the design and installation experience of prior ship classes.

050-6.4.5.1 D/H Zone. Large ships may be divided into more than one D/H zone, each served by a single D/H machine. All zones normally will be shown on the same standard D/H drawing. These drawings also include other information such as the size and location of the D/H machine, the location of sensing stations, the location of access to the zone, power requirements, approximate volume dehumidified, a schedule of D/H hose required, and other relevant information.

050-6.4.5.2 General. The following general notes are to be incorporated in the D/H drawings for standardization:

a. Prior to installation of equipment and arrangement of services as indicated on this drawing, prepare the ship in accordance with the ship's inactivation plan. Prior to operation of D/H equipment, close the ship in accordance with paragraph 050-6.5.5.

b. Close all dampers, doors, hatches, valves, and other closures in piping systems not shown; open those shown unless otherwise indicated. Valves shown, but not used for control of dry airflow, are to be left eased off from wide-open position.

c. Valves in fire main and connected services used for control of dry air are to be tagged KEEP CLOSED, KEEP OPEN, or USE FOR CONTROL as required.

d. Where existing ship structure or services deviate from drawings, modify airflow to suit the intent of the drawing.

e. Tag all valves, fittings, and ventilation ductwork to be removed to facilitate proper replacement.

f. All gaskets required for reassembly of valves, fittings, and so forth, shall be supplied and attached to the item removed.

g. The symbol M appearing near valves, outlets of duct, hose, or pipe indicates a modulation point for the controlled distribution of D/H air. At the ends of duct or hose, modulation may be shown in Figure 050-6- 1. Small openings may be modulated by the use of tape alone. Where flanges and pipe are wedged apart, the

wedged opening shall be taped tight and modulation achieved by puncturing holes of the required size in the taped surface. Valves used for modulation are to be opened or closed to the extent required to secure satisfactory bleed-off.

h. Where airtight duct is indicated, commercial galvanized stovepipe, downspouts, or flexible duct may be used.

i. All D/H ducts exposed to the weather are to be of watertight construction.

j. All flexible hose shall be at least 4 inches in diameter.

k. Dehumidification volumes:

Zone 1 cu ft:

Zone 2 cu ft:

l. Shore service requirements:

Power #1 - Ship's service power and lighting kw

Power #2 - D/H system and miscellaneous power kw

m. Ship service power and lighting switchboard shall be energized through shore connection box. All circuit breakers on the switchboards shall be opened except those feeding power and lighting services in use. Refer to D/H Power and Lighting Type Drawing 56202-687666.

n. Where to cut openings in structure such as holes in bulkheads and decks for passage of air, provisions shall be made for readily closing such openings upon return of ship to active status; that is, plating of suitable dimensions, with arrangement for ready installation, properly identified and secured nearby.

o. D/H ductwork and hose should be hung from bulkheads or overhead with wire or plastic banding. No special hangers are required. Ductwork should be of the slip joint type, joints being sealed by the use of preservation sealing tape.

p. Holes provided in bulkheads or decks for proper circulation of air are to be 12-inches diameter (except as noted).

q. Holes cut into decks or bulkheads for routing duct or hose through an adjacent zone must be fitted with sheet metal patch plates made airtight by tack welding and use of liquid envelope or sealing compounds, or by preservation.

r. Areas requiring expanded metal guards on horizontal surfaces to eliminate personnel hazards:

1. Overall open manholes except where D/H hose is extended through openings.
2. Overall open hatches with vertical ladder below, except in trunks; tophatch only to receive guard in trunks.
3. Overall open scuttles except in hatches or where D/H hose is through opening.

s. Piping systems not carrying D/H air but open to D/H spaces and penetrating main watertight transverse bulkhead below the D/H watertight integrity level, shall be blanked

t. All atmospheric openings into the dehumidified area of the ship shall be blanked.

u. Dry air is distributed from the D/H machine to the desired spaces through flexible hose, fire mains and other installed piping and extended where necessary by flexible hose. With the doors and hatches open, the air will flow back to the D/H machine on a predetermined path through the various ship spaces. Diffusion of dry air into adjacent areas will take place if not separated by more than two bulkheads each having an opening equal to or larger than a manhole.

v. Control of the D/H machines is by humidistats located approximately where indicated on this drawing. Humidistats shall be wired in accordance with NAVSEA dwg 810-4542745, and are to be set to energize.

w. All fuel oil tanks are not to be opened to the D/H system unless certified as gas freed.

x. Provide ducts for reactivation air inlet and outlet with elbows down at the open ends. Ducts shall have a minimum of 5-degree downward slope from machine. Install 1/2-inch wire mesh screen recessed 5 inches from opening.

y. To prevent shifting, the installing activity shall secure the base of the D/H machine to the deck.

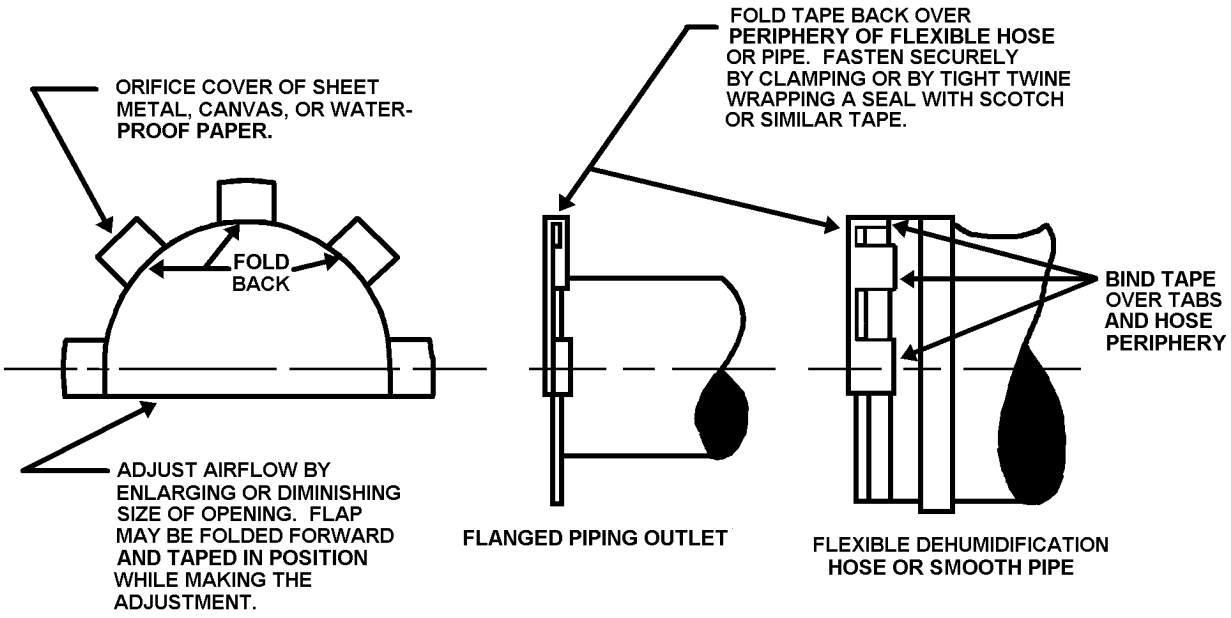


Figure 050-6-1. Throttling Device

050-6.5 INSTALLATION AND INITIAL ADJUSTMENT

050-6.5.1 General. To ensure watertight integrity and proper flow paths for dehumidified air, it is necessary to close certain accesses and cut holes in certain bulkheads. Special attention should be paid to dead-end spaces such as stacks and kingposts. It may be necessary to put a crossover between the inner and outer stacks to provide adequate air flow. These closed accesses and additional openings are shown on the D/H diagram. Otherwise, all accesses, manholes, and closures, (including openings to voids, cofferdams, and double bottoms) normally shall remain open. This general rule, however, must be applied with the full understanding of the security requirements of the ship, regarding instructions for preventing progressive flooding between main transverse bulkheads, and paragraph 050-3.5 for preservation of tanks and other spaces that must be closed for security or other reasons. Compartments that must be closed to safeguard pilferable equipment and are not planned for in the D/H drawing, shall be provided a screened diffusion opening as high as practical of at least 6 inches in diameter if a dry-air piping supply and exhaust are not otherwise available within the compartment.

050-6.5.1.1 Changes. Changes to the installation that are required in order to install D/H in the most practical and economical manner on a particular ship can be authorized by the local INACTSHIPMAINTO director, if such changes are within the intent of this chapter and do not jeopardize watertight integrity of the ship.

050-6.5.1.2 Installed Drawings. An as installed drawing of the D/H installation will be developed by INACTSHIPMAINTO and will also indicate facilities that must be restored upon reactivation as a result of the D/H installation. This drawing should be stowed in a convenient central stowage for ready accessibility by the INACTSHIPMAINTO having custody of the ship.

050-6.5.2 Watertight Integrity Level.

a. Value of equipment, if any, located in the adjacent compartments.

b. Volume of space as it would affect change in draft or stability and permit progressive flooding to other portions of the ship.

c. Number of sea connections, if any, in that area of the ship that could be a possible source of flooding.

050-6.5.2.1 General. The watertight integrity level generally is established as 4 feet above the berthing waterline of an inactive ship. This level will amply ensure against progressive flooding in most cases; however, on some ships the 4-foot rule cannot be applied. In other cases, individual determination of the watertight integrity level will be advantageous. The berthing draft plus the change in the ship's draft that would be caused by complete flooding of the watertight section that would cause the greatest change in draft determines the watertight integrity level.

050-6.5.2.2 Level of Watertight Integrity. For those few types of ships and craft in which complete flooding of a watertight section would cause the ship to sink, the watertight bulkheads for that section are to be maintained as high as practical, or to conform with watertight integrity level requirements of sections. Reliance must be placed on hull and sea connection inspections and repairs, and on early detection, should flooding occur. Any questions about the location of the watertight integrity level on a particular ship should be submitted to NAVSEA for resolution, giving current berthing draft fore and aft and pertinent information on possible D/H installation problems.

050-6.5.3 Location of D/H Machines. D/H machines shall be located in either the interior or exterior of the vessel in such a fashion as to permit ready access for maintenance. Provisions shall be made for sheltering the machine from the weather if necessary to be located externally. An inexpensive prefabricated sheet metal shed is excellent for this purpose.

050-6.5.4 D/H Machine Control. The sensing station locations will be marked and psychrometer readings taken at these locations when balancing of dry air within the zone is required. Control of the D/H machines (except during the initial drying period when the main steam plant is being dried) is by humidistat (four per zone or as indicated on the dehumidification drawing) located in the uppermost, forward most, and aftermost sensing stations; and for single-zone ships in the forward engine room. For multizone ships, the fourth humidistat shall be located at the lowermost station. Humidistats are to be connected in parallel with the D/H machines and are to be set to energize the machine between 35 and 45 percent RH. Zone humidity below the setting on the humidistats is not objectionable on steel-hulled ships. For humidity control and alarm light system wiring diagram, refer to NAVSEA dwg 810-4542745.

050-6.5.4.1 Elapsed-Time Indicator. An elapsed-time indicator is to be installed on each dehumidification machine. The indicator (in series with the humidistats) is to be located at a convenient exterior position near the dehumidification machine.

050-6.5.4.2 Trouble Light A trouble light shall be installed and wired to the terminal connections in dehumidification machine control panel. Refer to wiring diagram in dehumidification machine maintenance manual for location of terminals. This light shall be automatically activated upon machine failure.

050-6.5.4.3 Manual Control. During initial drying period of the ship, the dehumidification machine servicing the main steam propulsion plant shall be on manual control, bypassing the humidistat.

050-6.5.5 Closing the Ship. Achieving a certain minimum level of water and weather tightness is a prerequisite for the effective and efficient operation of the dehumidification system. It is necessary, therefore, to take the following actions before dehumidification is begun:

a. Blank all sea connections.

b. Dry all bilges and keep them dry.

c. Stop all underwater leaks.

d. Thoroughly drain and dry all steam and water piping, all machinery, boilers, condensers, and so forth. Check each system to ascertain that all pockets that may collect water, such as pump casing, valve bodies, and loops are provided with drain connections. Where drains are not so provided, it may be necessary to disconnect the pipe fittings to permit draining. All drains should be opened, including those on pumps and fittings. The systems should then be blown out with compressed air of sufficient pressure and velocity to clear the lines and machinery units of all entrapped water. As each drain connection ceases to show water in the air stream, it should be temporarily closed to provide greater pressure on the remaining portions of the system. The importance of getting ferrous piping systems absolutely dry cannot be overemphasized.

e. Close to outside atmosphere all exhaust pipes, ventilation openings, safety valve exhaust pipes, tank vents, drain pipes, and voice tubes, except vents and overflow lines for fuel, diesel, and JP5 tanks that contain oil, or are empty but have not been cleaned. Remove all scupper downcomers to allow piping that penetrates the hull to be sealed. Blanking off should be accomplished, where possible, with metal covers. Seal weld metal covers on smoke stacks and atmosphere exhaust pipes.

f. External openings for ventilation systems should be covered with sheet metal, tack welded, and sealed with RTV. Cargo hatches having wooden hatch boards should be covered with 16-gage sheet metal butted together. Drill holes 12 inches apart along seams, nail to boards with 2-inch monel boat nails (size 10), tack weld 1/2 inch every 6 inches along perimeter of sheet metal to the hatch coaming, then seal all seams as above. If metal hatch boards are installed, cover with sheet metal, tack weld, and seal as with wood boards, but without nailing. Flanged vent openings may be blanked with 16-gage sheet metal cut to fit inside the bolt holes. Set the blank in place on a bead of caulking compound and hold it in place with bolts and washers in the flange bolt holes. As an alternative, omit the caulking and tack weld the cover at intervals around the perimeter. The joint area is then cleaned and sealed as above. When no flange exists, seal weld the sheet metal, wire brush the welds, and apply one coat of aluminum heat resisting paint (NSN 8010 AMERON 023 TY (1 gallon)) to weld areas.

g. Inspect all airports, hatches, and doors opening to the weather. See that gaskets and knife edges are free from grease, dirt, and paint and are in good condition. Adjust dogs, if required, and ensure by chalk test, proper bearing of knife edges. If more than one access opening is provided, restrict normal access to only one opening and make sure that it is conspicuously marked by painting complete access yellow and dogged tight except when actually in use. Those doors and hatches that are not required for normal access shall be closed and marked SEALED-DO NOT OPEN. Doors and hatches which are to remain closed shall be secured and sealed Doors that are warped or constructed of light sheet metal with insufficient dogs for proper closure shall be sealed by filling all cracks, crevices, and voids with caulking compound (MIL-C-15705 or MIL-C-18969) or other approved material. Wiring of all dogs around doors and securing doors by padlocks, or other means, will prevent inadvertent opening. Treat similarly all other possible sources of air leakage (such as electric cable stuffing tubes, and voice tube covers). Where metal joiner doors are a boundary, seal as above, including locks. Seal riveted doorframes with caulking compound.

050-6.5.5.1 Dehumidification Zone. Each dehumidification zone within a ship shall be tested to ensure the D/H equipment operates less than 50 percent of the time to maintain the required R/H condition of paragraph 050-6.1.2. This procedure and the associated test criteria will apply to Navy Inactive Fleet assets in both INACT-SHIPMAINTO and Maritime Administration facilities.

050-6.5.5.2 Air Leaks. Pressure sensitive tape should not be used for correcting air leaks on weather opening.

050-6.5.5.3 Water Vapor. The foregoing procedure eliminates the excessive entry of water vapor by breathing. In similar rigorous fashion, the entrance of rainwater through cracks, seams, and nontight stuffing tubes or from the sea, through seams and leaky rivets must be absolutely eliminated. The quantity of water that can enter by even a very small leak can easily be greater than the capacity of the dehumidifier and, in any case, will seriously reduce its effectiveness. The preferable method of stopping underwater seam leaks in steel hulls is caulking, welding, or gunning with waterstop compound such as pine tar, shellac, or other suitable material. For underwater leaks through holes on steel hulls, NAVSEA approved repairs can be made using concrete conforming to ASTM A185 welded fabric. When applying the compound, use pressure to hold it in place until dry.

050-6.5.6 Starting and Adjusting Dehumidification Equipment. Dehumidification machines shall be checked for proper installation, electrical connection, and operation in accordance with their technical manuals.

050-6.5.6.1 Main Control Valve. A main control valve is shown on the diagram. For installation within the zone, an inexpensive sheet-metal valve similar to Figure 050-6-2 should be used. When located in the weather, either a gate valve or a sheet-metal valve, if properly painted for preservation and adequately sealed with a caulking compound to ensure air tightness, may be used. With this value, the total flow should be adjusted to the optimum indicated by the flow meter on the dual-bed-type dehumidification machine and then should be readjusted frequently, if necessary, during the subsequent balancing. The dehumidifier should never be allowed to run without ducts or other restrictions to prevent airflow exceeding the maximum indicated on the meter, as the desiccant will be damaged by too high air velocities. (Once the air distribution adjustments have been completed, the main valve will seldom need resetting and may be sealed against leakage with tape or caulking compound.) Rotary, desiccant, drum-type machines are not equipped with flow meters because machine design requires none.

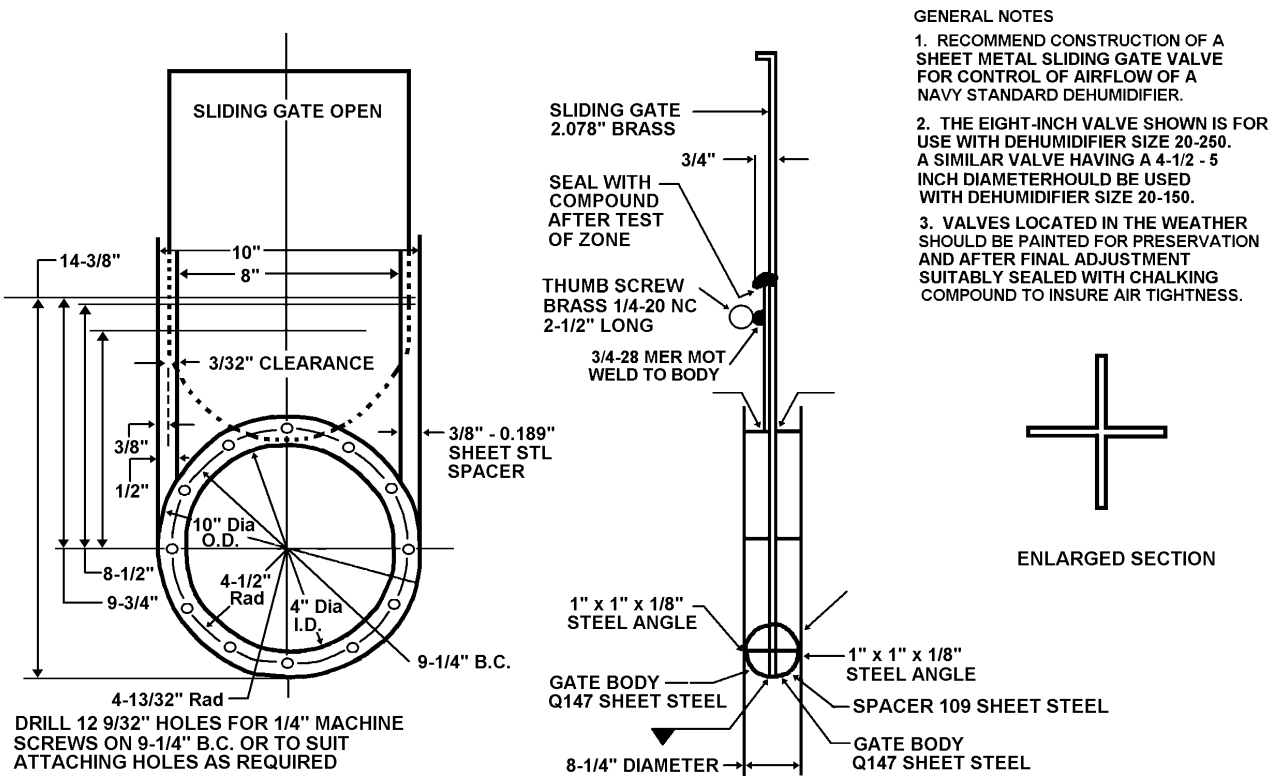


Figure 050-6-2. Eight-Inch Main Control Valve

050-6.5.6.2 Dry Air Outlet. The flow at each dry air outlet should then be adjusted. As a guide for this adjustment, a percentage figure is indicated on the dehumidification diagram at each outlet shown. This figure roughly approximates the percent of total zone volume served by the outlet and represents the approximate percent of the total air supply that should be delivered at that outlet. There is no practical way to measure the airflow at the outlets, so the first adjustment must be made with good judgment by comparing the feel of the airstream emitted at various outlets. Outlets are selected, as far as possible, so they can be controlled by a valve or another feature permanently installed in the piping system being used. If nothing suitable exists, a simple throttling device such as that shown on Figure 050-6-1, or any other equally inexpensive means, should be used. The cost of installing valves for this purpose is not justified.

050-6.5.6.3 Psychrometer Readings. During this initial balancing phase, psychrometer readings will be made at all sensing stations until zone air distribution is balanced. Within 2 days to 1 week, the humidity in the zone will start to drop with noticeable differences in various locations. The airflow from outlets should then be increased in the vicinity of the higher humidifies and decreased in the areas of lower humidity. After an interval of dehumidification with the new air distribution, this process should be repeated as many times as necessary. Within 3 weeks to 3 months, the humidity should be down to the prescribed level and should be within the allowed variation throughout the zone. During this period, inspections should be made as often as necessary to ensure rapid balancing and tightness of the zone. If the first adjustment is completed during cold weather, the distribution may be partly aided by convection currents, and the adjustment will probably have to be reset later during warm weather; thereafter, little or no adjustment should be necessary.

050-6.6 STEAM PROPULSION PLANT

050-6.6.1 Corrodible Components. During inactivation, preserve all corrodible components of the water, steam, and firesides of steam propulsion plants by dynamic D/H using NAVSEA dwg S3805-1507266 as a guide. No solvent cutback corrosion preventive shall be used on any part of the water, steam or firesides system. No change shall be made to current inactive ships unless a major represervation of the system is required.

050-6.6.2 Dehumidifier. Connect a dehumidifier over break line (paragraph 050-6.4.4) to supply dry air into the boiler or into the steam cycle in the vicinity of the boiler. On ships where the level of main steam and main feed piping at any point is not above the watertight integrity level, a manifold system located above the watertight integrity level, a manifold system located above the watertight integrity level has to be used to supply the dry air separately to each fireroom and engine room. Dry air shall be distributed throughout all parts of the fireside, steam, and water cycle, including boilers, turbines, piping, pumps, interchangers, and accessories, except that no air circulation is required for noncorrodible components, and air shall not be circulated through the heating coils of fuel oil tanks. Air shall be exhausted into the firerooms and engine rooms after it has passed through the system and be returned to the dehumidifier via the space. Distribution of air throughout all parts is to be obtained to the maximum practical extent by adjustment of existing valves to throttle parts of the system and by opening existing valves to bleed air out of the system. Disconnection of the pipes and installation of blank flanges will be permitted only to maintain watertight integrity in transverse bulkheads and where adequate distribution and bleeding of air cannot be achieved, by the disconnection of fittings, lifting of valve bonnets, and by the use of existing valves. When such breaks are necessary, they shall be fined to the smaller portions of the system insofar as possible.

050-6.6.3 Installations. Actual installations are to be in accordance with the watertight integrity requirements of paragraph 050-6.5.2. These installations can be varied from those shown on the above mentioned drawings and the ship type D/H drawing to suit the actual conditions aboard specific ships, so long as these changes are within the original intent of the planned installation.

050-6.6.4 Installing Activity. The installing activity shall obtain a blueprint copy of the steam piping drawings, on which they should indicate all adjustments and modifications made to the steam system. The marked up blueprint is then to be retained by the INACTSHIPMAINTO as a record drawing and guide for restoring the steam system upon reactivation.

050-6.6.5 Humidity. Because of the relatively small volume of the interior of the steam system, the humidity of the air, at any point in the interior of the system while air is being blown through, reflects the humidity condition of the inlet air rather than the quantity of moisture on the interior surfaces. Therefore, it would be impractical to have a humidistat control the operating time of the machine and only manual control will be necessary. However, it is considered that the following drying sequence will ensure that all parts of the system have been adequately dried and will so remain:

a. For initial drying, operate the dehumidifier continuously for a period of at least three months.

b. After this initial drying, the dry air branch can be shut down.

c. After shipyard overhaul or at such other time when water has been applied to the interior of the steam system (hydrostatic tests), repeat the above sequence. If there is any reason to believe that moisture could have reentered the steam system when the interior of the ship was exposed to periods of high humidity, open the dry air branch for a period of 1 month.

050-6.7 TOPSIDE D/H PACKAGES

050-6.7.1 General. Equipment subject to deterioration that is installed on the weather decks and cannot be effectively preserved by use of paint and other protective coatings is to be protected with a metal package or removed and stored aboard ship under D/H.

050-6.7.1.1 Topside Packages. Topside Packages. In all topside packages, seal and seam between flanges of upper panel lower coaming as follows:

a. Apply sealing compound to flanges that have been cleaned and primed. Apply compound by brushing, knifing, or other means.

b. If irregularities of flange surfaces cause large gaps between the top and bottom flanges, fill the gaps by application of sealing compound that, if necessary, can be held in place by a temporary dam until the material has set. After installation, properly prepare the exterior surface of the packages and paint metal packages with two coats of aluminum paint.

050-6.7.1.2 Package Construction. Construct packages and hatch covers with internal bracing adequate to prevent collapse during air tests.

050-6.7.1.3 Humidistat. Mount the humidistat so that it is visible from the exterior of the packages.

050-6.7.2 D/H of Topside Packages. Provide dynamic dehumidification for all packages. The air inlet and outlet should be separated as far as practical within each package to ensure effective diffusion of dry air within the package. No other special arrangement of the dry air inlet and humid air outlet is required. Changes in weather temperature cause changes in the humidity percent of a dehumidified space. The smaller the amount of surface and absorbent material in a space, the greater the rate and magnitude of the humidity change for a corresponding temperature change. The humidity percent within packages will, therefore, change more rapidly and to a greater extent than the humidity percent within the dehumidified ship. Such fluctuations of humidity are not considered harmful unless condensation forms inside the package when low temperatures occur. If condensation is detected, the operating limits of the package humidistat should be lower to eliminate this condition.

050-6.7.2.1 Package Fans. It is also suggested, where feasible, that package fans be installed in the supply or exhaust line outside the package in an airtight enclosure to facilitate servicing. A simple system with few topside packages may be arranged in a single loop with the package dehumidifier connected in series in the air circuit without the use of package fans. Existing systems having fans installed in series with the dehumidifier should be revised as shown on Figure 050-6-3 if difficulty in maintaining dehumidification is experienced.

050-6.7.2.2 Foundation. A single, Inexpensive foundation constructed of angle irons, with the dehumidifier held in place by the angles rather than secured, will keep the dehumidifier out of water pools, permit the recycle ports to be extended downward and separated for protection from the weather and prevent recirculation. This type of installation will also facilitate maintenance and preservation of the deck. Connect piping to the dehumidifier with flexible couplings. This prevents a strain being placed on the dehumidifier as a result of thermal expansion and permits easy removal of the dehumidifier for replacement or servicing. The arrangement and installation of topside dehumidification should satisfy the following considerations:

a. The connecting piping must be serviceable and watertight. Use of flexible tubing is recommended due to its ease of installation.

b. There will be an outward pressure downstream and inward pressure upstream from each fan and dehumidifier. The packaged dehumidifier develops about 1/8-inch WG pressure difference at 20 cfm. The fans develop about 5/8-inch WG pressure difference at 20 cfm. Both develop less pressure at greater flow and conversely greater pressure at less flow. Therefore, if the flow is restricted, the pressures will be higher and the leakage will be increased between the package system and the weather. This factor may be the principal reason for difficulty in maintaining preservation in many cases and should be carefully considered in the layout. If the piping is of smaller diameter, more fans should be used, or fewer packages should be included in a single system. If the breathing of packages causes difficulty in maintaining tightness, install a pressure relief, consisting of a T fitting in the absorption piping where it returns to the package unit, with a length of several diameters of pipe in the T, turned downward and open to the weather.

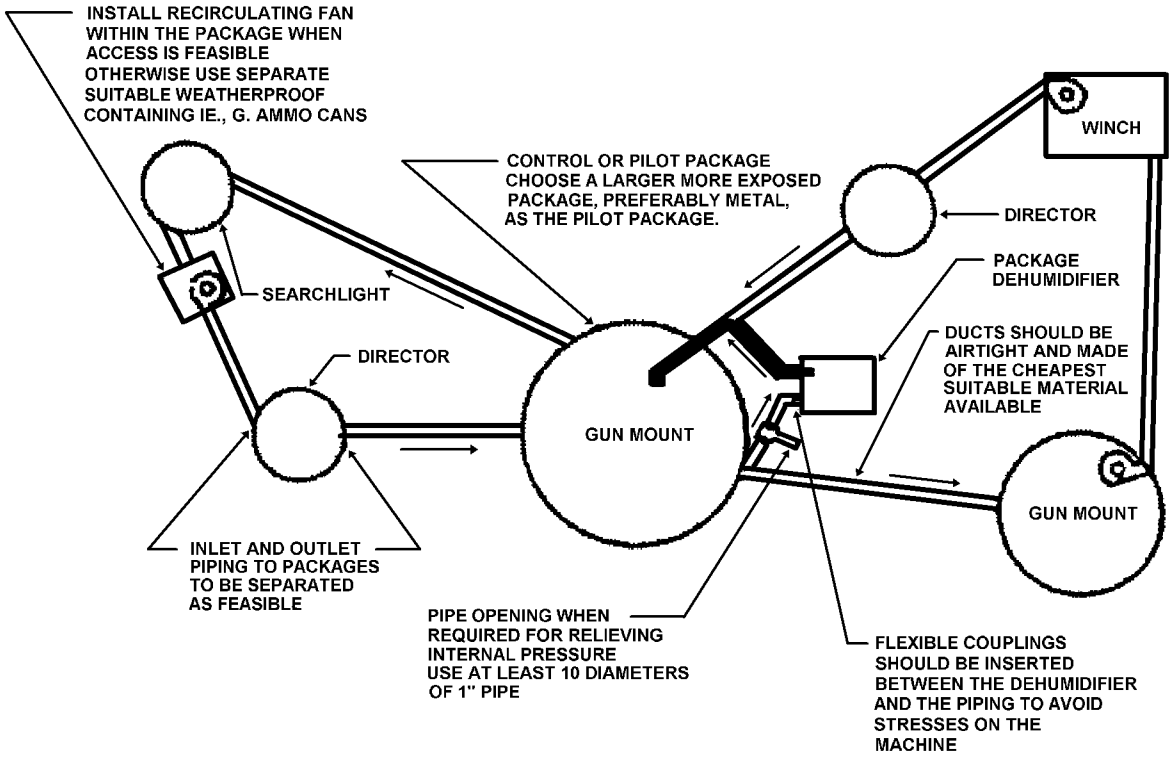


Figure 050-6-3. Topside Package Dehumidification

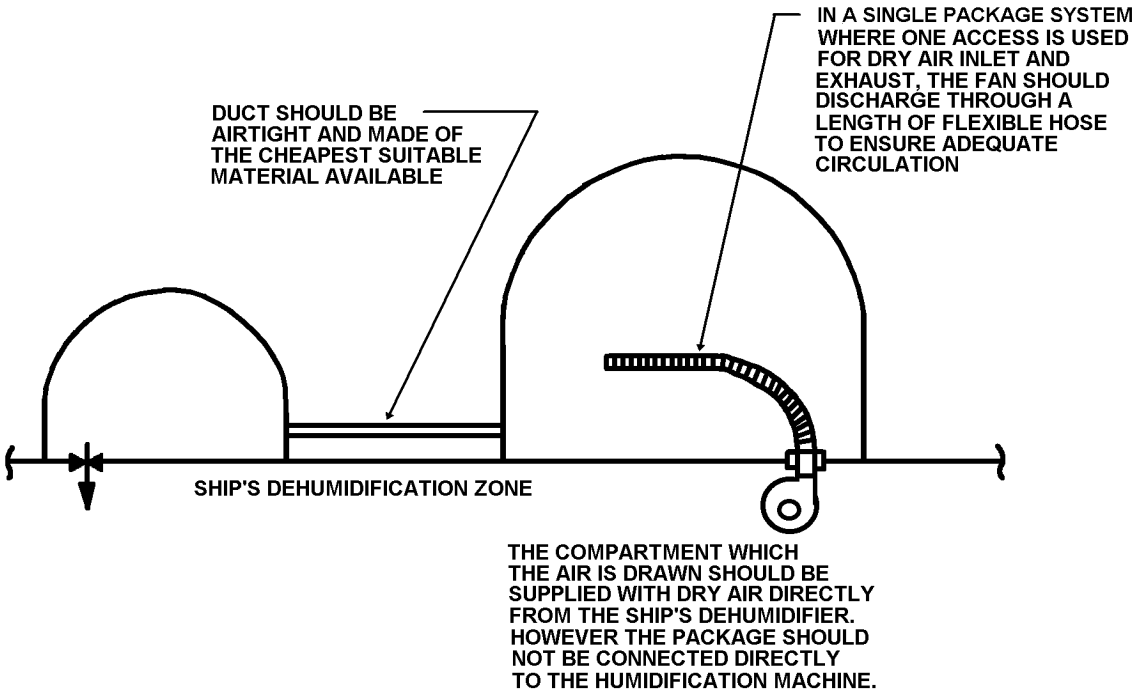


Figure 050-6-4. Ship Zone Dehumidification

050-6.7.2.3 Dry Air. Whenever practical, use dry air from the ship zone instead of a package dehumidifier for dehumidification of topside packages (Figure 050-6-4). Separate the supply and return openings of each system to prevent recirculation; preferably, they should be in different compartments of the same zone. Since the ship air is at approximately 40 percent humidity in contrast to the drier air from the package dehumidifier, a greater amount must be circulated to remove a given amount of water. Locate the package-circulating fan within the ship zone for maintenance accessibility and connect electrically for continuous operation. There is little choice between the systems considering the protection they afford. No attempt should be made to deliver air directly from the ship dehumidifier to installed packages, but a direct dry air supply to the ship compartment from which the air is recirculated to the package is recommended. In cases when the dehumidifier for the zone from which air is taken for the package system operates infrequently because of low zone load, it may become necessary to occasionally operate the dehumidifier manually or to lower the humidistat setting to ensure adequate dehumidification of the packages.

050-6.8 D/H INSPECTION AND MAINTENANCE STANDARDS

050-6.8.1 Inspections. After inactivation (or after any prolonged period not under dehumidification), dehumidification inspections are to be performed.

050-6.8.1.1 Scheduled Inspections. The inspections will be scheduled as follows:

NOTE

Dehumidification inspection frequencies are authorized only after security, watertight integrity, and weather tight integrity (including air testing and sealing) requirements for the ship have been met.

a. Immediately after the dehumidification system has been energized and checked for proper performance.

b. End of first week.

c. End of third week.

d. End of fifth week.

e. End of twelfth week.

NOTE

If humidity readings are found to be within the desired limits, inspection may be put on a quarterly basis at this time. If little or no improvement in humidity conditions has occurred, continue corrective action and conduct inspections very 2 weeks until desired conditions are achieved at which time inspections can revert to the quarterly schedule.

f. Quarterly thereafter.

050-6.8.1.2 Dehumidification Inspections. During routine dehumidification inspections, perform the following

a. Check topside packages quarterly for indication of water leakage, that is, excessively high humidity readings and other visible signs (such as water on the deck) as seen from the exterior.

b. Humidity readings shall be taken quarterly by use of a battery-powered psychrometer at each of the humidistat locations.

c. Note any evidence of leakage from topside and underwater sources as well as operation of booster blowers.

d. Accomplish preventive maintenance routines for dehumidification machines quarterly.

e. Change filters annually on those D/H machines that are located in the interior and weather decks of the vessel.

f. If throwaway type fiberglass filter elements are used, an authorized substitute that may prove more economical is a permanent filter frame that uses a replaceable polyester filter medium. The latter is supplied in bulk roll form. Cut a piece of the medium to the proper size and mount it in the frame. When the medium becomes loaded with dust, remove and discard it, and replace it with a new piece. Supplies for this type of filter are available from commercial sources that deal in heating and air-conditioning equipment. A satisfactory source is Weather-Rite Air Filter Systems, 312 Kennedy St., P.O. Box 14066 Raleigh, NC 27610.

050-6.8.2 Machine Operability Check. Machine operability checks are to be conducted on a monthly basis except that they should be combined with routine dehumidification inspections when the times for these two inspections coincide. Start idle machines manually to ensure they are operable. Readings of the elapsed time indicators shall be noted along with the date.

050-6.8.2.1 Scheduled Inspections. As soon as is practical, corrective action shall be scheduled along with other required work, in accordance with local practice. However, good judgment should be exercised in the opening of the ship for problems. For example, if the monthly machine check shows the machine operating somewhat above 50 percent run time, investigation may be scheduled to coincide with the more complete quarterly opening period, but if the machine is operating at 100 percent (after initial drying period) or is not operable at all, investigation should be scheduled at an early date.

050-6.8.2.2 Dehumidification Inspections. Policy relevant to shipboard procedures shall limit entry aboard ship to the greatest extent possible consistent with adequate security and maintenance. Only special category ships (e.g., those in a disposal or activation status) shall be exempt.

050-6.8.3 Maintenance Standards. Dehumidification machines and system maintenance work will be required to correct:

a. . Excessive machine operation. Normally greater than 50 percent machine run time is unsatisfactory. Dehumidification machine corrective action shall be at the discretion of the Director, INACTSHIPMAINTO.

b. High humidity readings (average zone readings of higher than 40 percent RH or individual readings higher than 45 percent RH for steel-hulled ships).

c. Unbalanced air zone distribution (high or low zone readings greater than plus or minus 5 percent RH of the zone average).

d. Malfunction of dehumidification machine, booster blowers, and ancillary equipment.

e. Visible signs of air or water leakage.

f. Leakage of topside packages.

g. Other similar deficiencies.

SECTION 7

SAFETY PRECAUTIONS

050-7.1 INTRODUCTION

050-7.1.1 General. Safety must be a constant concern. Safety consciousness is an acquired talent born of experience. With the constant influx of new personnel, it is a never-ending job to educate personnel in the hazards of the Navy work environment. Continuing emphasis on safety at all supervisory levels is required to develop safety consciousness throughout all commands. Safety requirements, found in OPNAVINST 5100.19 (Series) Navy Occupational Safety and Health (NAVOSH) Program Manual for Forces Afloat, OPNAVIST 5100.23 (Series) Navy Occupational Safety and Health (NAVOSH) Program Manual, and others referenced in this section, shall be adhered to.

050-7.2 SHIPBOARD SAFETY

050-7.2.1 Scope. Inactivation and reactivation of Naval ships entails extensive repair and modification in a wide variety of shipboard areas requiring thorough knowledge of and strict compliance with numerous safety precautions and regulations. In addition to the requirements set forth herein, safety precautions listed in referenced NSTM chapters are of particular importance and require strict adherence.

050-7.2.2 Responsibility. Many accidents result from disinterested or uninformed leaders. An effective training program will result in continuing command attention to safety. A command with officers and petty officers that are concerned and informed is normally a safe command. Commanding officers of ships undergoing inactivation and reactivation will publish necessary safety regulations and ensure all hands are indoctrinated in the provisions thereof and will ensure that appropriate safety precautions are posted and adhered to as required.

050-7.2.3 Corrective Action. Discovery of a safety deficiency or violation is only the first in a chain of events that should result in the elimination of that deficiency or violation. One of the common shortcomings in command safety programs is the lack of adequate procedures to ensure prompt action to correct deficiencies AT THE TIME THEY ARE DISCOVERED. To delay in taking remedial action, for even a short period, jeopardizes the safety of personnel and equipment, and makes material casualties probable. Officers will establish procedures that ensure prompt remedial action AT THE TIME DEFICIENCIES ARE DISCOVERED.

050-7.2.4 Safety Equipment. All personnel are required to wear appropriate protective and safety gear. Failure to use such items as life jackets and safety lines can result in injury or death. Consequently, Commanding Officers will procure safety equipment for issue as required and ensure that equipment is tested prior to use and is then used.

050-7.2.5 Flammable and Toxic Materials Safety. During inactivation and reactivation procedures, flammable and toxic materials, including oxygen displacing material such as refrigerant, are encountered to a greater extent than during routine operations. NSTM S9086-SP-STM-010 Chapter 542, GASOLINE AND JP-5 FUEL SYSTEMS, NSTM S9086-RQ-STM-010 Chapter 510, HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS FOR SURFACE SHIPS, NSTM S9086-SX-STM-010 Chapter 550, INDUSTRIAL GASES-GENERATING, HANDLING AND STORAGE, NSTM S9086-H7-STM-010 Chapter 262, LUBRICATING OILS, GREASES, SPECIALTY LUBRICANTS AND LUBRICATION, and NSTM S9086-RW-STM-010 Chapter 516, REFRIGERATION SYSTEM go into greater detail on the specific precautions that must be adhered to in addition to those general precautions contained in OPNAVINST 5100.19 (Series).

050-7.2.6 Entering Tanks and Voids. Due to the special circumstances surrounding inactivating, frequent inspections, and the readiness and care involving inactive ships and craft, particular attention must be given to ensure that all required measures are explicitly followed prior to permitting personnel to enter and work in tanks and voids. All Damage Control Fire and Flooding Investigation Teams must have a certified Gas Free Engineer. Ships undergoing inactivation must ensure that ship personnel are trained, equipped, and certified prior to commencement of the preservation measures in tanks, cofferdams, or voids.

050-7.2.6.1 Gas Free Certification. All unventilated spaces, for example, closed compartments, tanks, cofferdams, voids, and bilges, will be considered hazardous until certified as safe for entry after inspection by the Safety Officer and a qualified certified Gas Free Engineer. No space shall be entered unless there is at least 20 percent oxygen present.

050-7.2.6.2 Posting. SAFE FOR ENTRY signs or labels will be conspicuously posted at or near spaces certified. A Gas Free Certificate shall be posted. When the space is again closed all signs will be removed. The Gas Free Engineer will maintain a record of each space inspected showing the atmospheric composition determined by tests before ventilation and the means and lengths of time to establish a safe atmosphere. Periodic gas free tests shall be made as necessary; however, under no circumstances is the Gas Free Certificate valid for more than 4 hours.

050-7.2.6.3 References. Procedures for gas free testing and safe atmospheres will be used in accordance with NSTM S9086-CH-STM-030 Chapter 074, VOLUME 3, GAS FREE ENGINEERING and NSTM S9086-CH-STM-010 Chapter 074, VOLUME 1, WELDING AND ALLIED PROCESSES. Additional assistance can be obtained from the nearest naval shipyard.

050-7.2.7 Handling and Removal of Asbestos Materials. The unusual circumstances associated with inactivation, cannibalization, and retention of ships and craft may result in personnel exposure to hazardous friable asbestos fibers. Past naval shipbuilding programs have included extensive use of asbestos materials for shipboard installations such as thermal insulation and deck tile. Occasionally, shipboard stores and consumable supplies left on inactivated ships include asbestos materials. It is incumbent on all personnel to familiarize themselves with the hazards of asbestos materials and safety procedures as cited herein. Commanding Officers will ensure that all hands are indoctrinated in safe handling procedures for asbestos materials.

050-7.2.7.1 Requirements. Asbestos, in any form (cast, powder, pipe coveting, gasket, etc.) in storage in storerooms or ready service lockers must be removed prior to transfer of the ship to the Inactive Fleet. Contact Navy Environmental Health Center for disposition instructions. Once an asbestos contaminated area is cleared of all asbestos debris and the exposed asbestos insulation has been sealed, a Qualified Asbestos Competent Person shall certify the area safe for unrestricted personnel entry. Contractors engaged in operations that could involve exposure of personnel to friable asbestos materials shall be guided by the requirements set forth, herein. Additional costs relative to asbestos removal must be borne by requestors of stripped or cannibalized material. Activities accomplishing safe storage preparations, inactivation, or reactivation will fund asbestos-related costs. Acceptance of a ship prepared for safe storage will, in part, be predicated on complete removal and cleanup of asbestos debris resulting from stripping and safe-storage preparations and the sealing of all friable asbestos material.

050-7.2.7.2 References. Handling or removal of asbestos materials (installed insulation or consumable stores) shall be in strict compliance with the requirements of OPNAVINST 5100.23 (Series); NSTM S9086-VH-STM-010 Chapter 635, THERMAL, FIRE, AND ACOUSTIC INSULATION; and 29 CFR 1910.1001 Occupational Safety and Health Act (OSHA).

050-7.2.8 Handling and Removal of Polychlorinated Biphenyl, (PCB)

050-7.2.8.1 Electrical Cable with PCB. Electrical Cable with PCB. Cables presently installed in Navy ships need not be removed because of PCB's. When cables are removed, manage them for PCB's in accordance with the steps below.

050-7.2.8.1.1 Cables Manufactured After 1 Jan 84. Cables manufactured after January 1, 1984 are presumed free of PCB's. All low-smoke (per MILC-24643 or MIL-C-24640 and marked with the prefix 'LS' in the type designation) are free of PCB's. Such cables may be handled and disposed of without PCB controls.

050-7.2.8.1.2 Cables Manufactured Prior To 1 Jan 84. Cables manufactured prior to January 1, 1984 may contain PCB's. These cables should be handled as follows:

a. If there is no visible evidence of any oily or greasy residue on the cable, the cable may be handled and stored aboard ship without personal protective equipment or special packaging.

b. If there is visible evidence of an oily or greasy residue on the cable, wear viton, neoprene or butyl rubber gloves and, if necessary, a Type suit, to protect the hands and clothing from contact with PCB's when handling the cable.

NOTE

Latex surgeon's gloves provide NO protection from PCB's.

c. Store the cables and used gloves aboard ship in a plastic bag to prevent possible spread of PCB's.

050-7.2.8.2 Other Items Containing PCB. Reserved.

050-7.2.8.3 References. Please refer to the latest NAVSEA PCB ADVISORY

050-7.3 FACILITY SAFETY

050-7.3.1 Safety Programs. Each Naval Inactive Ship Maintenance Office (INACTSHIPMAINTO) safety program will comply with OPNAVINST 5100.23 (Series), OPNAVINST 5102.1 (Series) Mishap Investigation and Reporting, NAVSEAINST 5100.15 Navy Occupational Safety and Health (NAVOSH) Program, and each facility will undergo a safety inspection when scheduled.

050-7.3.2 Accident Reporting. Lessons learned from accident reports have proven extremely beneficial in educating personnel regarding unsafe practices and procedures. The Naval Safety Center has been established to screen and evaluate all accidents, near-accidents, injury, and death reports and to make recommendations to the Chief of Naval Operations concerning remedial action. Only by prompt submission of the required information can NAVSEA expect to realize the full value to be gained by careful analysis of accidents and incidents occurring in field activities. To this end, Commanding Officers and Directors of INACTSHIPMAINTO's will ensure prompt compliance with accident reporting procedures set forth in OPNAVINST 5102.1 (Series) and other pertinent directives.

050-7.3.3 Safety Developments. Commands frequently develop potentially dangerous evolutions, or procedures to enhance or promote con procedures will be provided to NAVSEA for evaluation and promulgation.

050-7.3.4 Publication. For those inactive ships under their cognizance, Directors of INACTSHIPMAINTO's will publish and post necessary safety regulations per the guidance of paragraph 050-7.3.1 and ensure that all personnel are indoctrinated in the provisions thereof, as required.

SECTION 8

FACILITY MANAGEMENT

050-8.1 GENERAL INFORMATION

Readiness for reactivation means the ability to remove a ship from inactive status as rapidly as possible with a minimum industrial assistance. Such readiness is a prerequisite, since the principal reason for inactivation and preservation is to provide a reserve of sea power ready to augment the active fleet in time of emergency. The following are readiness guides used in managing the inactive ship program:

050-8.1.1 Readiness.

a. Habitability spaces, berthing and messing, including equipment, should be maintained in the highest practicable state of readiness.

b. Ships equipment and systems are to be kept fully assembled and ready for use except where economical long term preservation requirements dictate disassembly.

c. The ship's COSAL allowance shall be maintained on board except for items that are classified as dangerous, perishable or that may deteriorate over a 3-year period. Also, items that have been designated for removal shall be off-loaded with the other items during inactivation and replaced only when activation is ordered.

d. Preservation materials and procedures are to be such that removal of preservatives and activation of equipment and systems can be rapidly accomplished.

050-8.1.2 Reactivation Work Package. To enhance the readiness of the vessel upon reactivation, a work package that fully addresses the reactivation items, repair items, and INSURV deficiencies is to be developed by Ship Program Manager's Office or its designee. This work package aids in measuring the readiness of the ship for mobilization.

050-8.1.3 Removal of Equipment. Cannibalization, or the removal of parts or equipment from a mobilization asset, a Foreign Military Sale, or a Lease candidate, to support the operating forces, is authorized only in well-defined cases. OPNAVINST 4770.5 (Series) shall be strictly follow proper records, report the status of ships affected, and ensure that replace order. Once a ship is stricken, removal of useful equipment is encouraged. Even so, stripping is done in accordance with a published schedule only, and under the direction of INACTSHIPOFF.

050-8.2 PREVENTION OF DETERIORATION

050-8.2.1 Overview. Preservation measures specified in this chapter were developed to ensure adequate and economical protection from deterioration over long periods of time without further preservation of the ship or the assignment of a skeleton crew for the purpose of maintenance. The procedures specified in this chapter are based on retaining the ship in water. This results in the need for flooding alarms, installing blank flanges over hull openings and sleeves around shaft bearings, impressed current cathodic protection systems, special mooring facilities, and periodic drydocking for corrosion protection. Corrosion and rot are the most serious forms of deterioration in inactive ships. However, both of these conditions require moisture. By controlling the amount of moisture available to support these reactions, they can be reduced or eliminated. This control is achieved in two ways:

a. Dehumidification equipment is used to control the humidity within the ships.

b. Coating systems exclude moisture from contacting metal surfaces.

050-8.2.2 Control of Deterioration. Deterioration can also be caused by dust, corrosive vapors and gases in the air, sunlight (ultraviolet radiation), fungi, and by galvanic effects. Deterioration from these causes is controlled to some extent by placing some equipment below decks, sealing the ship, encapsulating parts of the ship, filtering circulating air, selecting suitable mooring sites, and the use of impressed current cathodic protection systems. In addition, each retention ship and craft, including those berthed by the Department of Transportation, Maritime Administration, is to be entered into a five year (minimum) paint

050-8.2.3 Items Subject To Deterioration Over Time. A much more difficult type of deterioration to control occurs in certain materials solely as a result of time. This is termed shelf life, and usually depends on temperature and oxygen concentration. It is not affected by changing humidity or applying preservatives. Offload or remove items of this nature from their normal storage locations. Items that must remain on board must be tested or examined periodically and treated with special precautions during inactivation.

050-8.3 SHIP SECURITY AND SAFETY PRECAUTIONS

050-8.3.1 Overview. Even when inactive ships are berthed in sheltered areas, there is still a chance that damage to, or failure of, hull fittings below the waterline may cause flooding that, unless special precautions are taken, could progress through open systems or accesses and jeopardize the safety of the ship or otherwise cause damage to installed equipment. To help ensure against progressive flooding, a watertight integrity level for inactive ships shall be determined as outlined in paragraph 050-6.5.2.1. Below the watertight integrity level, integrity of the watertight transverse bulkheads separating major watertight divisions is to be maintained so that flooding of one major division will not spread to other areas of the ship. In addition, outboard blanking of all sea connections, and examination and preservation of the hull, shall be accomplished during inactivation (or subsequent drydocking for ships already in inactive status) in order to reduce chances of failure of hull or hull fittings.

050-8.3.2 Precautions. The possibility of flooding and fire is given the highest consideration throughout this chapter; therefore, adherence to developed inactivation procedures will reduce the chance of a serious occurrence. However, the continued maintenance of safe conditions is under the control of ship custodian, INACTSHIP-MAINTO. It is very important that maintenance and security personnel consider the following at all times:

a. Flooding accidents, fires, severe weather damage, and collisions have actually occurred to inactivated ships.
b. The seriousness of each occurrence when detected early allows easier control and is more cost effective.
c. The basic principles of inactivation and maintenance that reduce the probability of such occurrences.
d. The means available within the local area for early detection of flooding or fires (i.e., security inspections, draft marks, and fire and flooding alarms).
e. The actions necessary to cope with these occurrences. Conduct fire and flooding drills regularly to ensure that the proper actions will be taken in actual situations and to establish that emergency equipment is in working order.

050-8.3.3 Fire and Flooding Alarms. Fire and flooding alarm systems shall be installed on all inactive ships and craft maintained at the facility. As a minimum, these systems will provide:

a. An audible and visible alarm to be activated by fire and flooding sensor.
b. A fire and flooding alarm switchboard of local manufacture installed in a sheltered location external to the sealed portions of each ship. The switchboard shall have installed sensor cutout switches to permit identification of the sensor causing the alarm and its location.
c. Fire sensors shall be constructed of heat-sensitive cable set to activate at 150°F Fire sensors shall be installed at each dehumidification machine, at all energized switchboards, and at any other areas where significant fire hazards exist.
d. Flooding sensors are to be installed in the following areas:
    1. Each major watertight subdivision of the ship.
    2. Main propulsion machinery spaces and shaft alleys.
    3. Steering machinery spaces that are below the inactive waterline.
    4. Other areas where significant flooding could occur through the hull or hull fittings without activating other installed flooding sensors.
    5. Fire and flooding alarm systems should be simple. They should not require elaborate blueprints for a satisfactory installation. Light gage wire may be used to connect each sensing device to the topside alarm

panel. A drawing that has been developed for one type and class ship is NAVSEA dwg No. H-89219-LCC7-4012062799 Rev A. Modifications to this drawing are authorized to accommodate the individual configuration of each ship. The following are some modifications that may be required.

(a.) Number and location of fire and flooding sensors,

(b.) Cable lengths, and

(c.) Locations of alarms and power indicator, and the control panel.

6. The system shall have installed audible and visual alarms with a power, available indicator located to allow visual detection from a distance of about one mile. The control panel shall be marked, for easy identification, with the title Fire and Flooding Alarm Control Panel.
7. The following tests of the Fire and Flooding Alarm System shall be accomplished upon closing the ship and if the system was disturbed at any time during the boarding. Routine operational checks (consisting of tripping the float and monitoring alarms to ensure they activate) of the Fire and Flooding Alarm System satisfy the semi-annual testing. In any event the required semi-annual test shall not be canceled or delayed:

   (a.) Secure power to the fire and flooding alarm system,

   (b.) Open (turn off) all sensor isolation switches,

   (c.) Attach ohmmeter leads to the test terminals of the test switch,

   (d.) Close (turn on) the isolation switch of the sensor under test. The meter should read the value of the resistor across the float switch or the heat sensitive cable indicating the circuit is complete to the sensor. If meter does not indicate that value, inspect sensor and cable to determine the malfunction and take corrective action.

   (e.) Open (turn off) the isolation switch of the sensor just tested and repeat Step 4 for each sensor.

   (f.) Remove the ohmmeter leads from the test terminals, turn on power to system, and close (turn on) all sensor isolation switches. Close (turn on) test switch to check the alarm light and audible alarm. The power available light should be energized at all times, except during the above tests.
8. Flooding Sensor. A commercial fish net float may be used as a flooding sensor. The float is about 4-inches long, 2-3/8 inches in diameter, elliptically shaped, with an approximate 3/8-inch hole through its center axis (see Figure 050-8-1). A mercury bulb-type switch and 240K resistor are inserted into the hole of the float and secured in place with RTV sealing compound. The float sensor is then placed in the ship on the pin shown in the figure. Flooding sensors shall be tested by tipping float to ensure the alarm sounds. Testing is required semiannually for MOB B and annually for non-MOB B vessels.

050-8.4 TOWING

050.8.4.1 Preparations. When preparing an inactivated ship for tow, take all necessary safety precautions to prevent flooding or fire during the transit and to ensure safe delivery. These precautions include closing all watertight doors, hatches, tank and void covers, and bulkhead stop valves or other valves that would serve a similar function in preventing progressive flooding. In addition, place adequate and operable firefighting and dewatering equipment aboard the ship, and check sea-connection fittings and valves to ensure that they are tight and in good condition. The crew of the towing vessel will inspect the ship and determine other normal requirements for temporary power, supplies and flooding alarms for the purpose of ensuring safety during the tow. These alarms generally differ from those specified for moored inactive ships. See Figure 050-8-2 for a suggested alarm system for unmanned tows.

050-8.4.1.1 Ship To Remain Inactive. If the towed ship is to remain inactive at the final berthing area, reestablish normal preservation measures promptly to prevent undue deterioration. In addition to items listed above, all shaft and rudder locks should be checked to ensure that they are intact and in satisfactory condition to withstand

tow. Since inactive ships are frequently poorly lighted, poorly ventilated, have limited avenues of entry and exit, frequently have hatches left open for dehumidification purposes, and normal safety equipment may not be present, it is essential that Commanding Officers of ships being inactivated and INACTSHIPMAINTO ensure adequate safety precautions are promulgated and that safety practices are frequently reviewed during and after the inactivation process. The goal is to prevent personnel injury, loss of material, and damage to equipment.

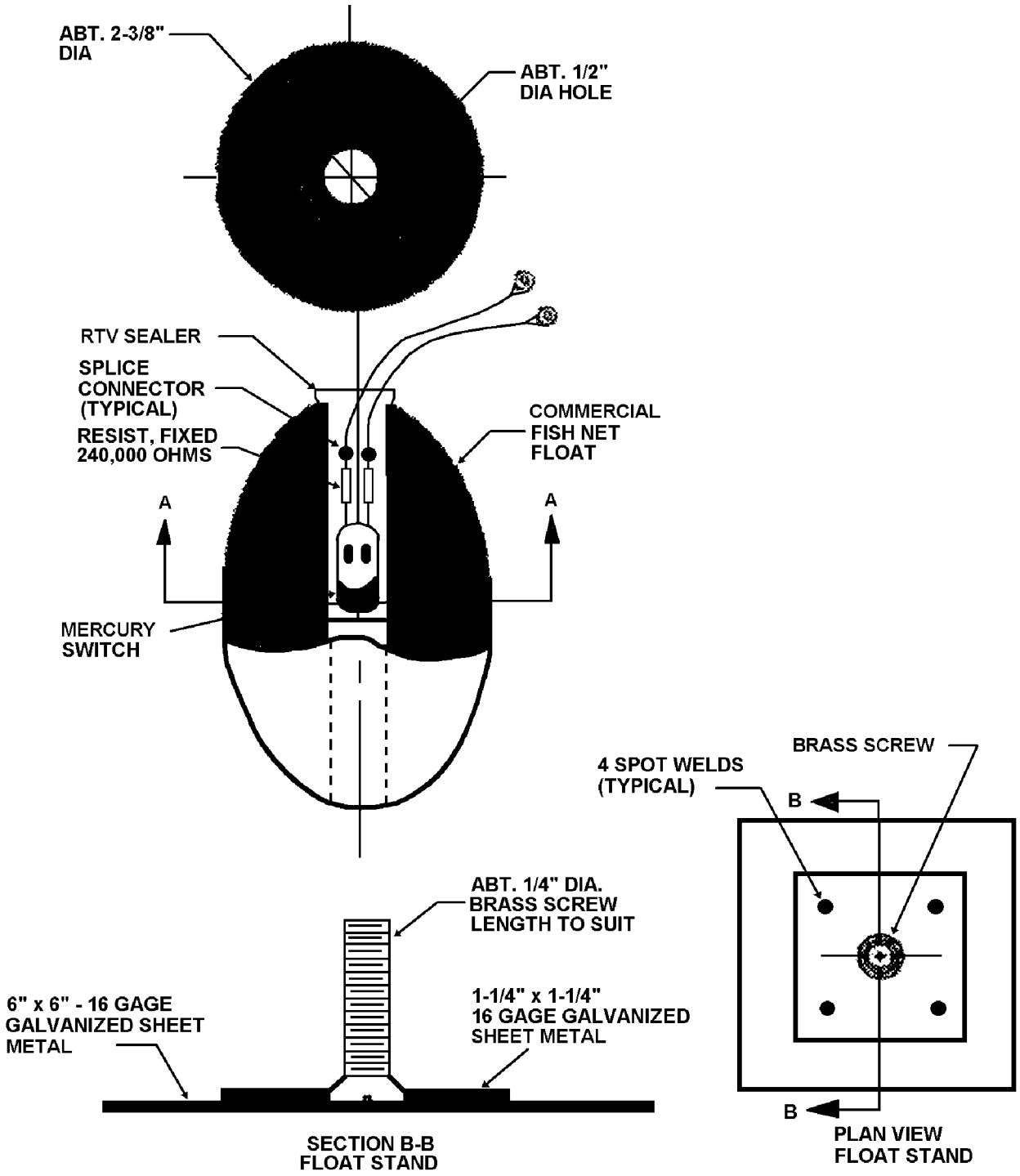


Figure 050-8-1. Automatic Flood Alarm Switch

050-8.5 STABILITY

050-8.5.1 List and Trim. Ships in inactive status will usually be in a light draft condition. Satisfactory stability in this load condition should receive attention, particularly if they are lighted in fuel. Stability will generally

be satisfactory in the berthed condition if GM is at least 1 foot after free surface correction has been applied. It may also be necessary to correct a list or trim condition. The ship should be on an even keel, except ships with no camber should be listed slightly to facilitate the drainage of water from weather decks. Trim down by the stern is advantageous for draining rainwater from weather decks, and trim need be reduced only as required to clear the bottom of the berth.

050-8.5.2 General Ballasting. Ballasting a ship to correct its list, trim, or stability is done by shifting liquid load. The required shift or addition of liquids may be calculated from information given in the inclining experiment data (form NAVSEA 263) or Chapter III-A, of the Damage Control Book, Stability, and Loading Data, for the ship concerned. If stability is positive, and list is a result of asymmetrical loading, the list may be corrected by shifting or adding liquids. Completely fill any tanks used for ballast, but if any are to be only partly filled, they should be the smallest available to reduce the area of liquid free surface, thus avoiding loss in metacentric height.

050-8.5.2.1 Negative Stability. The possibility of negative stability should be investigated by an examination of the inclining experiment or other stability data before beginning to pump liquids from bottom tanks. If Condition A (light ship) shows moderate GM and righting arm without liquids, then all bottom tanks may be pumped out completely. The effect on GM removing any water ballast that may be listed in NAVSEA 263 may be approximated by using the data on the form. NAVSEA 263 may also be used in estimating the weight of ballast to add in cases where Condition A stability is inadequate. If no applicable data are available, a check on stability may be made by occasionally sallying the ship as tanks are emptied. Larger tanks should be emptied first because their surface effects are greater.

050-8.5.2.2 Insufficient Data. If data are insufficient to determine stability conditions, inquiries should be addressed to NAVSEA.

050-8.5.3 Ballasting of Tankers, Oilers, and Support Ships. Prior to decommissioning and towing to the INACTSHIPMAINTO Facility, tankers, oilers, and support ships should be ballasted to achieve recommended navigational drafts as prescribed by the Tow Master. Tanks to be ballasted will be specified by Code 244 NSWCC, or other designated design agent. Clean freshwater is to be used as ballast in the appropriate cargo tanks, as described in paragraph 050-3.5.5.1 and protection against freezing provided if required. Ballasted tanks are normally to be approximately full with the minimum space (ullage) for expansion. Due to special local conditions, or for other reasons, the cognizant INACTSHIPMAINTO may decide that deviation from these instructions is desirable for a particular ship. In such a case, the INACTSHIPMAINTO will inform NAVSEA of the facts, make specific recommendations, and request permission to alter the standard ballasting scheme.

All hull penetrations below the waterline, and those likely to result in flooding casualties have been externally or internally blanked. Internal blanks have been fabricated from 1/2-inch thick steel plate and installed with a .060 solid rubber gasket having the same number of boltholes as the flange. (Cloth inserted rubber gaskets per HH-P-151 Class 1 cut from 1/8-inch thickness sheet, not bonded or seamed, is an authorized substitute gasket material.) The watertight integrity level generally is 4 feet above the lightship waterline.

Internal blanks have been painted yellow with a stenciled serial number painted on each blank. A list has been prepared and provided to INACTSHIPMAINTO containing the following information for all internally installed blanks: blank serial number, compartment number, frame number, port or starboard, and system blanked.

If external blanks were installed over underwater hull openings during the inactivation availability, a copy of either the blanking drawing, the docking report, or the ship's Docking Plan prepared perparagraph 050-3.3.5.1 has been provided to INACTSHIPMAINTO.

All stern tube packing and rudder packing glands have been tightened so that there is zero leakage. Packing has been added as necessary to maximize the amount of adjustment remaining on the packing gland take up studs (more than two inches of adjustment is not required).

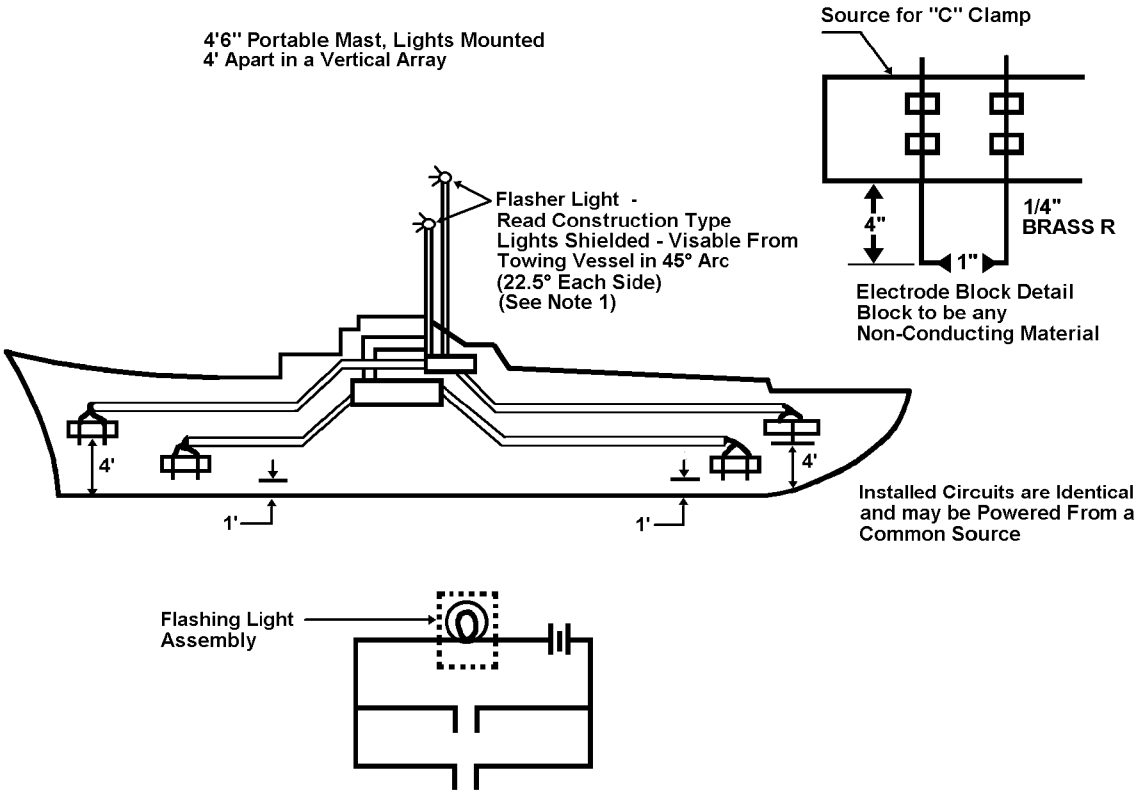


Figure 050-8-2. Unmanned Tow Alarm System

050-8.6 TESTS AND INSPECTIONS

050-8.6.1 General. Low cost maintenance is necessary to permit retention of inactive ships at economical cost. The preservation measures prescribed in this chapter represent the best-proved methods known. Additional studies and tests are being conducted to provide even better preservation methods, and revised instructions will be promulgated as available. These preservation measures permit a great reduction in required tests and inspections as compared to active ships. When specific procedures are not given, apply the necessary corrective measures and preservation as a matter of good judgment to meet local conditions. When common deficiencies or failures are noted, NAVSEA should be informed together with details and recommended corrective action. As far as practical, the required tests, inventories, inspections, and other work required aboard inactive ships is to be coordinated to permit reduction of excessive entry into ships.

050-8.6.2 Performance of Tests and Inspections. In general, except as discussed in paragraph 050-8.6.3, tests and inspections of installed equipment and systems are to be limited to spot checks of representative items conducted during informal inspections by INACTSHIPMAINTO personnel. These checks are for determining gen-

eral preservation conditions and trends, and, specifically, to determine the need to pursue more detailed tests and inspections. Preservation deficiencies found in one ship should be checked on others. All personnel should be alert whenever they are aboard inactive ships to evidence of lack of preservation effectiveness (such as is disclosed by active rust or mold) and, particularly, to evidence of water leakage from topside or underwater hull sources.

050-8.6.3 Material Inspections. Whenever there is a need to develop new information as to the condition of installed equipments and systems (such as may be necessary in conjunction with periodic formal material ship inspections required by Navy Regulations, preparation of activation or overhaul repair work lists, or for other similar reasons), the tests and inspections included in this section are applicable and are to be used. However, except when safety or security of the ship or personnel is involved, no tests of inactive systems or equipments are required solely on a time basis.

050-8.6.3.1 Jacking of Preserved Machinery. Operation of machinery, once it is protected by thin-film, rust preventive compound, tends to destroy the protective coating on journals, cylinder walls, and other wearing surfaces. For this reason, as well as for the reduction in labor, jacking of machinery so preserved is prohibited (paragraph 050-4.2.2.5).

050-8.6.3.2 Steam and Diesel Machinery. Routine, periodic operation of steam and diesel machinery as a test of preservation effectiveness is not included in these instructions. Operational tests to check repair results, routine inspections, spot-check inspections, and activations will suffice to evaluate preservation results.

050-8.6.3.3 Electrical Installation. Actual operation of electrical equipment and circuits affords the most positive method for determining the adequacy of any repairs and the correctness of reinstallation after repair. Periodic operational tests also provide an indication of the effectiveness of applied preservation measures. For such operational tests, electric power will, in most instances, be available through the ship's service switchboard. For testing DC circuits on AC ships, DC power can usually be supplied by conducting a concurrent operating test on an appropriate AC/DC motor generator. Power for testing AC circuits on DC ships can usually be supplied in a similar manner. When the use of an installed motor-generator is not feasible for supply, a temporary shore connection or portable generator may be used.

050-8.7 ELECTRICAL INSPECTION AND TEST

050-4.8.7.1 Overview. Besides information of a general and precautionary nature that applies to all electrical equipment, this subsection will be arranged as follows:

a. Generators.

b. Circuits and Insulation.

c. Motors and Electrical Equipment.

d. Post Repair Tests, Inspections and Records.

e. Reactivation.

050-8.7.1.1 General Information. Routine checks for the purpose of determining the condition of electrical circuits and equipment are to include insulation resistance readings for each complete circuit together with necessary inspections and additional measurements to determine the cause of any unsatisfactory values. A 500-volt

megger should be used for determining insulation resistance of electrical power, lighting, and degaussing circuits. Power and lighting circuits except those which are an integral part of, or directly connected to, equipment should be further checked by energizing them at rated voltage from their normal supply switchboard. Instructions for testing electronic, interior communication, fire control, and ordnance electrical equipment and circuits are contained in paragraphs 050-8.8.2 and 050-8.9.1.1 and NAVSEA OP 1208, respectively.

050-8.7.1.2 Precautionary Measures. Whenever circuits that are normally deenergized while the ship is inactive are to be energized incident to test and inspection, precautionary measures must be taken to safeguard personnel and equipment. Safety must be stressed for personnel having access to the ship during the period when such additional circuits are energized. There is an unavoidable tendency among personnel working primarily with normally deenergized equipment and circuits to relax normal safety standards. Switches, contactors, and pushbuttons that are for the immediate purpose of connecting equipment that might be damaged by inadvertent energization should be checked to ensure that they are in the open position and that suitable warning tags are in place. Circuits that are normally deenergized should be checked with a megger for shorts or grounds prior to being energized. Upon the completion of tests and inspections, all switches not required to be closed for normal lighting, supply to power outlets for use in emergencies, or for operation of dehumidification equipment should be left in the open position.

050-8.7.2 Testing Generators. The activation of steam or diesel-driven generators for routine tests is not desirable. Prior to starting electrical rotating equipment that has been inactivated, carefully check the equipment to ensure proper lubrication and freedom of movement. After starting, adequacy of lubrication and operating condition of the bearings, especially grease-packed bearings should be checked at frequent intervals. If excessive temperatures, vibration, or unusual noises are noted, secure the equipment and take corrective measures. Avoid additional greasing to correct such conditions until it has been definitely determined that additional grease is required. Previous experience indicates that in certain instances the grease remaining in the bearings aboard inactive ships has hardened with age, thus reducing its lubrication qualities. In such instances, bearings should be removed, cleaned, inspected for wear, replaced if necessary and repacked with new grease of the proper specification. Observe these precautions during routine operational tests, tests following repair and operational tests performed during activation.

050-8.7.3 Testing Circuits and Insulation. Circuits and insulation should be tested as follows:

050-8.7.3.1 Circuits. The following procedure is to be followed for test and inspection of all electrical power, lighting, and degaussing circuits except those which are an integral part of, or directly connected to, equipment:

a. Starting with those switches most remote from the switchboard, check position of each switch on each circuit. All switches in normal feeder circuits, except those for the immediate purpose of energizing equipment, should be closed after verifying with a megger that there are no faults or ground on the circuit.

b. If unsatisfactory insulation resistances are noted, inspect the circuit including all switches, terminals, connected fixtures, fittings, and wiring appliances and clean as necessary to ensure that the fault is not due to moisture (particularly on weather-exposed circuits), improper connections, accumulation of dirt, or foreign matter.

c. If after inspection and cleaning the circuit is still unsatisfactory, corrective measures as outlined in NSTM S9086-KC-STM-010 Chapter 300 ELECTRIC PLANT-GENERAL will be necessary.

d. Procedures explained in paragraph 050-8.7.1.1 should be followed for tests and inspections of all power, lighting, and degaussing circuits except those that are an integral part of, or directly connected to, equipment.

e. The adequacy of insulation resistance values should be determined by a comparison with previous readings as outlined in NSTM S9086-KC-STM-010 Chapter 300 ELECTRIC PLANT-GENERAL. Unacceptable values should be investigated and remedial action taken to correct or prevent further deterioration.

f. For those circuits found in satisfactory condition, record insulation resistance values on the appropriate Megger Test Record Card in accordance with NSTM S9086-KC-STM-010 Chapter 300 ELECTRIC PLANT-GENERAL. For those circuits on which corrective action was necessary, both unsatisfactory and final insulation resistance values should be indicated on the record card. Corrective action taken is to be entered on the appropriate Material History Card, and a Repair Record Card prepared for necessary repairs not yet made.

050-8.7.3.2 Insulation. The most feasible method for determining the general condition of insulation is by a comparison of the observed insulation resistance taken in accordance with NSTM S9086-KC-STM-010 Chapter 300 ELECTRIC PLANT-GENERAL, with previously measured values, supplemented by a thorough visual inspection.

050-8.7.3.2.1 Condition of Insulation. When determining the condition of insulation of a specific winding or circuit, particularly one that has been in service for an extended period or has been subjected to severe conditions, remember that a high value of insulation resistance does not necessarily indicate that the insulation is in perfect condition. Thus, if the insulation has become brittle or has developed cracks, or if a failure exists between phases or turns of a winding, these effects will not always be reflected in variations of insulation resistance to ground. Similarly, deterioration in the moisture-repellent qualities of the insulating varnish on windings (caused by oil or other foreign deposits) is not readily detected by insulation resistance measurements as long as the winding remains in a relatively dry atmosphere. The black insulating varnishes with asphalt bases are particularly susceptible to deterioration caused by contact with oil.

050-8.7.3.2.2 Visual Inspection Or History Record. If visual inspection or the history record of the equipment indicates the probability of such insulation weaknesses, would not be readily disclosed by insulation resistance measurements, consideration should be given to conducting more conclusive tests. Additional tests, such as high potential tests, should be conducted only by experienced personnel when the necessary time, funds, and facilities are available for the immediate repair of the equipment. Insulating materials deteriorate with age because of the individual or combined effects of heat, moisture, vibration, mechanical damage, dust, oxidation, and chemical action from acid or alkali fumes, salt, air, or oil. The foregoing effects are materially reduced in equipment that has been properly cleaned, inactivated, and maintained idle in a clean atmosphere with relatively low moisture content. For this reason it is imperative that the insulation of all essential electrical equipment be properly cleaned incident to inactivation. Visual inspections are to be sufficiently thorough to disclose the need for cleaning.

050-8.7.4 Testing Motors and Equipment. Motors and electrical equipment should be tested as follows:

050-8.7.4.1 Representative Testing of Motors In addition to the foregoing circuit checks, representative motors except those under dynamic dehumidification should be test-operated at least once each 30 months. Coordinate the schedule for these tests and inspections with other required work to reduce entry into the ship and to facilitate the preparation of comprehensive and up-to-date work lists for maintenance periods. Procedures used in performing these tests and inspections are to comply with precautionary measures outlined in paragraph 050-8.7.1.2, and should be in accordance with the detailed instructions in paragraphs 050-8.7.3.1 and 050-8.7.4.2, Motor Testing, Detailed Procedures. The number of motors to be tested, the number of tests to be performed, and the extent of testing procedures required to ensure that motors are in a satisfactory condition and that preservation measures are adequate must be determined by local judgment.

050-8.7.4.2 Representative Testing of Motors The number of motors to be tested, the number of tests to be performed, and the extent of testing procedures required to ensure that motors are in a satisfactory condition and that preservation measures are adequate must be determined by local judgment.

a. Motor Selection. For the operating tests, only representative motors on weather decks and spaces not under dehumidification need be tested. If more than one preservation method is used for electric motors on the same ship, at least one motor with each type of preservation is to be tested. When practical, at least one commutator type and one non-commutator type motor in each zone is to be tested. In general those motors considered to be in the poorest condition (as determined by examination of the records, visual inspection, or insulation resistance reading) should be tested first. Extensive activation of associated equipment solely for testing is not generally desired, and consideration is to be given to the ready availability of suitable test loads in selecting the motors to be tested. If practical, select different motors for each succeeding scheduled test period.

b. Test Preparation. After selection of the unit to be tested, remove as necessary the existing preservation measures applied to the motor and to all gear on which the motor is dependent for normal operation.

c. . Extent of Test. Operate each motor selected for a period of 1 hour under as near normal load conditions as practical. It may not be practical in all cases to choose a motor that can be readily loaded because of difficulties involved in providing a load or because of the extent of preservation measures applied to the motor or its associated gear. In such cases when the motor cannot be operated under load, it will be satisfactory to operate it at a rated speed without load as a substitute test procedure; one exception is the series-wound motor, which should never be operated unless connected to a load. The test should be the equivalent of the daily maintenance requirements specified in NSTM S9086-KC-STM-010 Chapter 300 ELECTRIC PLANT-GENERAL. This test will indicate whether additional tests are required. If a piece of equipment operates satisfactorily, no additional tests are required; however, if operation is unsatisfactory, determine the basic cause, take corrective measures within the capacity of INACTSHIPMAINTO personnel, and perform additional tests on other, similar equipment to determine whether the particular trouble is general or confined to an isolated case or cases.

d. Record Entries. After completion of the test, record results on the appropriate Material History Card for each unit tested. This information is to be sufficiently completed to assist in conducting future operating tests and provide a general indication of the material condition of other similar electrical motors aboard ship. If for any reason corrective action is not completed at the time of the test, a Deferred Action, OPNAV 4790/2K, is to be prepared, giving the necessary information, and is to be included in the activation work package.

e. Represervation. Represerve all equipment in accordance with current instructions after completion of tests.

050-8.7.4.3 Representative Testing of Motors The following is the procedure for testing and inspection of electrical power, lighting, and degaussing equipment:

a. Take and record insulation resistance of electrical equipment; include windings, component circuits, and portions of external wiring directly connected to equipment, as outlined in paragraph 050-3.10.2.5 for similar measurements.

b. Supplement the insulation resistance measurements by visual inspection of the insulation before arriving at conclusions relative to the condition of insulation. For weather-exposed equipment that is sealed against moisture and for which satisfactory insulation resistance readings are obtained the requirement for visual inspection of insulation may be waived.

c. Any steady or sudden downward trend in the insulation resistance values, as disclosed by a comparison with previous readings, requires an investigation of the various parts of the particular machine circuit, with a check

of the circuit, and correction of the unsatisfactory conditions. Refer to NSTM S9086-KC-STM-010 Chapter 300 ELECTRIC PLANT-GENERAL, for detailed information on insulation resistance measurements and corrective action.

d. For those equipment items found in satisfactory condition, enter the insulation resistance values on the appropriate Megger Test Record Card (531) in accordance with NSTM S9086-KC-STM-010 Chapter 300 ELECTRIC PLANT-GENERAL. For items on which corrective action is necessary, the unsatisfactory and final insulation resistance values are to be recorded and a suitable entry made in the activation work package, using OPNAV 4790/2K. The preparation of insulation resistance records described in paragraph 050-3.10.2.5 will facilitate the accomplishment of subsequent tests.

050-8.7.5 Post Repair Tests, Inspection and Records. Suitable tests and inspections shall be conducted by INACTSHIPMAINTO personnel after repair to a ship's electrical system or equipment in order to determine adequacy of the repair work. If feasible, tests shall include operation in place under normal operating conditions. Extensive activation of associated equipment not requiring repair solely to permit such tests is not desirable.

050-8.7.5.1 Location of Test. Much electrical equipment can be satisfactorily tested in the ship after the equipment has been removed from the ship for repairs. Such ship tests may be considered Satisfactory Operation Tests if they meet the following requirements:

a. A shop test can be more economically conducted than a shipboard test, and its cost is not disproportionate to the work done.

b. Test is adequate to establish satisfactory completion of specified repairs and the ability of the tested item to perform its designed function subject only to proper installation and adjustment aboard ship. When repairs have restored equipment to original design specification or to such authorized modified design that has been fully tested in identical equipment, the requirement for a full load test may, in general, be waived.

c. Final adjustment to achieve satisfactory operation (in regard to physical installation and electrical circuits) can be performed incident to activation.

050-8.7.5.2 Testing of Repaired Motors. Test multi-phase electric motors that have been removed or disconnected for repairs in place for correct rotation prior to final wiring connections incident to reinstallation. Check the ship's switchboard from which the motor circuit is supplied for normal phase sequence prior to undertaking such tests. Refer toNSTM S9086-KE-STM-010 Chapter 302, ELECTRIC MOTORS & CONTROLLERS. If such tests are not feasible, final connection of the motor to the ship's electric system should be deferred until activation. Attach a tag so stating to the motor and make a suitable entry in the ship's records. Follow a similar procedure for DC motors with externally connected fields or permanent magnet fields and for AC and DC generators if there is a doubt as to the correctness of polarity or phase sequence of the connections.

050-8.7.5.3 Recording Results. Suitable entries covering the accomplishment of the required tests and inspections, as well as a description of the completed repair work, are to be made on the Ship's Maintenance Project Material History Card for the repaired equipment or circuit. After the completion of repairs and reinstallation, measure the insulation resistance of the repaired item and record in the appropriate insulation resistance recorded

050-8.7.6 Reactivation of Electrical Equipment. Tests and inspections of electrical equipment and circuits incident to activation are to conform to the requirements set forth in paragraph 050-10.7.4.

050-8.8 ELECTRONICS

050-8.8.1 General Testing Do not reinstall for testing purposes any topside components that have been removed for preservation purposes. Examine and replace, as necessary, desiccant in radar antenna pedestals stowed in spaces not under dehumidification. Inspect representative units of electronic equipment and test operate, insofar as practical, for at least 1 hour. Apply filament voltages for at least 15 minutes before applying plate voltage. When the presence of gas is indicated (by blue or pink glow in transmitting tubes; glow is normal in mercury vapor tubes), allow the tube to heat with only filament voltage applied for a longer period of time.

050-8.8.2 Testing Cables. Test electronic equipment power supply cables and control cables for power and lighting circuits with a 500-volt megger in accordance with paragraph 050-8.6.3.3 to determine if short circuits or grounds exist in the conductors. Do this test only after all switches and contactors located on, or controlled from equipment panels in controller boxes and distribution panels are open or in the OFF position.

050-8.8.3 Solid Dielectric and Gas-Filled Cables. All solid dielectric and gas-filled coaxial cables shall be tested with a 500-volt megger after the cables have been disconnected from equipment. For sonar equipment, check the transducer circuit in accordance with paragraph 050-3.12.3. Enter a record of these tests in the appropriate Electronic Equipment History Card.

050-8.9 IC AND FC CIRCUITS

050-8.9.1 General. The following discussion and instructions apply to interior communication and fire control installations, including all circuits listed in NSTM S9086-PA-STM-010 Chapter 430, INTERIOR COMMUNICATION INSTALLATIONS, except that the instructions contained in NAVSEA OP 1208 will apply in the case of fire control circuits for NAVSEA equipment. The discussion and instructions for other items of the electrical installations are generally applicable to the interior communication and fire control installation, subject to noted exceptions and additional instructions.

050-8.9.1.1 General Testing. Except as may be required incident to the testing of ordnance equipment in accordance with NAVSEA OP 1208, routine tests and inspections of interior communication and fire control installations do not include energizing the circuits. These checks must be coordinated with other required tasks to eliminate excessive shipboard entry and to facilitate preparation of comprehensive, up-to-date repair records. Procedures are to be in accordance with instructions in paragraph 050-8.7.1.1 and are to include the measurement of insulation resistance from each conductor of each ship's cable to ground, the accomplishment of necessary corrective measures within the capacity of INACTSHIPMAINTO personnel, and bringing up to date and correction of records.

050-8.9.1.2 Criteria. For circuits and items of equipment determined to be in satisfactory condition, the insulation resistance readings, corrected to 25°C (77°F) and recorded on the appropriate Resistance Test Record Card in accordance with NSTM S9086-KC-STM-010 Chapter 300 ELECTRIC PLANT-GENERAL, will suffice. For circuits or items of equipment on which corrective action is necessary, both unsatisfactory and final insulation resistance values must be recorded on the insulation resistance record. Enter corrective action taken as a completed maintenance action. Prepare a deferred action for necessary repairs not completed.

050-8.9.2 Circuits Deenergized. Maintain interior communication and fire control circuits in a deenergized condition with switches on the interior communication, action cutout, and fire control switchboards and panels in the OFF position, except as specifically approved by NAVSEA. In order to further preclude unintentional ener-

gizing of the circuits, remove all fuses on the switchboards and panels except when specifically directed to do otherwise. Tags of distinctive color or design, similar to those required in paragraph 050-3.9.1, are to be installed on those switches that are to be kept in the closed (ON) position. These tags are to contain information as to why the switch is closed. At the time tests are made, replace fuses required for testing ordnance equipment in accordance with NAVSEA OP 1208.

050-8.9.3 Measure Insulation Resistance. Measure insulation resistance to ground on wires connected to transmitter station voice coils in announcing systems (other than intercommunication units) with an ohmmeter only, since in some cases these coils have not been designed to withstand application of 500 volts to ground. Measure insulation resistance of all other circuits with a 500-volt megger. In interpreting these values, note that the insulation value required for telephone cables type TTHFA and TRHFWA, as shown in the temperature insulation resistance curve, NSTM S9086-KC-STM-010 Chapter 300 ELECTRIC PLANT-GENERAL, are only 40 percent of those required for type BF cable.

050-8.9.3.1 Taking Insulation Readings. In general, most interior communication, action cutout, and fire control switchboards and panels are provided with terminal compartments to which all ship cables are connected. The insulation measurements should be made at these terminal blocks wherever available; however, in some cases, such as for live front switchboards or large switches installed on dead front switchboards, ship cables have been brought directly to the switch or associated fuse holder terminals without use of terminal blocks. In order to ensure complete coverage of all circuits, it is recommended that the manufacturer's elementary switchboard wiring diagrams be used as a guide in determining the proper switchboard terminals at which the measurements are to be made.

050-8.9.3.2 Taking Insulation Readings on a Dead Front Switchboard. In many of the more recent designs of dead front switchboards, fuse holders have been provided. The prod of the megger can be inserted through the hole in the fuse holder cap to facilitate ground measurements without requiring use of terminal blocks. However, in the case of insulation measurements on inactive ships, the holes in the fuse holders should not be used since such practice might lead to confusing and incorrect results. In this connection, it should be noted that, in the 30-and 60-ampere fuse holders, the terminal in the cap is on open circuit when no fuse is inserted in the holder. In the 100- and 200-ampere fuse holders, when no fuse is inserted, the terminal in the cap will be either connected directly to the line or connected to the line through the lamp and series resistor, depending upon how the fuse holder was wired into the circuit. In the latter case the value of the insulation resistance indicated on the meter would be meaningless. For these reasons, make all insulation measurements on the above circuits either at the switchboard terminal blocks, if provided, or directly at the fuse holder or switch terminal to which the cables are connected.

050-8.9.3.3 Taking Insulation Readings On String-Type Circuits. In the case of string-type circuits, take measurements at the nearest convenient jackbox. In the case of sound-powered telephone circuits, take the ground measurements at the associated switchboard or switchbox if provided. Close all line switches on the associated switchboards and switchboxes, but leave open all tie switches and tie-plus switches between circuits in order to reduce the total length of cable for which conductances to ground are added.

050-8.9.4 Cables Not Connected. Except as previously stated, a separate test will not be required on ship cables that are not connected to a switchboard or panel because normally such cables are local runs or are used for auxiliary circuits; conductances of such cables will add to that of the associated switchboard cable. Where practical, watertight switches and similar devices are to be turned to an active position (at the time of inactivation) so that associated cables are connected electrically through the switch. Secure the switch or device in this active posi-

tion and install a suitable tag at the switch indicating the correct position. Also note the correct switch position on the insulation resistance record for the applicable circuit.

050-8.9.5 Post-Repair Tests and Inspections. Post-repair tests and inspections shall be conducted in accordance with instructions in paragraph 050-8.7.5; these instructions are equally applicable for interior communication and fire control installations.

050-8.9.6 Reactivation. Tests and inspections incident to reactivation must be in accordance with the requirements set forth in paragraph 050-10.7.

050-8.10 INSPECTION AND TESTING OF MISCELLANEOUS ITEMS

050-8.10.1 Inspection of Exterior Surfaces. Exterior machinery surfaces should be inspected visually to determine that preservation is adequate whenever the compartment in which the machinery is located is inspected. Reapply solvent cutback corrosion preventive as required. Examine machinery interiors through inspection plates if such inspection plates are provided (on gear cases, for example). Disassembly for further inspection is to be determined by the result of such inspection. When disassembly is necessary for inspection, as for shaft journals and cylinders, select representative parts for inspection rather than conducting complete breakdown of a machine. Results of such an inspection will indicate any need for a more thorough inspection of the machine in question or of other similar machinery (or equipment).

050-8.10.2 Dehumidification. Spaces being dehumidified shall be inspected at periodic intervals, in accordance with instructions outlined in Section 6, to observe general adequacy of preservation, and detect presence of hull or deck water leaks and other discrepancies. Erratic or excessive operation of the dehumidification machines is an indication of increased air or water leakage and requires inspection and corrective action. Keep access openings tightly closed at all times except as necessary for inspections and during passage of material and personnel and then for the shortest time possible.

050-8.10.3 Lighting. Ships having lighting circuits will have spaces brilliantly lighted during inspections. This use of the circuits provides a test for operability.

050-8.10.4 Petroleum Products. Boiler fuel, diesel fuel, lubricating oil, and hydraulic fluids left in inactive ships are not to be routinely tested. Fuels required to be offloaded will normally be tested by the receiving activity. Products offloaded will not be replaced until the ship is activated.

050-8.10.5 Inspection and Repair of Insulation In Refrigerated Spaces. Insulation under deck sheathing of refrigerated spaces is to be inspected at least annually. If standing water or excessive moisture is found, the insulation shall be dried if feasible. Mineral wool insulation may be dried by forcing heated air through one or more inspection holes and venting through others. If mineral wool insulation in bulkheads is suspected to be wet, it can be dried in this manner. Small accumulations of water in the vicinity of inspection holes may be dried by exposure to the dehumidified air. However, drying insulated cork decks in this manner may not be possible.

050-8.10.5.1 Wet Insulation. If insulation is wet, find and repair the leak. A common source of leakage is a poorly fitting deck drain. Once repaired, it is permissible to seal the deck even if all the insulation has not dried.

Replace insulation only if it is evident that corrosion has endangered structural integrity or if wood floor supports have obviously decayed and replacement is necessary to provide firm support for floor loads. Required work will be added to the activation working package.

050-8.10.5.2 Repairing and Replacing Insulation. When insulated construction is repaired or replaced, confine the work to the smallest area possible. Joints between new and old construction are permissible and need be watertight only on the deck and to 18 inches above.

050-8.10.5.3 Precautions. Take the following precautions when repainting or rebuilding refrigerated spaces:

a. . If coils or other apparatus was originally supported on the deck, every effort is to be made to support them on bulkheads or overheads

b. If the support must pierce the decking of the space, the lead pan (if installed) shall be flashed up at least 2 inches about each support and soldered watertight.

c. If there is a concrete or mastic deck surface, also flash up the support to at least 2 inches.

d. Deck drains are to be inspected for watertightness.

SECTION 9

PREPARATION FOR SAFE STOWAGE

050-9.1 GENERAL INFORMATION

050-9.1.1 Vessel Selection. On occasion, funding and other resources may not have been identified for inactivation of a ship or craft, or it may not be considered prudent to expend funds on a ship/craft that is scheduled for transfer to a foreign government under the Security Assistance Program, under a Navy-to-Navy lease, or according to other transfers. In each of these cases, custody of the ship/craft may be transferred to an INACTSHIPMAINTO for safe storage pending identification of funding or outcome of legislation, authority, or transfer actions.

050-9.2 STORAGE PREPARATION

050-9.2.1 General. Required storage preparations are designed to ensure the tight security of the ship/craft while at the storage facility. Fire and flood prevention are the principal concerns. Accordingly, the minimum preparations required are those that will increase hull integrity and remove obvious fire hazards. Protection of classified material is also a prime concern. There is generally a requirement for the removal of classified documents and the safeguarding of classified equipment. The INACTSHIPMAINTO will provide ships force training in closeout actions for classified documents to support Commanding Officer's certification and will accomplish a thorough closeout review of spaces during custody transfer inspections. In addition to the normal shipboard locations for storage/use of classified documents, ships force should thoroughly inspect other areas where classified documents may have been used or stored during the ship's service life, such as:
In weapons storage areas and magazines
Under raised deck plates and cable run areas
Within false overheads
Behind cabinets, safes, and furniture
In electronic equipment and weapons operations and maintenance spaces

In bridge and in mission planning spaces
Behind or underneath drawers and shelves of cabinets/safes and furniture in any compartment (e.g. inside and under drawers of navigation chart tables)

Since ships/craft are normally delivered to the INACTSHIPMAINTO by tow, all preparations required for a Navy tow (that are generally more detailed than for a commercial tow) must be completed.

050-9.2.2 OPNAVINST 4770.5. The provisions of OPNAVINST 4770.5 (Series) that pertain to preparation for safe stowage are applicable and shall be complied with, as shall additional guidance provided herein.

050-9.3 JOINT INSPECTIONS

050-9.3.1 Turnover of Custody. Prior to turnover of custody, provisions must be made for joint inspections of a ship or craft in order for the prospective custodian to know the condition of the ship/craft that is being transferred. Accordingly, a booklet of general plans, tank loading and sounding tables, CSMP, blueprints, and other machinery records must be available and sighted before the turnover. Required turnover materials also include a listing of the tank soundings and the location and amount of installed fixed ballast, as well as other applicable engineering documents.

050-9.3.2 Safe Stowage. Safe storage inspection checkoff list is given in Table 050-9-1.

050-9.4 INACTSHIPMAINTO ACCEPTANCE OF SHIP/CRAFT

050-9.4.1 Ships/Crafts. Ships/crafts not properly prepared for safe storage will not be accepted for INACTSHIPMAINTO custody.

050-9.5 MAINTENANCE

050-9.5.1 Fire and Flooding. Fire and Flooding. Ships/craft prepared for safe stowage, and in custody of INACTSHIPMAINTO, shall receive maintenance and care vital to prevention of fire and flooding casualties only, unless otherwise directed by INACTSHIPOFF.

050-9.5.2 Safe Stowage. Prepare requisitions for material required to accomplish urgent repairs; forward requisition copies to the supply support activity. Take this action even though the repairs cannot be accomplished without industrial assistance or because of the inability to perform operational tests following the accomplishment of the repair. All requisitioned material, when received, shall be securely marked to indicate the repair for which it is intended.

050-9.6 RESPONSIBILITIES

050-9.6.1 Type Commander. The Type Commander is responsible for the following:

a. Messing and berthing ashore

b. Consumable distribution direction.

c. Towing arrangements and delivery of ship. (NAVSEA funds towing preparations as part of ship inactivation).

d. Task repair/maintenance planning activity to develop bid specifications, provide estimates and establish a Restricted Availability (RAV) to address responsibilities designated Ship's Force/Industrial Activity (IA). The RAV should be scheduled concurrently with the Inactivation Standdown Period.

e. Coordinating with item managers for pre-decommissioning equipment removal.

f. Monitoring ship's inactivation progress.

g. Coordinating adequate mooring with services available.

h. Provide security/safe storage from decommissioning until arrival at INACTSHIPMAINTO.

i. Diving services if required (prior to DECOM).

j. Temporary fire protection

k. Ship's Force Transportation

050-9.6.2 INACTSHIPMAINTO. INACTSHIPMAINTO is responsible for:

a. Providing safe storage briefing, inspections and guidance.

b. Obtaining proper documentation in order to compile the activation work package and to prepare both the Service Craft and boat Accounting Report (SABAR) OPNAVINST 4780.5, and the Material Readiness Report (MR), NAVSEAINST 4770.2.

Table 050-9-1. Safe Stowage Inspection Checkoff List

Inspection Item	Not APP	Not Comp	% Comp	Comp
1. Safety/Security				
a. All trash, rags, debris, oil, grease, and other fire hazards have been removed from the ship and spaces are clean and dry.				
b. The following are in place and secured: Refer to Table 050-9-2 for a list of useful stock numbers for recommended supplies.				
(1) Weathertight/watertight closures.				
(2) Weather-deck doors, hatches, and scuttles (except for one access with working hasp), as directed by INACTSHIPMAINTO.				
(3) Weather-deck lifelines/liferails				
(4) Drain holes cut in coamings to provide weather drainage.				
(5) Stanchions/safety chains around interior ladders, hatches, scuttles.				
(6) Deck plates and gratings.				
(7) All vent duct openings including the stack, all topside deck drains that return inside of ship are sealed shut.				
(8) Dry all bilges and keep them dry. Normal cleanliness standards apply.				
(9) Repair all underwater leaks.				
(10) Depressurize all steam and water piping, all machinery, boilers, etc. All drains are to be opened including those on pumps and fittings.				

Table 050-9-1. Safe Stowage Inspection Checkoff List - Continued

Inspection Item	Not APP	Not Comp	% Comp	Comp
(11) Close to outside atmosphere all intakes, exhaust pipes, ventilation openings, tank vents, voice tubes, etc except for overflow vent lines.				
c. Lockers, wardrobes, desk drawers, and file cabinets containing material NOT required to be retained on board are empty in the following spaces. (Do not wire shut until final INACTSHIPMAINTO walk-through):				
(1) Officer berthing				
(2) CPO/enlisted berthing				
(3) Offices				
(4) Other compartments				
d. All flammables have been removed from storerooms and compartments.				
e. All compressed gas cylinders (halon, acetylene, carbon dioxide (CO_2), nitrogen, oxygen, etc.) removed except as modified by item 1.f. of this table. Remove fixed carbon dioxide cylinders.				
f. Five full (weighed, hydrostatically tested, tagged and sealed) 15-lb CO_2 bottles have been placed at the designated emergency entrance.				
g. Refrigerants have been recovered in appropriate cylinders and turned in.				
h. All portable PKP has been off-loaded. All fixed PKP cylinders have been off-loaded.				
i. All switchboards, and electrical circuits, except lighting circuits, have been deenergized and red tagged. All equipment (e.g., fans, scuttlebutts) is disconnected from lighting circuits.				
j. All batteries (including those in storerooms) have been removed from the ship except those required for flooding alarms and tow lights.				
k. All compartments have adequate lighting (minimum of 50 percent). If more than 50 percent, DO NOT REMOVE to 50 percent.				
1. All firefighting liquid has been off-loaded.				
(1) Drain AFFF distribution piping; secure all valves in their OPEN (to the atmosphere) position. PIPING FLUSH IS NOT REQUIRED.				
(2) OPEN all low point drain cocks and secure them in the OPEN position; break flanges loose as necessary to enhance drainage of low points and leave them OPEN to the atmosphere to facilitate further system dryout.				
(3) As a safety precaution, segregate tank from system by blanking.				
(4) Disposal of draining AFFF/sea water affluent should be handled and disposed of as hazardous waste.				

Table 050-9-1. Safe Stowage Inspection Checkoff List - Continued

Inspection Item	Not APP	Not Comp	% Comp	Comp
(5) Observe all personnel safety procedures associated with AFFF including the potential for release of toxic levels of Hydrogen Sulfide (H_2 S) gas. As an additional precautionary measure, ensure that all personnel involved with the breaking and drainage of AFFF System piping are outfitted with an approved self-contained breathing apparatus. Test for the presence of toxic atmospheres as required by NSTM S9086-CH-STM-030 Chapter 074, VOLUME 3-GAS FREE ENGINEERING.				
(6) Remove hoses from reels and redistribute as directed by TYCOM.				
m. All insulation materials are in a sealed, non-friable condition. This includes ALL insulation whether it contains Presumed Asbestos Containing Materials (PACM) or not. Refer to paragraph 050-7.2.7.2.				
(1) All PACMs such as pipe insulation, equipment insulation, etc., are in a sealed, non-fiable condition. Any compartments containing PACMs that are disturbed during inactivation work, equipment removals, or is an existing condition, must be certified by an asbestos qualified competent person as being safe for unrestricted entry. Note Asbestos containing materials have been found to be in non-skid, especially in applications requiring additional fireproofing. Any non-skid to be removed must be tested for the presence of PACMs. INACTSHIPMAINTO representatives may require additional testing of remaining non-skid.				
(2) INACTSHIPMAINTO has been provided with an inventory of location, type, and condition of all PACM insulation.				
n. Any asbestos containing material in storage has been removed from the ship and disposed of.				
o. All safes have been locked in the open position with the standard combination 50-25-50 set, and wired in the open position.				
p. All high security locks, except those installed on reduction gears or designated by the INACTSHIPMAINTO have been removed and redistributed in accordance with TYCOM instructions or turned in to Naval Weapons Station, Crane, IN (NSTM S9086-UK-STM-010 Chapter 604, LOCKS, KEYS, AND HASPS).				
q. All keys have been identified and stored in a space agreed upon with INACTSHIPMAINTO.				
r. All transformers and large capacitors containing or suspected of containing PCB's have been inventoried and labeled. INACTSHIPMAINTO has been provided a copy of the inventory.				
(1) A baseline inventory, by manufacturers, of known PCB sources is provided. This list along with an updated COSAL will assist in identifying specific items containing PCBs.				

Table 050-9-1. Safe Stowage Inspection Checkoff List - Continued

Inspection Item	Not APP	Not Comp	% Comp	Comp
(2) All transformers and large capacitors (larger than 3 lbs.) dielectric fluid have been removed. Those under 3 lbs. have been removed to the extent feasible.				
s. Hydraulic oil systems have been inventoried and quantified. INACTSHIPMAINTO has been provided with the inventory.				
t. All mercury containing equipment and components have been located, inventoried, and removed. INACTSHIPMAINTO has been provided with the inventory.				
u. All locked-in fresh water ballast tanks have been tested for sodium chromate concentrations. Ballast water has been disposed of as a hazardous waste if chromium concentrations are equal to or greater than 5 ppm.				
v. Contents of continuous boiler water treatment tanks have been removed and disposed of ashore. On board stock of boiler water treatment chemicals has been offloaded for redistribution.				
w. All bulk paints, solvents, greases, oils, acids, insecticides, pesticides, film processing chemicals, etc., have been off-loaded for redistribution or disposal.				
x. All used and/or excess hazardous material identified in OPNAVINST 5100.19C has been containerized and off-loaded for redistribution or disposal.				
y. Vessel has been exterminated for rodents, insects, pests, etc. and an extermination certification provided to INACTSHIPMAINTO.				
z. All systems containing Fire Resistant Hydraulic Fluid (FYRQUEL) containing butylated triphenyl phosphate shall be completely drained and FYRQUEL removed from the ship.				
aa. All radioactive materials or equipment (i.e., electron tubes, smoke detectors, etc.) have been removed from storerooms, spare parts lockers, etc., and have been returned to the supply system for reissue.				
ab. All keys, technical manuals, and writing diagrams for circuit FZ or 4FZ have been turned in.				
2. Command/Administration				

Table 050-9-1. Safe Stowage Inspection Checkoff List - Continued

Inspection Item	Not APP	Not Comp	% Comp	Comp
a. All nonregistered, unclassified instruction books, technical manuals, EOSS, PMS cards, ship's drawings (blueprint and microfiche), unclassified Ship Selected Record data, machinery history records, logs, ship's instructions, bills, files, correspondence and similar documents/publications that may be of assistance for ship reactivation have been retained on board, inventoried, and stowed in normal locations. An inventory sheet noting contents of each filing cabinet drawer, bookcase and desk has been fastened on the outside of the container and a master inventory list, with locations, provided to INACTSHIPMAINTO. Note U.S. tonnage certificates are no longer required to be retained on board U.S. Navy ships. Any U.S. tonnage certificates, regardless of ship status, may be discarded or destroyed. They are not to be returned to NAVSEA or the U.S. Coast Guard (USCG). On board Suez and Panama Canal tonnage certificates should be retained, treated as part of the ship's official papers and stored in a secure place. USCG will not issue original or replacement certificates to these ships, if missing or misplaced, until ship reactivation.				
b. All classified correspondence, navigation charts, tactical publications and software have been removed from the ship. All classified technical manuals for equipment remaining on board, all classified Ship Selected Record data, and the last INSURV report have been inventoried and stored in one secured location on board or delivered to INACTSHIPMAINTO, at the direction of the INACTSHIPMAINTO Director. The ship's Commanding Officer has certified in writing that all classified material has been removed from the ship or delivered to INACTSHIPMAINTO.				
c. The Ship's Commanding Officer has certified in writing the location and classification of all classified equipments remaining on board, and the certification has been provided to INACTSHIPMAINTO.				
d. Armed Forces censorship stamps have been disposed of.				
e. Special Services property has been transferred or disposed of.				
f. Postal system has been disestablished.				

Table 050-9-1. Safe Stowage Inspection Checkoff List - Continued

Inspection Item	Not APP	Not Comp	% Comp	Comp
g. At least one copy of the Booklet of General Plans, Tank Loading and Sounding Tables, Ship's Characteristics Card, Damage Control Book and Diagrams, and Current Ship's Maintenance Project, last drydocking report, docking plan and ship's paint schedule (particularly noting whether ORGANOTIN is applied as an underwater hull anti-fouling paint) has been inventoried, retained on board and centrally located in Compartment ----------. An additional copy of the Booklet of General Plans is to be provided to INACTSHIPMAINTO for off ship use. If classified, deliver the Ship's Characteristics Card to the INACTSHIPMAINTO Director.				
h. All HM&E technical manuals have been retained on board, inventoried and stowed in normal locations. If the ship has been designated by CNO for disposal by scrapping, centrally stow in the compartment identified in item 2.g of this table. Provide inventory list with locations to INACTSHIPMAINTO.				
i. A listing of all tank soundings made upon completion of inactivation work and ballasting for tow has been compiled. The tank sounding tape measure has been converted from the linear unit (feet and inches) to the volumetric measure (gallons).				
(1) The ship's Liquid Load Diagram has been updated or marked up to reflect all tank and voids, in gallons, including locked-in fresh water ballast, roll stabilization tanks and tanks ballasted for tow.				
(2) A copy of the updated Liquid Load Diagram has been provided to INACTSHIPMAINTO. Sound all tanks prior to turnover.				
(3) The above has been validated by a INACTSHIPMAINTO representative during the compartment turnover inspection.				
j. Upon completion of stand down period, the ship's Commanding Officer has certified in writing to INACTSHIPMAINTO that the ship has been properly secured in accordance with the INACTSHIPOFF Portsmouth, VA Inactivation Plan, and that no unauthorized removals of installed equipment or onboard spares have occurred. (Refer to OPNAVINST 4770.5E and, for Foreign Military Sales/Lease transfers, SECNAVINST 4900.48)				
k. Authorized removals of installed equipment and on board spares are documented individually on form DD1149. All DD 1149s are delivered to INACTSHIPMAINTO with transfer of ship custody.				
3. Engineering/Hull				

Table 050-9-1. Safe Stowage Inspection Checkoff List - Continued

Inspection Item	Not APP	Not Comp	% Comp	Comp
a. All hull penetrations below the waterline, and those likely to result in flooding casualties have been externally or internally blanked and painted YELLOW. Internal blanks have been fabricated from 1/2-inch thick steel plate and the installation includes a .060-inch solid rubber gasket having the same number of bolts as the flange. The watertight integrity level generally is 4 feet above the lightship waterline. All blanks have a stenciled number, painted on, and a list of blank flanges have been provided by blank, serial number, compartment number, frame number, port or starboard, and system blanked. This list has been provided to INACTSHIPMAINTO. Refer to Table 050-9-2 for a list of useful stock numbers for recommended supplies.				
b. All piping system items removed to facilitate blanking are wired in a conspicuous location near the installed blank.				
c. All sea valves have been wired shut with multiple strand seizing wire.				
d. All stern tube packing and rudder packing glands have been tightened so there is no leak-off. The quantity of packing installed shall be such as to maximize the amount of adjustment remaining on the packing gland take up studs. Add packing as necessary.				
e. Entire CHT System has been cleaned in accordance with NSTM S9086-T8-STM-010 Chapter 593 POLLUTION CONTROL, left open, and certified by a marine chemist as safe for entry and safe for hot work.				
f. Propeller(s) is (are) in the docking position. Lock the shaft in accordance with paragraph 050-3.6.5.1.				
g. Rudder(s) is (are) locked mechanically on centerline with a locking device in accordance with U.S. Navy Towing Manual.				
h. All steam, freshwater, saltwater, condensate, air and drain piping systems have been drained to low point and left open for natural drying.				
i. All boilers and heat exchangers have been drained to low point and left open.				
j. All lube oil tanks and systems have been pumped empty. Lube oil systems have been drained and flushed to the point that no low point pockets of residual oil exist. Reduction gear sump will only be drained and hand wiped to the extent practical.				
k. All fuel tanks of every kind including ship's propulsion, storage, service, settling and JP5 tanks shall be pumped empty then refilled with fresh water to maintain stability. Lines have been drained and flushed to the point that no low suction pockets of residual oil exist.				
(1) All fuel oil transfer valves are wire closed with seizing wire.				
1. All AVGAS and MOGAS tanks and cofferdams have been cleaned and gas freed, as safe for entry.				

Table 050-9-1. Safe Stowage Inspection Checkoff List - Continued

Inspection Item	Not APP	Not Comp	% Comp	Comp
m. Internal watertight and subdivision integrity is maintained and acceptable.				
n. The following are in place, SECURED WITH ALL FASTENERS, and weather sealed:				
(1) Stack covers (16-gage sheet metal)				
(2) Porthole covers				
(3) Deck accesses				
(4) Deck plates and grates				
(5) Handrails and ladders				
o. All heads and sanitary facilities are clean and dry. All sinks and urinal traps have been removed and wired to piping next to where they were removed.				
p. All bilges of machinery spaces and pump rooms are clean and dry.				
q. All hydraulic systems have been drained and left open with the exception of the anchor windlass and rudder.				
r. All reefers/refrigerators are clean, with doors either: wired open and blocked at the outer edge with shoring to prevent sagging or removed and stored inside.				
s. All sounding tubes are properly marked, capped and workable. A listing of all tank soundings made within last week prior to transfer of ship has been provided to INACTSHIPMAINTO.				
t. Fuel tanks or any tank required to be ballasted has been isolated from associated piping systems by blanking. Tanks have been cleaned and gas freed, then filled only with fresh water. Tank vents have been left open with flash screens installed. Ship's ballasting has been accomplished per U.S. Navy Tow Manual (NAVSEA SL 740-AA-MAN-010, Rev. 2)				
u. Flooding markers shall be 6 inch by 3 foot, horizontal, international orange stripes painted on the hull forward, aft and midships, at the water edge to allow visual inspection.				
4. Navigation				
a. Charts and hydrographic publications have been turned in for redistribution.				
b. Sinuous course clocks and cams have been turned in for redistribution.				
5. Weapons				
a. All ammunition, missiles and dummy rounds have been off-loaded.				
b. All small arms, firearms, 50 caliber machine guns and mounts, and Stinger launchers and mounts have been removed and off-loaded.				
c. All pyrotechnics have been off-loaded.				
d. All gun mounts and missile launchers are stowed in depressed position.				
e. Tompions are installed.				

Table 050-9-1. Safe Stowage Inspection Checkoff List - Continued

Inspection Item	Not APP	Not Comp	% Comp	Comp
6. Supply				
a. As directed by TYCOM redistribute office machines, labor saving devices consumables, etc and document all transfers.				
b. Electronic test equipment peculiar to ship's installed equipments have been stowed in a locked compartment (Pilferable Gear Locker).				
c. General Purpose Electronic Test Equipment (GPETE) has been forwarded to the nearest Naval Supply Center.				
d. All custody records for equipage have been updated to reflect disposition (if any) and retained onboard in the Supply Office.				
e. Ship's COSAL (including ILO supplement) and other unclassified allowance lists have been retained on board in the Supply Office.				
f. All Supply functions have been closed out and final reports have been submitted as required by the TYCOM.				
g. Appropriate Curator items have been removed and shipped to the Curator. Refer to OPNAVINST 4770.5 (Series) Appendix D for expanded description of the items to be removed. Items are to be sent to: Receiving Officer, Supply and Fiscal Department, Washington Navy Yard, Building 176, Washington, D.C., 20374. Mark for: Curator for the Department of the Navy, Washington Navy Yard, Building 70.				
h. The Pilferable Gear Locker (PGL), located in Compartment _____, has been secured with hasp and padlock, and keys provided to INACTSHIPMAINTO. PGL contents will be jointly inventoried with INACTSHIPMAINTO before acceptance by INACTSHIPMAINTO.				
i. All portable 2F/7H radiac equipment and dosimeters have been off-loaded and turned in to the nearest NAVELEX field manager.				
j. All ship's boats shall be removed during inactivation. Per NSTM S9086-TX-STM-010 Chapter 583, BOATS AND SMALL CRAFT, a Boat Inspection Report (BIR), NAVSEA 9583/3 (Rev 11-97), shall be obtained for each assigned boat during the first month of stand down prior to decommissioning. The BIR can be accomplished by any Intermediate Maintenance Activity, SUPSHIP, or Naval Shipyard. Cost of inspection, if necessary, will be funded from ship's OPTAR funds. The completed report shall be forwarded requesting disposition instructions to: Commander, Naval Surface Warfare Center, Detachment Norfolk, Carderock Division, 116 Lake View Parkway, Suite 200, Suffolk, VA 23435-2698. These actions need to be accomplished at the earliest opportunity to ensure that the boats are designated for either turn-in or for disposal prior to removal. Abandon-ship equipment installed in lifeboats, floater nets, and inflatable boats shall be removed and turned in to stocking point.				

Table 050-9-1. Safe Stowage Inspection Checkoff List - Continued

Inspection Item	Not APP	Not Comp	% Comp	Comp
k. All night vision equipment on board decommissioning ships are to be returned to the following address: Receiving Officer, NAVSURFWARCENDIV Crane, 300 Highway 361, Crane, IN 47511-5001. NAVSURFWARCENDIV Crane POC is Code 80PM13, TEL DSN 482-5842 or COMM (812) 854-5842.				
7. Ship Movement To INACTSHIPMAINTO				
a. One (1) complete set of mooring lines including storm lines are retained onboard to permit ship to be moored upon delivery to INACTSHIPMAINTO.				
b. For ships to be berthed at NDRF facilities, provide the following additional equipment:				
(1) Ten lengths of 7/8″ wire rope each with a six foot FLEMISH EYE on one end and each 500 foot in length(4 wires coiled forward and 4 aft).				
(2) Two lengths of 1.5″ or 2″ wire, with clamps/clips, 500 foot in length, one coiled forward and one coiled aft.				

Table 050-9-2. Materials Needed For Safe Stowage Preparation (Verify Stock Number Prior To Ordering)

Nomenclature	Federal Stock Number
Seizing wire (3/32″)	4010-00-222-5346
Seizing wire (1/8’1	4010-00-222-5347
Swedging Sleeve	4030-00-132-9163
Lock wire (.040)	9525-00-729-5435
Lock wire (.064)	9525-00-554-1678
Plier, fencing	5120-00-293-3485
Tiedown (large)	5975-00-156-3253
Salt and pepper wire (MRI-D-1)	6145-01-202-7764
Dehumidification Tape	9Q-5710-00-890-9874
RTV	8040-00-225-4548
Compound, plastic coating	8030-00-721-9380
* Adhesive (water resistant) (gallon cans)	8040-00-754-2685
* Canvas	8030-00-170-5090
Lagging cloth (Cloth, lain weave)	8305-00-148-7363
Lagging paste (Thermal insulation)	8040-00-273-8707
Bag, Mailing (Cotton Bag 3″ x 5″) BD - 100 Ea	8105-00-281-3924
Bag, Mailing (Cotton Bag 6″ x 9″) BD - 100 Ea	8105-00-271-1511
Bag, Mailing (Cotton Bag 8″ x 10’j BD - 100 Ea	8105-00-290-3360
Tag, stock marking (For labeling keys)	8135-00-239-1648
Cap, protective plastic (for S/R receptacles)	5340-00-437-6461

*Required for sealing with canvas/pro-seal (vents and general sealing).

Table 050-9-3. Shipboard Used/Excess Material/Container Cross-Reference
Not All Inclusive

Hazardous Material	Container
Acetic acid	Plastic bottle; plastic-lined steel drum
Acetic acid, glacial	Plastic bottle
Acetone	Tin can; steel drum, bung, and vent
Activator/stabilizer (sodium borate)	Plastic-lined steel drum
Adhesive, N.O.S.	Steel drum
AFFF (aqueous film forming foam)	Variable
Alodine 1201 (chromic acid)	Glass carboy
Ammonia solution, nickel electroplating	Plastic bottle
Aniline	Tin can; steel drum, bung, and vent
Asbestos	6 mil (6/1,000 inch) plastic bag
Batteries (lead-acid or alkaline wet cell)	Steel drum
Battery acid (sulfuric)	Plastic bottle; plastic-lined steel drum
Baygon (phenolic pesticide)	Steel drum, bung, and vent
Blanket wash (acacia gum)	Steel drum
Bulbs, fluorescent light (with mercury)	Original carton
Chemicals, photographic, N.O.S.	Plastic bottle
Chromium electroplating solution	Plastic bottle
Citric acid	Plastic bottle
Cleaner, chemical, N.O.S.	Tin can; steel drum
Cleaning solvent, N.O.S.	Steel drum, bung, and vent
Cobalt electroplating solution	Plastic bottle
Compound, epoxy	Steel drum
Compound, silicone	Steel drum
Concentrated Solutions (photo refresher), N.O.S.	Plastic bottle; plastic-lined steel drum
Copper electroplating solution	Plastic bottle
Compound, antiseize (graphite-petroleum)	Steel drum, removable cover
Compound, antiseize (lead oleate)	Steel drum, removable cover
Compound, boiler passivator (oxalic acid)	Plastic-lined steel drum
Compound, descaler (caustic/acid)	Plastic-lined steel drum
Compound, sealing (synthetic polymer)	Steel drum
Damping fluid (petroleum base)	Tin can
Darco drycoal activated	Steel drum (for contaminated material, removable cover)
Developer, N.O.S.	Plastic-lined steel drum
Disinfectant, fungisol (quinone)	Plastic bottle
Disinfectant, general purpose	Steel drum, bung, and vent
Disodium phosphate	Steel drum, removable cover
Earth, diatomaceous (filter)	Plastic-lined steel drum (for contaminated material)
Electroplating etching solution, N.O.S.	Plastic bottle; plastic-lined steel drum
Ethylene glycol (antifreeze)	Plastic-lined steel drum
Ethyl alcohol	Plastic bottle
Fiberglass epoxy	Steel drum
Fixer (w/silver halides), N.O.S.	Plastic bottle; plastic-lined steel drum
Flux (sodium nitrate/nitrite) N.O.S.	Tin can; steel drum
Formic acid solution, nickel electroplating	Plastic bottle; plastic-lined steel drum
Formic acid solution, nickel electroplating	Plastic bottle; plastic-lined steel drum
Freon	Plastic bottle; plastic-lined steel drum
Grease, ball bearing	Steel drum, removable cover

Table 050-9-3. Shipboard Used/Excess Material/Container Cross-Reference

Not All Inclusive - Continued

Hazardous Material	Container
Grease, general purpose	Steel drum, removable cover
Grease, graphite	Steel drum, removable cover
Grease, halocarbon	Steel drum, removable cover
Hydraulic fluid (petroluem)	Steel drum, removable cover
Hydraulic fluid (synthetic)	Epoxy-lined steel can; plastic-lined steel drum
Hydrochloric acid	Plastic bottle
Hydrofluoric acid	Plastic bottle
Hydrogen peroxide	Plastic bottle; plastic-lined steel drum
Hypo cleaning (ammonium persulfate)	Plastic-lined steel drum
Indicator, stop bath (organic dye)	Steel drum, bung, and vent
Ink, black oil based	Steel drum, bung, and vent
Insecticide diazinon (organophosphate)	Tin can; steel drum, bung, and vent
Isopropyl alcohol	Plastic bottle
Lacquers	Tin can; steel drum, bung, and vent
Leak test (penetrant)	Plastic bottle
Lithographic solutions, N.O.S.	Plastic bottle; plastic-lined steel drum
Lithographic solvents, N.O.S.	Steel drum, bung, and vent
Mercuric nitrate	Plastic bottle
Mercury (amalgam)	Plastic bottle
Mercury remover (calcium oxide-sulfur)	Steel drum, removable cover
Methyl alcohol	Plastic bottle
Methyl ethyl ketone	Steel drum, bung, and vent
Molybdenum graphite, drylube	Steel drum, removable cover
Molybdenum nickel 447	Plastic bottle
Morpholine, 40 percent	Tin can; steel drum, bung, and vent
Naphtha	Steel drum, bung, and vent
Nickel, chromium, aluminum 441	Tin can; steel drum, removable cover
Nickel solutions	Plastic bottle
Nitrate silver	Plastic bottle; plastic-lined steel drum
Nitric acid	Glass carboy
Nonskid flight deck compound (asphaltic)	Steel drum, removable cover
Oil, cutting (synthetic)	Epoxy-lined steel can
Oil, liquid coolant (synthetic)	Epoxy-lined steel can
Oil, N.O.S.	Steel drum, bung, and vent
Oxygen breathing apparatus canister	Fiberboard box
Paint, enamel, N.O.S.	Steel drum, bung, and vent
Perchloroethylene	Steel drum, bung, and vent
Petrobond sand with waste oils	Steel drum, bung, and vent
Phosphoric acid	Plastic bottle; plastic-lined steel drum
Pinso pads (shellac)	Steel drum, removable cover
Polychlorinated Bipenyls (PCB's), items containing	Polyethylene lined steel cans; plastic-lined steel drum, bung, and vent/removable cover
Remover, paint (caustic)	Plastic bottle; plastic-lined steel drum
Resin, ion exchange (activated polymers)	Steel drum (for contaminated material)
Resin laminating (plastic)	Steel drum

Table 050-9-3. Shipboard Used/Excess Material/Container Cross-Reference

Not All Inclusive - Continued

Hazardous Material	Container
Reverser (aromatic hydrocarbon reducers)	Steel drum
Silver solutions	Plastic bottle
Sodium chromate (ballast)	Variable
Sodium chromate	Plastic bottle
Sodium cyanide solution, gold electroplating	Plastic bottle
Sodium hydroxide solid	Steel drum, removable cover
Sodium hydroxide solution	Steel can; steel drum, bung, and vent
Sodium nitrate	Steel drum
Sodium phosphate	Steel drum
Stannous chloride	Plastic bottle
Stannous fluoride	Plastic bottle
Stop bath, N.O.S.	Plastic bottle
Sulfamic acid solid	Plastic-lined steel drum
Sulfamic acid solution	Plastic bottle; plastic-lined steel drum
Thinner (organic), N.O.S.	Tin can; steel can; steel drum
Tin plating solution	Plastic bottle
Tin 2090	Plastic bottle
Toluene	Tin can; steel can; steel drum, bung, and vent
Trichloroethane solvent	Tin can; steel can; steel drum, bung, and vent
Trichloroethylene	Tin can; steel can; steel drum, bung, and vent
Trichlorofluoromethane	Tin can; steel can; steel drum, bung, and vent
Trisodium phosphate	Steel drum
Varnish, insulating electrical	Steel drum, bung, and vent
Varnish, N.O.S.	Steel drum, bung, and vent
Varnish, phenolic resin	Steel drum
Xylene	Tin can; steel can; steel drum, bung, and vent
Zinc quick cold galvanizing	Plastic bottle; plastic-lined steel drum

Table 050-9-4. Radiac Points of Contacts

Activity7	TELEPHONE NUMBERS
Radiac Calibration Laboratory Supervisors	
Norfolk Naval Shipyard (UIC 00181)	(804) 396-3765 DSN 691-3945
Portsmouth Naval Shipyard (UIC 00102)	(207) 438-2747 DSN 684-2747
Puget Sound Naval Shipyard (UIC 00251)	(206) 476-2905/7249 DSN 439-2905/7249
Pearl Harbor Naval Shipyard (UIC 32253)	(808) 474-7215
Naval Submarine Support Facility Groton CT (UIC 68316)	(203) 449-4760 DSN 241-4760
US Space and Naval Warfare Systems Facility Pacific Naval Electronic Engineering Activity, Yokosuka, Japan (UIC 66120)	DSN 243-7533
Naval Electronic Systems Engineering Center San Diego (UIC 05584)	(619) 556-7363 DSN 526-7363

Table 050-9-4. Radiac Points of Contacts - Continued

Activity7	TELEPHONE NUMBERS
Radiac Calibration Laboratory Supervisors	
Naval Electronic Systems Engineering Center Detachment, Ma ort (UIC 41426)	(904) 241-6177 DSN 960-6177
Atlantic Ordnance Command Det Yorktown Yorktown VA (UIC 00109)	(804) 887-4583/4962 DSN 953-4583/4962
U.S. Naval Station Rota, Spain (UIC 62863)	COM (Int'1) 011-34-56-82-2359 DSN 727-2359

SECTION 10

RETURN TO ACTIVE STATUS

050-10.1 PURPOSE

050-10.1.1 General. The procedures and instructions contained in the following paragraphs are presented primarily for information and general guidance concerning reactivation of ships that are OCIR or OSIR; they are also applicable to ships ICIR or ISIR. They are based on the assumption that preparation of a ship for return to active status will be under conditions of national emergency when time is of the essence and mass reactivation of all ships has been ordered. While it is realized that on many occasions during peacetime, ships may be returned to active status when time is not pressing, nevertheless it behooves all personnel concerned to carry out the procedure with utmost dispatch in order that experience may be gained for rapid mobilization.

050-10.2 PROCEDURE

050-10.2.1 General. The procedure discussed herein covers the period from the time of receipt of the order to place the ship in active service until sea trials are conducted and the ship is ready for transfer to the active fleet. This period may be broken down into steps as follows:

a. The INACTSHIPMAINTO commences removing D/H and cathodic protection equipment, removes as much sealing material as possible, and prepares the ship for tow to the reactivation site. Concurrently, the receiving agent coordinates towing arrangements and delivery of the ship and its updated reactivation work package to the Supervisor of Shipbuilding, Conversion and Repair of the local Naval District, or to the naval shipyard designated to handle industrial activation work. The planning activity accomplishes planning and procurement for the activation and schedules the activation.

b. The ship's nucleus crew, the industrial planning representative, and the industrial facility jointly accomplish the activation, with the actual division of the activation work load dependent on availability of the ship's crew.

c. Toward the end of the reactivation and calibration period, equipment and system checkout are completed, shipboard training of the full crew begins, and trials are run.

d. After commissioning, final outfitting and training is accomplished, and the ship joins the active fleet.

050-10.3 PREPARATORY STEPS

050-10.3.1 General. The following procedure is for general guidance in the preparation of the ship for return to active status.

a. Prepare the ship to become self-sufficient in berthing and messing. This will normally require accomplishment of the following work:
   1. Removal of D/H equipment and opening up of the ship.
   2. Activation of living and berthing spaces.
   3. Activation of galley.
   4. Activation of refrigeration spaces and equipments.
   5. Activation of ventilation systems.
   6. Activation of electrical, fresh water, fire main, and plumbing systems as required for berthing and messing. This will include removal of external and internal blanks and reassembly of systems that have been left disassembled, such as the fire mains used for distribution of dehumidified air.
   7. Tanks have been ballasted with freshwater per towing vessel and paragraph 050-3.5.3.4.

b. Sea connection closure blanks may be removed when the ship is either in drydock or waterborne. If the ship is waterborne, tools designed for underwater use should be used.
   1. If the blanks were originally installed when the ship was in drydock, they may be removed by grinding, chipping, or burning, or other convenient means. Blanks that were originally installed by wet welding can be removed only by grinding or chipping. Burning (either oxyarc or flame) cannot be used successfully to cut wet welds because of the metallurgical properties of wet welds. Wet welds are austenitic in contrast to the hull and blank material and surface welds that are ferritic. All traces of austenitic wet welds must be removed by chipping or grinding to prevent serious cracking of the hull during rewelding using ferritic electrodes. Complete removal of the austenitic weld metal should be verified by using the acid test described in NSTM S9086-CH-STM-010 Chapter 074, VOLUME 1, WELDING AND ALLIED PROCESSES when the ship is drydocked as part of the activation operation.
   2. Closures should be inspected prior to their removal. All pad-eyes should be examined to ensure that they have not been broken off or damaged. Pad-eyes on the hull should be used as a point to secure the closure during the removal operation, and tap lines should be attached to the closure prior to removal. All rigging should be installed to ensure that the closure can be safely brought to the surface once it has been removed from the hull.
   3. All weld removal areas shall be inspected while the ship is in drydock by magnetic-particle techniques to ensure that these areas are free from cracks. If any cracks are present, they shall be removed and repaired in accordance with NSTM S9086-CH-STM-010 Chapter 074, VOLUME 1, WELDING AND ALLIED PROCESSES.
   4. If activation is for an emergency temporary situation where drydocking cannot be accomplished, the acid test (subparagraph a) and the magnetic-particle inspection (subparagraph c) shall be performed during the next availability of the ship for drydocking. Prior to this drydocking, the hull condition shall be considered a temporary condition.

c. Upon arrival of a substantial portion of the officers and men, the mess should be established and the crew berthed on board. The Commanding Officer, when directed by competent authority, should proceed with the ship's force portion of the activation work package in coordination with the planning activity and the industrial facility. The SUPSHIPS (or CO, Naval Shipyard) will supervise the industrial activation work.

d. Deficiencies will normally have been recorded by the ISSOT during inactivation, and will have to be requisitioned in conjunction with fitting out.

e. Before the operation of any machinery, check the machinery history, Current Ship's Maintenance Project record, ordnance repair records, and other material records and technical manuals.

f. Repair as necessary all D/H or cathodic protection equipment not required for immediate use on other ships. Package and store by INACTSHIPMAINTO for reinstallation aboard ships to be inactivated in the future. Stowage under D/H aboard a ship not to be activated is recommended where practical. Anodes should be stowed so as to prevent breakage. If quantities exceed the stowage facilities available, make disposition in accordance with NAVICP, Mechanicsburg or NAVSEA instructions as applicable.

050-10.4 MATERIAL CONDITION

050-10.4.1 General. In general the condition of the ship's machinery, electrical, and other equipment is to be accepted as that represented by the INACTSHIPMAINTO and as shown by the various material history records. The importance of keeping these records complete and up-to-date cannot be overemphasized. This includes all deficiencies noted and corrected at the time of inactivation, during inactive status, and during the activation period.

050-10.5 ACTIVATION WORK PACKAGE

050-10.5.1 General. The activation work package will include all known work, both for the ship's force and the shipyard, necessary to activate and repair the ship. Work requests are filled out on the standard forms (OPNAV 4790/2K) at inactivation and are added to as necessary by the INACTSHIPMAINTO during the ship's inactive period.

050-10.6 REPAIRS AND ALTERATIONS

050-10.6.1 General. In general, complete the repairs required to place installed units in operating condition as a part of activation. The quantity of repairs required will be greatly reduced where the ship has been properly inactivated and maintained. Docking should not be required for activation.

050-10.6.2 Preservatives. Removal of preservatives is not required for the sake of appearance. It need not be removed from the exterior of machinery, repair parts and stores, or bright work, and so forth, as its use will reduce upkeep and will not detract from the appearance or use of the unit. Refer to Section 4. Thin-film rust-preventive compound, grades 2, 3, and 5, should be removed from the interior of main propulsion, auxiliary machinery, and machinery piping systems. Refer to paragraph 050-10.7. The removal of grade 1 should not be necessary except for cleaning prior to reapplication or where the surface must be painted, in which case it may be removed with hydrocarbon solvent.

050-10.6.3 Alterations. Alterations will not be accomplished in activating units except as may be separately directed.

050-10.7 TRIALS

050-10.7.1 General. In general, place all machinery, equipment, and systems in proper operating condition with appropriate tests and calibrations. This is required for successful completion of the limited trials specified by General Instructions for Inactive Ships and Craft.

050-10.7.2 Pre-Trial Work. Prior to the operation of installed machinery, all external blanks must be removed. Diver inspection of propellers, shafts, struts, rudders, and stern and strut bearings is recommended, where time and facilities will permit, prior to conducting dock and underway trials. Blanks placed on sea connections should be removed in drydock rather than by divers since magnetic particle inspection of the hull is required after cutting off the blanks.

050-10.7.3 Preliminary Dock Trials. Stern tubes and sea chests filled with petroleum are to be thoroughly flushed to ensure free circulation, stern tube packing relieved, and shaft locks removed. Conduct preliminary dock trials with the assistance of the activation instruction team. Conduct trials as early as practical in order to permit accomplishment of required repairs, calibration, and adjustment without delay of the activation of the ship concerned.

050-10.7.4 Electrical Trials. Electrical apparatus may be tested using available outside power

a. When switchboards have been deenergized for an extended period, megger the switchboard to ensure there are no faults or grounds before power is returned to the switchboard. Make this insulation resistance check with all switches and circuit breakers opened. Each leg of the bus should be checked as indicated in NSTM S9086-KC-STM-010 Chapter 300 ELECTRIC PLANT-GENERAL. The insulation resistance values measured are to be considered satisfactory if they are not less than one megohm; however, if any measurements show values below the minimum, the cause of the low insulation resistance shall be located and corrected.

b. Test all electrical circuits before energizing.

c. Examine electric motors and generators to ensure that they are free of foreign material and grease or preservative on the insulation. If preservative or grease has been deposited on the insulation, it may be necessary to remove the units involved, clean, reinsulate, and bake to ensure satisfactory operation. Check to ensure freedom of movement and proper lubrication of the bearings, prior to and during test operation.

d. Check all electrical systems and components before they are energized and operated.

050-10-8. INVENTORY AND FITTING OUT

050-10.8.1 General. An accurate and complete physical inventory based upon correct and up-to-date allowance lists is mandatory for each ship. All items not on hand must be covered by requisitions, copies of which must be forwarded to the assigned supply activity. The use of repair parts and allowance material from ship's stock for activation purposes should be resorted to only in an emergency. Replacement action must be promptly initiated whenever this procedure is resorted to; cannibalization of other inactive ships is prohibited except where prior approval of the Chief of Naval Operations has been obtained.

050-10.9 SUMMARY

050-10.9.1 General. The following information is included as a brief description of common deficiencies that have occurred during past reactivations:

a. Incorrect or missing allowance books, current ship's maintenance project records, machinery history records, electronic installation records, and other hull and machinery records.

b. Deterioration of exposed topside units that have not been properly preserved or protected by D/H.

c. Non-availability of repair parts and consumables required for activation.

d. Extensive repairs to ferrous piping, valves, and regulators. Proper inactivation must include accomplishment of outstanding urgent repairs together with thorough cleaning, drying, and preservation of all internal surfaces. Disassembly of steel bodied valves and regulators may be required in many instances to ensure that proper cleaning and preservation measures are applied.

e. Extensive repairs to auxiliary machinery and galley equipment. This is to be anticipated where ships have been utilized for berthing and messing purposes over an extended period of time and have not been properly repaired at a subsequent time.

f. Deterioration of exposed electrical wiring, switches, outlets, navigational lights, kickpipes, and so forth. Proper inactivation together with frequent inspections and maintenance are required to prevent deterioration of these units.

g. Failure of electric motors and generators after they have been placed in operation. Extensive tests indicate that electrical equipment does not deteriorate because of D/H. Where inspection reveals that units are dirty, oil soaked, or inadvertently coated with solvent cutback corrosion preventive, the electrical portions are to be removed, thoroughly cleaned, reinsulated, and baked before they are placed in operation.

h. Extensive replacement of boiler tubes during activation. Take every precaution to ensure that those boilers that are washed for cleaning during inactivation are fired immediately following the washing period for a sufficient length of time to ensure the complete dryness of the boiler brickwork (paragraph 050-3.6.2).

i. Extensive repair and replacement requirements for damage control and firefighting equipment. All equipment must be placed in good operating condition, thoroughly cleaned, properly preserved, and stowed in dehumidified spaces at the time of inactivation.

050-10.9.2 Removal of MIL-C-16173 Compounds During Activation. Where lanolin-based products have been used on exterior surfaces that will be handled or where the presence of a soft film may be undesirable on an active ship, the surface may be cleaned by wiping down with rags. Similarly, where NAS was used on exposed hydraulic cylinder rams, Rapson slides, etc., wiping down the surface with rags will be adequate prior to returning the equipment to service. Where LIQUID A was used on machinery internals normally lubricated with oil, no specific action is required to remove the residual LIQUID A prior to adding the equipment's normal lubricant. Where LIQUID A was used to preserve water cooling systems, hot water flush (110°F or hotter) with mild detergent will be adequate to remove the film.

SECTION 11
DETAILED REACTIVATION INSTRUCTIONS

050-11.1 AUXILIARY TURBINE LUBRICATING OIL SYSTEMS

050-11.1.1 Preservatives.

a. Remove steam strainer bonnet and basket. Provide and install a blank flange with a temporary connection for air or shore steam.

b. Clean all oil surfaces in reservoir through hand hole openings, using clean lint-free rags dipped in turbine cleaning oil, MIL-C-15348. Remove all rags after completing cleaning.

c. Fill oil reservoir with turbine cleaning oil and circulate through system by means of a portable pump, maintaining cleaning oil at a temperature of 130°-135°R Equip the portable pump with a suction strainer or filter. Where strainers are used, install muslin bags in accordance with paragraph 050-11.17.1.3. Jack turbines over by hand while circulating oil. Make examinations in accordance with paragraph 050-11.17.1.3. Circulate cleaning oil until the muslin bags are free of solid contaminant. Examine sprays and oil sight flows on bearings frequently to see that they are clear, and to make certain that proper circulation is taking place during the entire cleaning operation. Continue the foregoing operation for four to eight hours. When strainers or filters do not indicate further deposit of dirt, remove cleaning oil, taking care to manually remove any remaining oil that the pump cannot take from the reservoir. Fill reservoir with displacement oil (clean used or new 2190 TEP oil). Maintain the displacement oil at a temperature of 160°-170°R Operate unit at low speed for approximately two hours using air or shore steam, then drain displacement oil. Immediately after removal of displacement oil, install clean nylon bags (as specified in paragraph 050-11.17.5.1) in strainer baskets and fill the sump tank with initial charge of 2190 TEP lubricating oil. This oil shall be circulated through the entire lubricating system for at least eight hours and then until nylon bags no longer accumulate foreign matter. While oil is being circulated through the system, take samples from sump tank and test in accordance with MIL-L-17331 for foaming and contamination. If samples fail to pass minimum requirements for new oil, repeat the flushing procedure as necessary until requirements are met. In cases where worm gears are installed, 3080 oil should be used in lieu of 2190 TER Check bearing temperatures while unit is operating. For precautions, refer to paragraph 050-11.18.

d. Circulation of cleaning oil through the governor may not be adequate. If upon trial, the governor does not function properly, dismantle and clean manually.

e. Remove carbon packing during activation. Before installation of the carbon rings, wipe the preservative from the shaft in way of the carbon packing with a clean lint-free rag dipped in cleaning oil. After complete removal of the preservative, dry shaft thoroughly. Ensure no preservative remains on shaft; for example, as in the casing grooves when the packing is installed. Every precaution must be taken to prevent damage to any of the sections of packing. Do not permit carbon packing to come in contact with oil or grease.

f. Clean and replace the steam strainer basket.

050-11.2 PRELIMINARY AIR PRESSURE TEST OF PIPING SYSTEMS

050-11.2.1 General. Air tests are desirable for preliminary testing of various piping systems in order to detect the presence of loose flanges and fittings, unpacked valves, deteriorated piping, and other defects before application of hydrostatic and operating tests incident to reactivation. Systems that may be tested by this method are:

a. Main steam.

b. High-pressure auxiliary steam.

c. Low-pressure auxiliary steam.

d. Auxiliary steam-exhaust.

e. Steam heating.

f. Fire and flushing.

g. Cooling water.

h. Fresh water.

050-11.2.2 Low Pressure Air Tests. Prior to hydrostatic tests or admission of dock steam for the removal of solvent cutback corrosion preventive, admit low pressure air to each of the systems listed above. The test is made after piping has been assembled. Each section of a system is tested separately. After completion of the sectional tests, test the entire system. Low pressure air tests are preliminary tests for locating obvious leaks and are designed to reduce the entry of water into the ship during the process of removal of oil solvent cutback corrosion preventive. Further operating and strength tests will be made in accordance with applicable paragraphs of this chapter.

CAUTION

A relief valve set at 5-psi shall be installed in each system under test.

050-11.3 AUXILIARY STEAM AND AUXILIARY EXHAUST SYSTEMS

050-11.3.1 General. Clean the 150-psi auxiliary steam system with shore steam via shore steam connections. Open all line valves and crack all funnel drain valves sufficiently to allow the rust-preventive compound to drain to collecting tanks, with minimum loss of steam. Instructions for cleaning the tanks are given in paragraph 050-11.13. During early stage of cleaning, allow condensate to drain to collecting tank and during later stage to deaerating feed tank via the high-pressure drain main. Check high-pressure drain valves slightly and allow flow through the high-pressure drain lines for at least 1 hour. Before discharging to the high-pressure drain, remove strainer and internal parts of drain traps. Before discharging to deaerating feed tank, ascertain that the tank relief valve is in operating condition and tank drain valve is open so as to prevent over pressurizing the tank. Circulate shore steam until no sign of rust-preventive compound is present in drainage from the lines. Clean traps and replace strainer and internal parts after system has been cleaned. Renew strainer and internal parts or traps, if necessary.

050-11.3.2 600-psi Auxiliary Systems. The 600-psi auxiliary steam and auxiliary exhaust systems are to be cleaned simultaneously with the steam end of auxiliary equipment. Admit shore steam into 600-psi auxiliary steam line via the 150-psi bleeder valve bypass line. Open all line valves (except valves servicing equipment) and drain the preservative and condensate from the lines via funnel drains and thermostatic traps.

050-11.3.3 Auxiliary Exhaust System. Remove all strainer baskets and trap bellows in auxiliary exhaust drain lines and replace covers before admitting steam to the exhaust line. Place baskets and bellows after cleaning is accomplished. Renew baskets and bellows if necessary. Open auxiliary exhaust main drain valves sufficiently to

permit draining of the line. Close valve connecting auxiliary exhaust main to deaerating feed tank to prevent loss of steam to deaerating feed tanks. Allow drainage from the auxiliary exhaust line to drain to the drain collecting tanks.

050-11.3.4 Steam End Cleaning. Clean the steam end of auxiliary equipment. While removing the compound, the equipment should not be operated until the lubricating system is, activated, nor is steam to be admitted to steam chests until rotor can be rotated by hand. Pumps should not be operated in a dry condition during cleaning of steam end.

a. Salt water pumps. Open pump suction and discharge valves, as necessary, to take suction from and discharge to the sea. Open the exhaust valves and admit steam to the turbine. The turbine casing drains should be opened intermittently to allow any accumulated rust-preventive compound to be drained. Rotate until no rust preventive compound is discharged from the casing drains. When the turbine is assumed clean, close steam and exhaust valves.

b. Forced draft blowers. Forced draft blower lubrication systems should be initially cleaned and operated as indicated above. The blower fan wheel and rotating parts are to be carefully wiped clean of all preventatives. Any uneven distribution of weight will cause unbalance and consequent vibration at high speeds. After final flushing, refilling, and remaking the steam joints, open the auxiliary exhaust valves and admit steam to the turbine. Repeat procedure listed for salt water pump turbines (subparagraph 050-11.3.4.a.) to remove all rust-preventive compounds. Accomplish initial operation on steam at less than half speeds and for a sufficient period to assure the operator that all rust-preventive has been removed and all control and governing mechanisms are operating properly and freely. Bring blower slowly up to rated speed, carefully noting that no unusual noises develop and that the unit is free from vibration throughout its speed range. Observe oil pressure closely. Proper oil pressure is an indication of adequate flow, provided no oil supply lines to the individual bearings are still plugged by hardened corrosion preventive compound. Where blower design provides thermometers at the bearings, the blower should be shut down if the temperature exceeds 200°R Where no thermometers are installed but the bearing housings are exposed, blowers should be shut down if housings become so hot that the hand cannot be held on the housing. In either case, no oil flow or inadequate oil flow is indicated. The bearing and attached piping or oil passages to the bearing should be inspected to ensure adequate flow before again running the blower. The blower should be operated about 30 minutes at rated speed, then slowly decelerated. After securing blower, make a final check to verify that no residual preventive compound has contaminated the lube oil system. If any traces of contamination are detected, drain system and refill with clean oil.

c. Fuel oil pumps. Open steam inlet and exhaust valves of the steam turbine and repeat procedure listed for saltwater pumps. In order not to run the transfer pumps dry, fuel oil should be transferred from one tank to another. The oil discharged from the service pumps should be recirculated back to the pump suction via the burner manifold.

d. Condensate pumps. The steam end of condensate pumps should be cleaned simultaneously with the cleaning of the condensate piping. Refer to paragraph 050-11.7. The procedure listed for saltwater pumps should be followed.

e. Feed pumps. Clean the steam end of feed pumps simultaneously with cleaning of feed piping. Refer to paragraph 050-11.8. The procedure listed for saltwater pumps should be followed.

f. Lube oil pumps. Clean the steam end of the lubricating oil pumps simultaneously with cleaning of lubricating oil piping systems of main propulsion turbines and reduction gears. Refer to paragraph 050-11.8.3.

050-11.3.5 Post Cleaning Operation. After auxiliary turbines have been cleaned, continue operation of sufficient turbines to ensure an adequate flow of steam to auxiliary exhaust main in order to remove any compound that may remain in the line. Discharge steam until no sign of rust-preventive compound is present in drainage from the lines.

050-11.4 MAIN STEAM PIPING

050-11.4.1 General. Clean the main steam piping with shore steam via the superheater protection lines where provided. Where superheater protection connections are not provided, make a temporary hose connection at a drain connection and use shore steam from the 150-psi auxiliary steam main via a hose. Open all line valves except valves to boilers, main turbines, and turbo-generators. Crack all funnel drain valves sufficiently to allow rust-preventive compound to drain with a minimum loss of steam. (Cleaning is not required for latest inactivations, but check preservation of steam systems carefully before activating.)

050-11.4.2 Drainage. During early stages of cleaning, allow condensate and rust-preventive compound to drain to the drain collecting tank and during later stage to deaerating feed tank via the high-pressure drain main, as described in paragraph 050-11.3.1.

050-11.5 FUEL OIL HEATING COILS

050-11.5.1 General. Remove the strainer and bellows from all traps. Discharge shore steam via the 150-psi system through the coils, allowing drainage to fuel oil inspection tanks. Drain inspection tanks to the bilge. After the tank heating coils have been cleaned, discharge steam for at least an hour through drain piping between inspection tank and deaerating feed tank. Remove any condensate remaining in drain piping. Keep deaerating feed tank drain valve open to prevent pressure build up. Replace strainers and bellows in all traps.

050-11.6 STEAM HEATING SYSTEM

050-11.6.1 General. Clean the steam heating system with shore steam via the reducing valve (150-psi – 45-psi). Before admitting steam, ascertain that the reducing valve is in operating condition; clean if necessary. Remove the strainers and bellows from all traps. Allow condensate to discharge to the drain collecting tanks. (Tanks cleaned later, refer to paragraph 050-11.13.) Do not permit drainage to reserve feed tanks. Circulate steam until drainage from the system indicates no rust-preventive compound present.

050-11.7 CONDENSATE AND FEED SYSTEM

050-11.7.1 Cleaning Solution and Methods of Sampling. Use or modify existing connections to discharge shore steam to the hot well of main and auxiliary condensates.

050-11.7.2 General. Open a vent on turbine exhaust casing (a relief valve connection, manhole, or other opening) and fill the condensers to a height just above last row of tubes with fresh water and the following solution: A 2 percent solution of sodium metasilicate pentahydrate (167 pounds of salt for each 1,000 gallons of water capacity) plus a 0.1 percent solution of a wetting agent (8.3 pounds for each 1,000 gallons of water capacity). The wetting agent is obtainable from standard stock. The solution can conveniently be mixed by almost filling a 55 gallon drum with water, heating with steam, and introducing no more agents than will completely dissolve, ensuring that for each 20 pounds of sodium metasilicate pentahydrate introduced, one pound of wetting agent

must be added. The sodium metasilicate pentahydrate should be added and dissolved before adding the wetting agent. Sodium metasilicate, Federal Specification O-S-64 is available in standard stock.

050-11.7.3 Sampling Cleaning Solution. Using a 100 ml graduated cylinder or equivalent, take a sample of the circulating cleaning solution at a drain connection. Note amount of oil and residue present; also note color of the solution. Repeat this sampling at 15 minute intervals. When sample is free of visible oil, and color and amount of solid residue become substantially constant, it can be assumed that this section of piping is acceptably clean.

050-11.7.3.1 Post Flushing Test. Repeat the preceding tests after flushing with hot filtered fresh water. The sample shall be free of oil. The color and amount of solid residue shall remain substantially constant.

050-11.7.4 Condensers, Condensate, and Air-Ejecting Piping Systems (No. 1 Engine Room). In order to clean the condensers, condensate, and air-ejecting piping systems, the following procedure is to be accomplished. See Figure 050-11-1.

a. Fill number one main and auxiliary condenser with the cleaning solution specified in paragraph 050-11.7.1 and heat to 71°C (160°F).

b. Remove all orifices in condensate lines. Install a temporary 20 mesh basket type strainer in condensate pump suction with an internal muslin bag.

c. Circulate heated cleaning solution from main condenser No. 1, through air-ejector condenser No. 1, vent vapor cooler, and back to main condenser No. 1 via recirculating line using main condensate pump No. 1. Circulate cleaning solution for a minimum of 1 hour until it is determined the condenser and section of piping through which the cleaning solution is discharged is clean. Determine this by inspection or by taking samples of the solution and testing in accordance with instructions given in paragraph 050-11.7.1. Inspect the muslin bag in the temporary strainer basket as often as necessary.

d. When the condenser and section of piping are cleaned and provided the solution is usable, as determined in paragraph 050-11.7.1, transfer the cleaning solution to main condenser No. 3 in same engine room via main condensate pump No. 2 and the recirculating line.

e. Repeat the procedure in paragraph 050-11.7.4.3 using main condensate pump No. 3 and main condenser No. 2; heat cleaning solution if necessary.

f. When this section of piping is assumed clean, as determined in paragraph 050-11.7.1, and if the cleaning solution is still usable, transfer it to a main condenser in after engine room, via condensate cross-connection line with main condensate pump No. 4. Repeat the procedure for the auxiliary condensate systems, except that after the piping for auxiliary condenser No. 2 has been cleaned and the solution is still usable, it should be used for cleaning the section of condensate piping leading to the deaerating feed tank in lieu of discharging it through the main condensate cross-connection to the after engine room. Refill the auxiliary condenser as necessary to clean the condensate line leading to the deaerating feed tank. Should the condition of the cleaning solution be such that it can be used again, it can be retained in the deaerating feed tank for cleaning of the feed system.

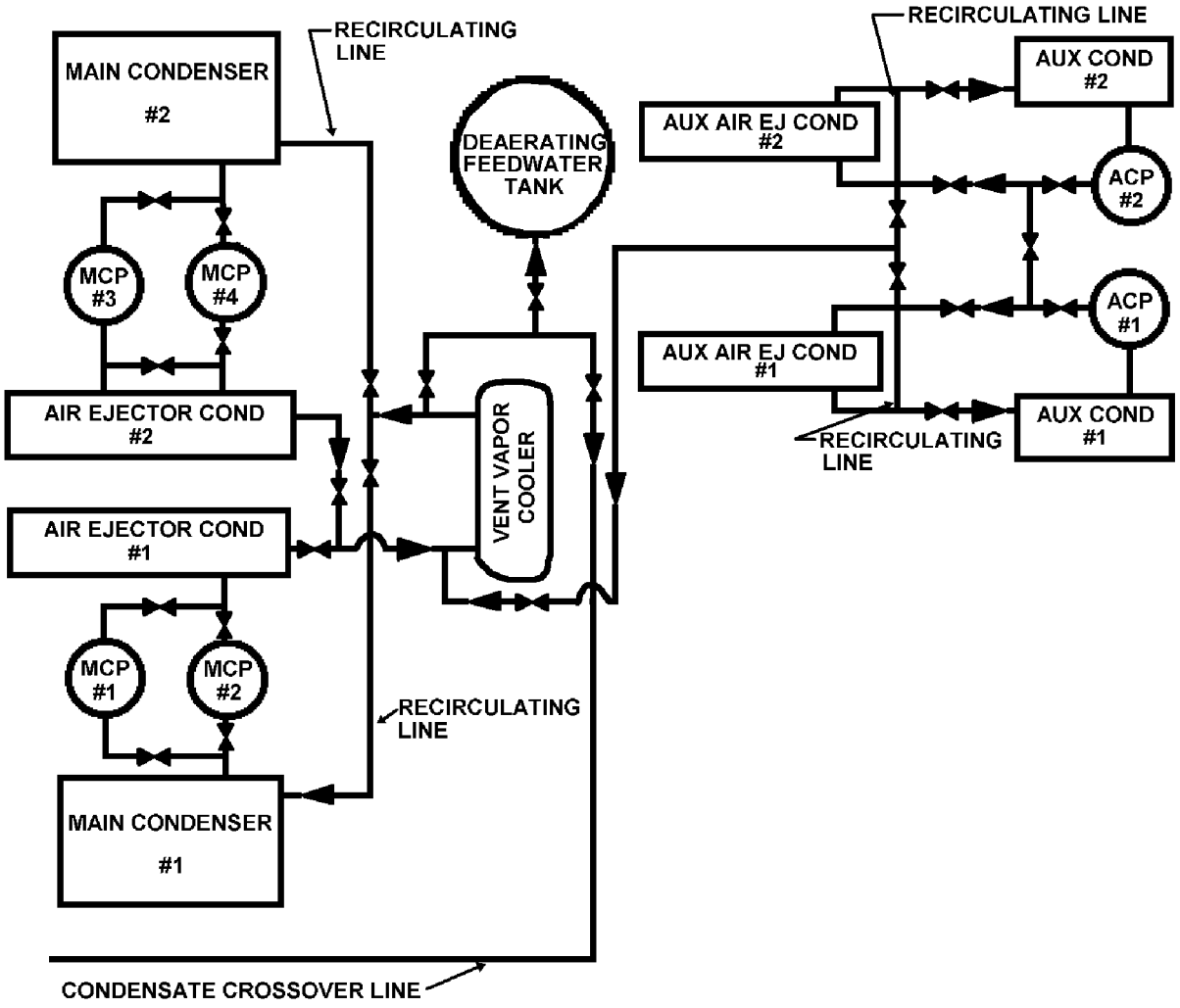


Figure 050-11-1. Cleaning Feed System

050-11.7.4.1 Examine The Waterside. If any of the outer metallic packing rings have mushroomed out of the glands, they are to be removed. The inner rings should be lightly caulked into position and new outside metallic rings installed to complete the set. Packing procedure is covered by NSTM S9086-HY-STM-010 Chapter 254, CONDENSERS, HEAT EXCHANGERS, AND AIR EJECTORS.

050-11.7.4.2 Steam Side. After necessary caulking and repacking has been completed, the steam side of the condenser should be filled with fresh water and allowed to stand for 72 hours. The water should then be heated to approximately 41°C (105°F), and maintained at that temperature for a period of approximately 48 hours. Apply air pressure of not less than five psi and not more than 15 psi to the steam side above the water and examine the tube sheets for leaks. Testing for tube leaks with air pressure is described in NSTM S9086-HY-STM-010 Chapter 254, CONDENSERS, HEAT EXCHANGERS, AND AIR EJECTORS.

050-11.7.4.3 Fiber Rings. The fiber rings used in metallic packing expand when in contact with moisture, creating a leak proof seal. Under dehydrated preservation, the fiber rings lose the moisture and contract. Application of an air pressure test before these rings have an opportunity to absorb the necessary moisture to expand to their original condition is, therefore, impractical and should be avoided.

050-11.7.4.4 Condensers. The foregoing instructions apply only to condensers having packed tube joints. For condensers having both inner and outer tube joints expanded, no special preparation is required prior to making the air pressure test. The test should be made, however, before placing these condensers in service.

050-11.7.4.5 Operation. Observe control valves and control equipment immediately upon resuming operation of a system to determine whether or not they are operating satisfactorily. Where faulty operation is observed, the equipment is to be disassembled and hand cleaned.

050-11.7.5 Condensers, Condensate, and Air-Ejecting Piping Systems (No. 2 Engine Room). Repeat the procedure in paragraph 050-11.7.4 for the condensate and air-ejecting system in the after engine room. However, if the condensate cross-connection line is considered clean, the main condenser is to be emptied to the bilge. If the cross-connection line is not clean, transfer the clean solution back and forth between one of the main condensers in the forward and after engine rooms until the line is clean, as determined by paragraph 050-11.7.4, then run the cleaning solution to the bilge.

050-11.7.6 Flushing Condensers, Condensate, and Air-Ejecting Piping Systems (No. 1 and No. 2 Engine Rooms). After cleaning with the cleaning solution, fill the No. 1 main and auxiliary condensers in the No. 1 engine room with hot (71°C (160°F)) filtered fresh water. Repeat the procedure as outlined in paragraphs 050-11.7.4 and 050-11.7.5 using the fresh water. While flushing, inspect the pump packing and repack if necessary. Repeat flushing until the system is clean. Drain water from the system and dispose of it, replace all orifices.

050-11.8 DEAERATING FEED TANK AND FEED PIPING SYSTEMS

050-11.8.1 No. 1 Fire and Engine Rooms. In order to clean the deaerating feed tanks and the feed piping system, the following procedure should be accomplished. See Figure 050-11-2.

a. Fill the deaerating feed tank in the forward engine room with cleaning solution in the proportions listed in paragraph 050-11.7.1 and heat to 71°C (160°F) with shore steam via a bottom drain or filling connection.

b. Do not allow the pressure in the deaerating feed tank to build up above the relief valve setting.

c. Remove all orifices in feed system lines. Install a temporary 20 mesh basket type strainer in main feed booster pump suction with an internal muslin bag.

d. Open vent condenser connection to the atmosphere.

e. Remove the flanged bonnet internal parts from the check side of boiler feed stop, check valves, and replace with a blank bonnet flange provided with a hose adapter. Run a steam hose from this connection to the deaerating feed tank. Do this for each boiler.

f. Circulate cleaning solution from deaerating feed tank through the actuated main feed booster pump No. 1 and back to deaerating feed tank via the pump recirculating line until this section of piping is clean. Inspect and renew muslin bag in temporary strainer basket as often as necessary. This should be performed on the remaining main feed booster pumps, operating one pump at a time. Where booster pump recirculating lines are not installed, it will be necessary to circulate cleaning solution through the booster pump to main feed pump, then through feed pump recirculating line and back to the deaerating feed tank.

g. After booster pumps have been cleaned, use one booster pump to transmit cleaning solution to the main feed pumps. The main feed pumps should be cleaned in the same manner as booster pumps in step 6.

h. Where an independent emergency feed pump suction line is provided from the deaerating feed tank, circulate cleaning solution from feed pump back to the deaerating feed tank via the hose attached to the boiler feed stop and check valve. This procedure will require operation of a booster pump and the emergency feed pump. Circulate until this section of piping is assumed clean as determined by paragraph 050-11.7. l.

i. Using a main feed booster pump and a main feed pump, circulate cleaning solution through boiler feed line of each boiler and back to deaerating feed tank via hose connected to the boiler feed check valve. Do not allow cleaning solution to enter boilers. Circulate cleaning solution until this section of piping and deaerating feed tank are assumed clean as determined by paragraph 050-11.7.3. All of the feed piping, except the crossover lines in No. 1 fire and engine rooms, should now be clean.

j. If the cleaning solution is still usable, transfer it to the deaerating feed tank in the after plant via one of the condensate or feed water cross over lines.

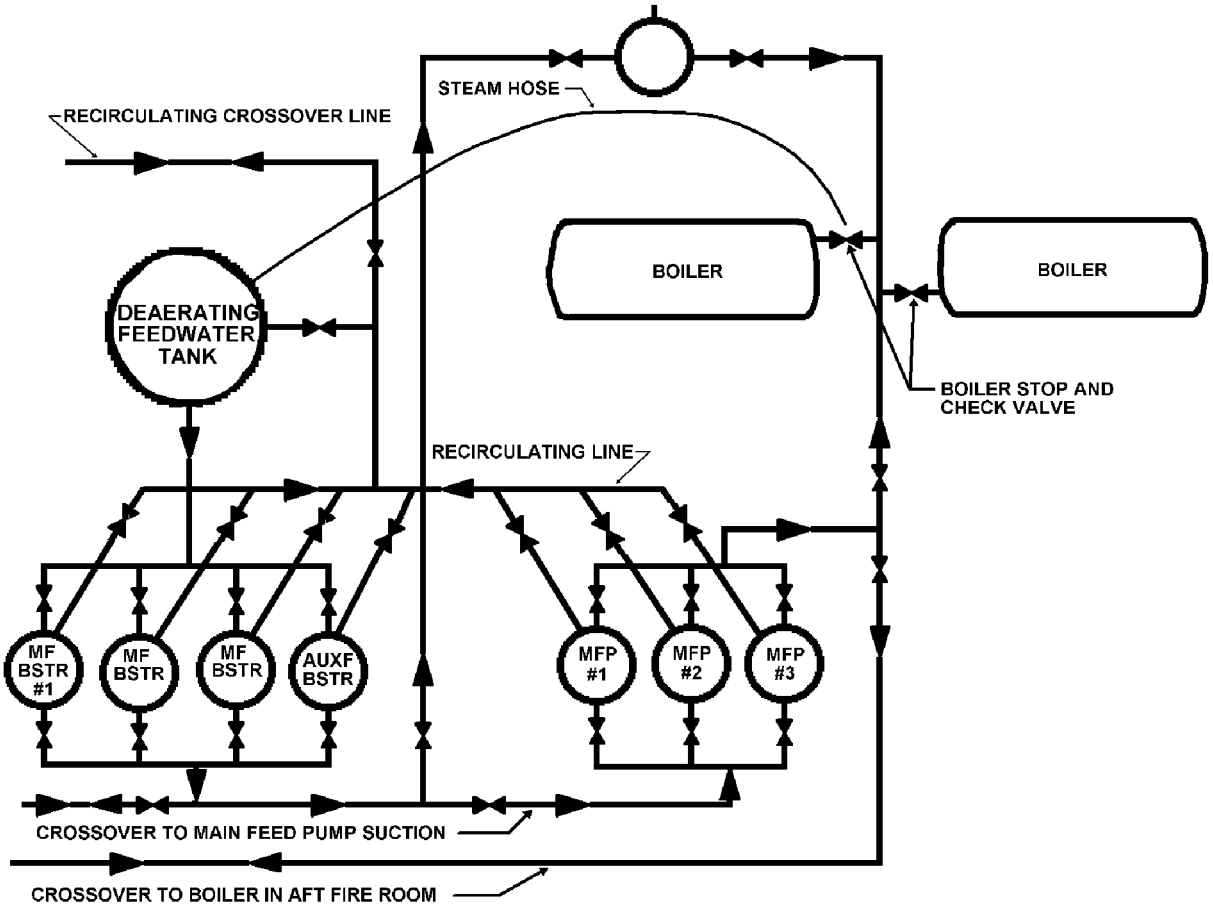


Figure 050-11-2. Cleaning Feed System

050-11.8.2 No. 2 Fire and Engine Rooms. Repeat the procedure outlined in paragraph 050-11.8.1 for the feed system in after engine and firerooms.

050-11.8.3 Feed Piping System Crossover Lines. Check cleaning solution in deaerating feed tank in after engine room. If necessary, replace cleaning solution and heat to 71°C (160°F). In order to clean all crossover lines, the cleaning solution should be transferred back and forth between the two deaerating feed tanks via crossover lines. Continue transferring cleaning solution through the crossover lines until they are clean, as determined by paragraph 050-11.7.3. When the lines are clean, empty the deaerating feed tank to the bilge.

050-11.8.4 Flushing. After cleaning with cleaning solution, fill deaerating feed tank in forward engine room with hot (71°C (160°F)) filtered fresh water.

050-11.8.5 Fresh Water. Repeat the procedures outlined in paragraphs 050-11.8.1 and 050-11.8.3, using the fresh water. While flushing, inspect pump packing, and repack if necessary. Replace all orifices, valve bonnets, and any previously removed piping.

050-11.9 RECIPROCATING STEAM ENGINES

050-11.9.1 Steam Side, Main Engine. The solvent cutback corrosion preventive shall be thoroughly removed from all steam passages such as upper and lower cylinder heads, clearance pockets, cylinder bores and pistons, steam packings, stripper rings, and piston rods. All cleaning shall be done manually with clean lint-free rags dipped in cleaning oil.

050-11.9.2 Engine Lubricating System, Skinner Engine Type. The cleaning of the engine lubricating oil system shall be done similar to that for the oil system of main propulsive steam turbines and reduction gears except that it is estimated that 25 muslin bags should be sufficient for cleaning one shaft. Spray the inside of crank case from top to bottom with cleaning oil, ensuring to carefully clean piston rods, connecting rods, crankshafts, and other internal parts. Swab all internal surfaces with clean lint-free rags dipped in cleaning oil. Clean out piston rod packing oil system to eliminate all trace of rust-preventive compound.

050-11.9.3 Inspection of Bearings. The same procedure should be used for inspection of turbine bearings except that the crank shaft bearing should be inspected.

050-11.9.4 Cam Box. Remove all hand hole covers and spray all internal parts with cleaning oil and carefully wipe with clean lint-free rags dipped in cleaning oil. If upon trial the mechanism does not function properly, it is to be dismantled and cleaned manually.

050-11.9.5 Addition of Displacement Oil. Oil shall be of the type required by the particular engine.

050-11.9.6 Fill System With Navy Symbol Oil. Immediately after removal of displacement oil, install clean bags in the strainer baskets and fill sump with a full charge of unused oil of type required by the system. Circulate through entire oil system for 30 minutes or until filter bags in the strainers show no signs of compound or foreign matter.

050-11.9.7 Engines Other Than Skinner Type. The crankshaft and rods on reciprocating engines other than the Skinner type are not enclosed and lubrication is of the drip type. It is essential that oil pots and piping be cleaned thoroughly of solvent cutback corrosion preventive or sediment as found necessary.

050-11.10 EVAPORATORS (STEEL SHELLS ONLY)

050-11.10.1 General. To remove the solvent cutback corrosion preventive from the inside of steel shell evaporators, perform the following:

a. Remove relief valves on top of first and second effect shells.

b. Remove 1-1/4-inch cleanout drain connection on first and second effect shells and modify to provide a water and steam connection.

c. Fill first effect evaporator shell to a height half way on the vapor separator with fresh water via the provided water and steam connection at bottom of shell.

d. Add sodium metasilicate pentahydrate and wetting agent in the same proportion as indicated in paragraph 050-11.7.3 by means of a funnel at the relief connection.

e. Admit shore steam into the first effect shell via the provided steam and water connection. Continue boiling cleaning solution until it is assumed that the first effect evaporator is clean. In the event some of the cleaning solution should flow from the relief valve connection, drain some of the solution via the brine overboard discharge pump.

f. When first effect shell is assumed clean, determine the concentration of cleaning solution for reuse. If solution is still usable, transfer it to the second effect shell. The cleaning solution can be transferred by attaching an air hose connection installed at the relief valve opening and using air pressure to force cleaning solution into the second effect shell. Should the cleaning solution be unfit for reuse, run it overboard by means of the brine overboard discharge pump.

g. Repeat the above procedure for second and third (where provided) effect shells, using transferred cleaning solution or a new batch mixed in second and third effect shell.

h. When all effect shells are assumed clean, flush with fresh water. Remove clean out doors and 8-inch hand hold covers and inspect inside of shells.

i. Reconnect relief valves and drain connections.

050-11.11 TURBO-GENERATORS

050-11.11.1 Lubricating Oil Piping System. Clean the lubricating oil piping systems of turbogenerators as instructed in paragraph 050-11.8.

050-11.12 DRAIN TANK CLEANING

050-11.12.1 Cleaning Solution. Open the fresh water drain connecting tanks and fill with cleaning solution. Heat cleaning solution by means of a steam hose. Continue boiling solution until tanks are clean. After tanks are clean, run cleaning solution to the bilge and flush tanks with fresh water.

050-11.13 DIESEL ENGINE LUBRICATION SYSTEM

050-11.13.1 Diesel Engine Installation With Separate Sumps. Partially fill one previously cleaned storage or settling tank with cleaning oil MIL-C-15348.

050-11.13.2 General. The quantity of oil required for diesel engine installation shall be 60 percent of sump tank capacity. Temporary jumpers, such as oil-resistant hose, shall be installed as necessary to eliminate dead end leads, and to ensure complete circulation of oil. Where orifices are installed ahead of the jumper, they shall be removed for better circulation of the oil. A temporary strainer box, approximately 1/4-inch mesh, shall be installed around the lubricating oil suction bellmouth in tanks that are utilized in the cleaning procedures.

050-11.13.2.1 Diesel Engine and Diesel Generator. For diesel engine and diesel generator installations, the engine and generator proper shall be bypassed to prevent damage to internal engine parts or clogging of oil passages and clearance spaces with foreign materials dislodged from various piping systems during flushing and cleaning procedures.

050-11.13.2.2 Strainers/Filters. Circulate cleaning oil through strainers or filters. Where strainers are used, install temporary cotton bag filters inside the strainer baskets. The bag filters shall be made of cotton muslin, Fed. Spec. CCC-C-432, type 7, class 1, and are to be made 1 or 2 inches larger in diameter and 4 inches longer in length than the baskets to eliminate possible rupture and to allow for folding bag at top of basket.

050-11.13.2.3 Flushing Arrangement. Prior to performing flushing procedures as specified below, the flushing arrangement shall be tested hydrostatically with cleaning oil to service pressure to ensure tightness and prevent spraying hot oil in the compartment. During flushing, monitor the entire system to ensure any system failure is detected promptly. Heat the cleaning oil to temperatures between 54°C and 57°C (130°F and 135°F) by use of temporary heaters, or other suitable means such as tank heating coils. Oil shall be circulated throughout the system at normal operating pressure by the installed pumps or by portable pumps to purge all connected service, purifying, filling, and transfer piping. Maintain oil temperature between 54°C and 57°C (130°F and 135°F) by suitable means. Continue circulation of cleaning oil for a minimum of 12 hours until filter bags remain free of visible solid contaminants over a 2-hour period. During circulation period, shift strainer baskets and examine muslin bags in use after a pressure drop of 2 to 5 pounds is indicated on strainer gages. If the bags are coated with foreign matter, they are to be replaced with clean bags.

050-11.13.2.4 Circulate the Cleaning Oil. Circulate the cleaning oil through all parts of the lubricating oil system. This includes all nonattached lubricating oil pumps, bypass piping, and any other alternative parts of the system. Attached lubricating oil pumps, system components, and piping that cannot be properly cleaned by the oil circulating in the lubrication system, shall be disassembled and cleaned by hand, using clean rags soaked in the cleaning oil.

050-11.13.2.5 Examine Accessible Parts. After circulation of cleaning oil is completed, examine accessible parts for presence of preservative or foreign material. If any is found, continue circulation until examination indicates a clean system. Reduce cleaning oil in temperature to between 32°C and 38°C (90°F and 100°F) while maintaining circulation. Circulation may then be stopped and cleaning oil drained from the system, open tanks and wipe down with clean lintless cloth, filter elements renewed, strainers cleaned, and filter bags renewed. Remove temporary jumpers and suction strainers and replace orifices.

050-11.13.2.6 Replace Cleaning Oil. Replace cleaning oil with displacement oil, that shall be lubricating oil of the type specified for the particular system. Maintain the displacement oil at temperatures between 71°C and 77°C (160°F and 170°F). Flush the entire system by circulating displacement oil. Continue flushing until bag filters remain free of visible solid contaminants for a period of 2 hours. Drain displacement oil from system, renew filter elements, clean strainers, and remove filter bags.

050-11.13.2.7 Lubricating Oil. Where applicable, fill the system with new lubricating oil of the type and grade specified (9000 series).

050-11.13.3 Diesel Engine Installation With Self-Contained Sump . Clean the engine system in accordance with manufacturer's recommendations. Clean and flush purification, filling, and transfer piping as described in paragraphs 050-11.13.2.3 and 050-11.13.2.4.

050-11.14 STARTING DIESEL ENGINES AFTER PRESERVATION WITH COMPOUNDS

050-11.14.1 General. After the engine lubricating system has been cleaned in accordance with paragraphs 050-11.13.2.3 and 050-11.13.2.4, it may be prepared for starting using normal procedures outlined in the manufacturer's technical manual and NSTM S9086-HB-STM-010 Chapter 233, DIESEL ENGINES. Any preservatives present in the fuel system will be removed during normal operation of the engine.

050-11.14.2 Procedure. The following procedure should be followed in removing rust preventive compound from cooling system:

NOTE

The following procedure must not be used in systems containing aluminum.

a. Fill with fresh water and operate engine for 5 minutes to ensure no leaks are present in cooling system.

b. Secure engine and drain water.

c. Fill cooling system with a 2 percent sodium metasilicate – 0.1 percent wetting agent (G7930-00-282-9699) solution in clean fresh water. This solution may be made up adding sodium metasilicate in concentration of 16.7 pounds of sodium metasilicate and 0.83 pounds (approximately 0.5 pint) of wetting agent for each 100 gallons of solution required.

d. Start engine and operate for 2 hours, keeping solution temperature at 71°C (160°F).

e. Drain cleaning solution from cooling system. Flush four times with fresh water to remove all traces of cleaning solution. Break several hose connections an examine waterside to ensure it is clean.

f. If engine is not clean, reassemble, refill with cleaning solution and repeat cleaning and flushing operations.

NOTE

Run engine for 5 minutes during each flushing. Lubricating oil and water should be checked for contamination after a few hours of operation, then drained and replaced if necessary.

050-11.15 BOILER, SUPERHEATER, ECONOMIZER

050-11.15.1 General. A diagrammatic arrangement of the necessary piping for the boiling out operation is shown in Figure 050-11-3. Provide a steam connection to bottom blow or drain fittings on water drum, water screen, and water wall headers and to lowest openings in the superheater and economizer. Blank off piping connections between economizer and steam drum and, if practical, between steam drum and superheater and close all other openings. Provide independent blow-down lines from economizer vent and, if practical, independent blow-down lines from both steam drum vent and superheater vent.

050-11.15.1.1 Boiling Out Solution. Make up a separate boiling out solution of sodium metasilicate pentahydrate and wetting agent for each section to be cleaned; that is, generating, superheater, and economizer. In making up batches of solution and when adding water to generating section of boiler for removal of preservative, use distilled water if available. If sufficient distilled water is not available, fresh shore water, of hardness not exceeding 2.0 epm may be used. Make however, an analysis of the shore water in accordance withNSTM S9086-GX-

STM-020 Chapter 220, VOLUME 2, BOILER WATER/ FEEDWATER TEST AND TREATMENT, to determine its suitability. Make reference to NAVSEA if doubt exists as to the satisfactoriness of the shore water for this purpose. Determine the quantities of sodium metasilicate pentahydrate and wetting agent required in the batch for each section to be cleaned in accordance with the following formula:

Sodium metasilicate pentahydrate:

(Capacity of section (gallons) x 167 = lbs required)/1000

Wetting agent:

(Capacity of section (gallons) x 0.83 = lbs required)/1000

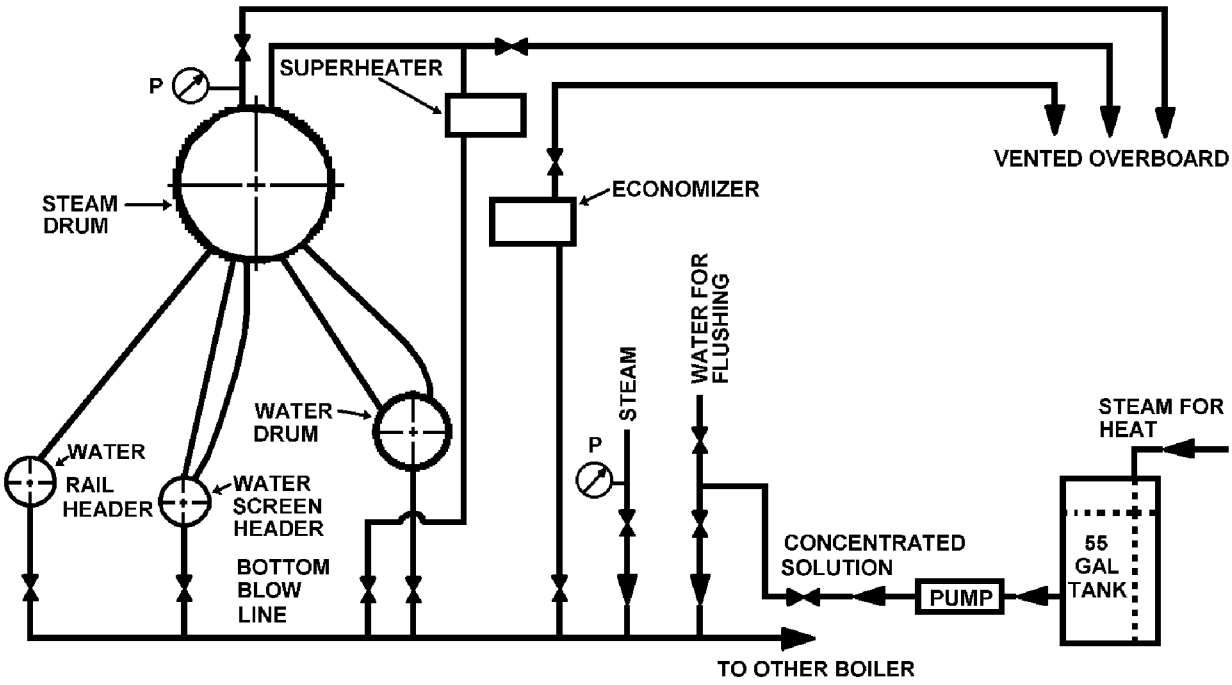


Figure 050-11-3. Boiler Boil-Out

050-11.15.1.2 Highly Concentrated Salt Solutions. Batches should consist of highly concentrated salt solutions. A batch can be prepared by partially filling a 55-gallon drum with distilled or fresh water, heating with steam, and introducing no more compound required to make a specific batch; several drum fillings may be required. After each batch of cleaning solution has been prepared, inject it into its applicable section of the boiler by use of a portable or hand pump. Then, add water to the generating section sufficient to bring the water level in sight at the lowest point in the boiler water gage glass. Do not add any water to the economizer or superheater sections after injecting the batches of concentrated solutions into those portions of the boiler. (Attention is invited to the fact that the quantities of cleaning compounds dissolved in each individual batch solution are such that after the boiling out procedure described below has progressed to the point where the accumulation of steam condensate has caused each boiler section to be completely filled, the resultant solution in each individual section will contain 2 percent sodium metasilicate pentahydrate and 0.1 percent wetting agent, by weight.)

050-11.15.1.3 Saturated Steam. Pass saturated steam to the generating superheater and economizer sections, maintaining a pressure of from 25 to 1000 psi, if available, on the boiler. The higher the pressure used, the more effective will be the cleaning action. The pressure of the steam supply should be about 25 psi higher than that of the boiler to ensure circulation. A continuous slow overflow of solution is permitted through each vent during entire boiling out period, but flow must be restricted so as not be blow out the compound. A visual examination of the vents will indicate results being obtained and whether or not it is profitable to continue boiling out operations.

050-11.15.1.4 Boiling Out. Boiling out should continue for 72 hours after obtaining the desired pressure on the boiler and after ensuring that all sections have been filled with the cleaning materials plus any condensate that may be required. At the end of boiling out operation, shut off steam supply and vent boiler to release steam pressure. The solution is then dumped, and each section is washed well with fresh, preferably hot, water. After boiler has dried, inspect each section thoroughly for cleanliness to ensure that all traces of rust-preventive compound have been removed. This may be accomplished by use of a small stream of water to determine whether or not the surface will be wetted by water or will repel water. Any compound left over would tend to form a hard adhering scale when boiler is fired. Unless boiler is scrupulously clean, a second boiling out, as outlined above, may be advisable.

050-11.16 ATOMIZERS AND BRANCH TUBING

050-11.16.1 Fuel Oil Branch Piping. Remove from boilers the fuel oil branch piping between fuel oil supply lines and burners and fuel oil return branch piping where installed. Remove atomizer assemblies from their racks or storage space and disassemble. Place disassembled atomizers and fuel oil branch piping in cleaning oil heated to 71°C (160°F) for a period of 1 hour to remove thin film rust-preventive compound from the parts. Reassemble the atomizers and return to racks. Reinstall fuel oil branch piping.

050-11.17 LUBRICATION SYSTEMS OF MAIN PROPULSION TURBINES WITH REDUCTION GEARS

050-11.17.1 General. The solvent cutback corrosion preventive must be removed prior to adding the final charge of lubricating oil to the system. Incomplete removal of preservative may result in serious emulsification of the oil. Operation with emulsified oil can result in wiped bearings with attendant damage to turbines and gears. Breaking such emulsion aboard ship, by heating, settling, and centrifuging is extremely difficult. Steam and electric power must be available before reactivation of the system is started. Once the cleaning procedure of main lubricating system is started, it must be continuous (around-the-clock).

050-11.17.1.1 Thin Film Preservative Compounds. Thin film preservative compounds are somewhat soluble in lubricating oil, and it is possible to remove these compounds by circulating 2190 TEP oil in the systems. It has been found, however, that complete removal of preservative compound and other contaminants by 2190 TEP alone may require several hundred hours of circulation. For circulation and flushing refer to NSTM S9086-H7-STM-010 Chapter 262, LUBRICATING OILS, GREASES, SPECIALTY LUBRICANTS AND LUBRICATION.

050-11.17.1.2 Lubricating Oil Piping System. Inspect lubricating oil piping system to ensure tightness of joints and connections to permit proper flow of cleaning oil to all parts of system. Inspect settling tanks, storage tanks, sumps, interior of gear cases, gear teeth, oil strainers, and other parts of the system that are accessible. Examination is to be made through inspection and cleanout openings. No gear case covers nor bearing caps should be lifted for this inspection, nor should any piping be dismantled. Remove any excessive volumes of preservative that are found. Clean internal surfaces of tanks, sumps, and gear cases of rust manually, insofar as practicable and accessible, by means of wire brushes. Wipe surfaces with clean lint-free rags dipped in cleaning oil to remove preservative and foreign matter. Main gear and turbine needle valves are to be at full open. Do not use wire brushes on gear teeth.

050-11.17.1.3 Cotton Muslin. Install cotton muslin (Fed. Spec. CCC-C-432, type 7, class 1) bag filters inside the baskets of the main lubricating oil strainers. Make the bags so that they are 1 to 2 inches greater in diameter and 4 inches greater in length than strainer baskets when installed to eliminate possible rupture of the cloth and to allow folding of bag at top of the basket. Approximately 100 bags should be available for cleaning each shaft lubricating system.

050-11.17.2 Circulation of Turbine Cleaning Oil. Partially fill one previously cleaned settling tank or storage tank with cleaning oil MIL-C-15348. Quantity of oil is to be 60 percent of sump tank capacity. Heat the cleaning oil to temperatures between 54°C and 57°C (130°F and 135°F) by temporary heaters, or other suitable means, such as tank heating coils.

050-11.17.2.1 Process of Cleaning. The process of cleaning, once started, shall be continuous to avoid condensation and redeposit of the preservative. There shall be no steaming or other events causing high moisture condition in the engine room during circulation of cleaning oil and until circulation of displacement oil has been started. Install bag filters in strainers, temporary strainers installed in sump, and temporary jumpers installed to bypass bearings and gear sprays to eliminate dead-end leads; remove orifice plates for better circulation of oil. For spraying as indicated below, a 1-inch oil-resistant hose with shutoff valve and nozzle shall be connected to a thermometer well of the lubricating oil cooler or other suitable connection.

050-11.17.2.2 Heated Oil. The heated oil shall be transferred to the sump tank. Start one lubricating oil service pump or portable pump and circulate the cleaning oil throughout the system through the strainer at normal operating pressure, to purge all connected service, purifying, filling, and transfer piping for a minimum of 12 hours. Maintain oil temperature between 54°C and 57°C (130°F and 135°F) by use of the purifier heater or other suitable means. During circulation, the system piping shall be vibrated periodically by use of a wooden mallet.

050-11.17.2.3 Filter Bags. When filter bags do not show any evidence of contamination for a period of 2 hours, open the inspection covers of main reduction gears and turning gear cases. Spray the turning gear thoroughly until clean. Spray the gear and gear cases thoroughly through the inspection openings. Starting at top of case, gear cases and gear elements shall be flushed down until clean.

050-11.17.2.4 Removal of Preservative Coating. Removal of preservative coating by vapor from hot cleaning oil is not an acceptable substitute for cleaning by direct contact with cleaning oil because the oil contains a rust inhibitor that is not present in the vapor phase.

050-11.17.2.5 Quill Shaft Flexible Coupling. Spray quill shaft flexible couplings thoroughly by extending hose nozzle to ends of gear case. If couplings are not accessible, remove end covers at end of cleaning period and wipe couplings clean of preservative, using lint-free rags soaked in cleaning oil.

050-11.17.2.6 Jumper Lines or Blanks. Remove jumper lines or blanks, reassemble piping to bearings and gear sprays, and continue circulation of cleaning oil for a minimum of 24 hours until strainer bags are clean for a period of two hours. Examine sprays to see that they are clear and examine oil sight flows on bearings to ensure that proper circulation is taking place during cleaning operation. After 12 hours circulation the turning gear shall be operated intermittently for two to three minutes at about 10-minute intervals. While the turning gear is in operation, detect any noise that would indicate bearing distress.

050-11.17.2.7 Circulating Period. During circulating period, shift strainer baskets and examine muslin bags in use after a two to five-pound pressure drop is indicated on the strainer gage. Where bags are coated with foreign matter, or where signs of deterioration (such as holes) are noted, replace with clean bags. Purification unit shall be examined to ensure it is thoroughly clean.

NOTE

Most larger particles of dirt and foreign matter will it's collected in muslin bags during the first two hours of cleaning, During this period it may be necessary to change the muslin bags about every 15 minutes.

050-11.17.2.8 Circulate Cleaning Oil. Circulate cleaning oil through all parts of the lubricating oil system. This will include all lubricating oil pumps, bypass piping, and any other alternative parts of the system. Attached lubricating oil pumps and piping that cannot be properly cleaned by oil circulating in the lubricating oil system is to be disassembled and cleaned by hand, using clean lint-free rags soaked in the cleaning oil.

050-11.17.2.9 Filter Bags. When filter bags show no evidence of contamination for a period of two hours, reduce the cleaning oil temperature to between 90°F and 100°F while maintaining circulation; circulation shall then be stopped and one of the forward turbine bearings opened. Examine the bearing shell, journal, and chamber for presence of preservative. If any preservative is found, it indicates that the system is not clean. Clean the affected parts, the shell replaced, and continue circulation of the cleaning oil for a longer period until preservative is not found upon examination of a second forward turbine bearing. If, upon examination of a second forward turbine bearing, foreign material is discovered, repeat the process for an additional period until examination of another turbine bearing indicates a clean system. Before stopping circulation, operate the system at reduced temperature as described in the preceding order to maintain protective coating of cleaning oil.

050-11.17.2.10 Navy Propulsion Turbines. Most naval propulsion turbines are not provided with governors; however, where installed, the hydraulic systems of the governors are to be carefully cleaned. Circulation of the cleaning oil through the hydraulic system may not be adequate. If, upon trial, the governor does not function properly, the system should be dismantled and cleaned manually.

050-11.17.2.11 Pump and Turning Gear. Pump and turning gear shall be secured. Secure steam and drain connections to the lubricating oil cooler. Transfer the cleaning oil, while still warm, to empty drums. Remove the last few gallons of oil from sump tank by means of the suction pump of the purifier. Remove remaining oil that the pump cannot reach manually. Inspect accessible equipment for complete removal of oil. Drain the strainers, coolers, thrust bearings, and pipe pockets. No dismantling shall be attempted at this time.

050-11.17.3 Preparation For Flushing With Displacement Oil. Install clean muslin bags in baskets of strainers. Inspect sump and clean if necessary. Remove the temporary strainers in sumps that were used for circulation of cleaning oil.

050-11.17.4 Circulation of Displacement Oil. Repeat procedures for circulation of cleaning oil, except that displacement oil shall be 2190 TEP lubricating oil, and no jumper shall be used. Maintain at temperatures between 160°F and 170°R Continue circulation with hot oil for 12 hours.

050-11.17.4.1 Purifier. Operate the purifier continuously during circulation of the displacement oil. When system is clean (muslin bags show no deposit of foreign material for a period of two-hours circulation), reduce the oil temperature gradually to approximately 105°R Continue circulation of the oil and engage and operate the turning gear for two hours, both ahead and astern for the main propulsion turbine. Operate the turbines briefly, if circumstances permit, to shake down inaccessible pockets of contaminants. Limit operation to that required during dock trials.

050-11.17.4.2 Turbines and Reduction Gear. After operating the turbines and reduction gear, stop circulation of the oil and open an after turbine bearing. Examine the bearing shell, journal, and chamber for presence of foreign material. If any foreign material is found, clean the affected parts, replace the shell and continue circulation for a longer period. Continue this procedure until a forward turbine bearing shows no deposit of foreign material. After circulation of the displacement oil is completed (muslin bags show no sign of solid contaminants after two-hours circulation through the bag), secure the pump.

050-11.17.5 Circulation With New Charge of Oil. Immediately after removal of the displacement oil, install clean nylon bags as specified herein in the strainer baskets and sump tank filled with the initial charge of 2190 TEP lubricating oil. Circulate this oil through the entire lubricating system for eight hours until the nylon bags are no longer accumulating foreign matter.

050-11.17.5.1 Nylon Filter Bags. Nylon filter bags are to be of continuous filament nylon cloth, scoured finish, 80 by 80 thread, 75-100 micron fiber thickness, 125-200 micron holes in cloth.

050-11.17.5.2 Samples. While oil is being circulated through the system, take samples from the sump tank and test in accordance with MIL-L-17331 for foaming and contamination. If samples fail to pass minimum requirements for new oil, repeat the flushing procedure as necessary until the foregoing requirements are met.

050-11.17.5.3 Cleaning Oil. Cleaning oil should be used only one time. Displacement oil can be used a second time if it is not too badly contaminated, contamination to be determined by the appearance of the oil used. Cleaning and displacement oil may be used on less critical systems (such as fuel pumps, heaters, pipes, bilges, and so forth, but not on generator or blower lubricating oil) or may be pumped into service and contaminated tanks and burned as fuel as soon as practical. Cleaning oil is not to be mixed with other fuel oil if practical; but if so mixed, it should be burned or disposed of as soon as possible.

050-11.18 PRECAUTIONS

050-11.18.1 General. Take the following precautions:

a. Once the cleaning operation is started, continue until it is completed.

b. The time interval between removal of cleaning oil and striking down of displacement oil is to be at a minimum to prevent rusting.

c. If available, used 2190 TEP oil stored in settling tanks or storage tanks should be used as displacement oil. Purify the oil before using.

d. Ventilating blowers in the machinery spaces are to be operated.

e. Observe normal precautions against fire during the cleaning period.

f. Nylon bags shall remain in main turbine lubricating oil systems until sea trials are completed. Provide tags on strainers stating.

WARNING

Remove nylon filter bags alter trials.

g. For several days after dock trials, operate the centrifuges continuously while underway to ensure removal of moisture and remaining solid contaminates in the system. Give special attention to signs of foaming or emulsification of the oil. Foaming or emulsification may not appear until after several days of operation. If foaming or emulsification cannot be corrected by the normal procedures outlined in NSTM S9086-H7-STM-010 Chapter 262, LUBRICATING OILS, GREASES, SPECIALTY LUBRICANTS AND LUBRICATION, the contaminated oil is to be disposed of by transfer of fuel oil service tanks and a new charge of unused 2190 TEP oil be put into the system. It is not believed that this will be necessary if proper temperatures are maintained and proper precautions are taken to remove foreign material during circulation of the cleaning and displacement oils.

h. Inspect carbon packing and carbon packing shaft surfaces. Check for burrs and dirt. Clean off the film preservative from shaft surfaces and wipe dry. Install carbon packing prior to turning units over with steam.

i. Adjust main gear and turbine needle valves after cleaning operations are completed.

j. During circulation periods, observe all units for proper operation. Watch gears and turbines closely for signs of bearing distress.

k. Whenever an inspection cover for tanks, gears, pipes, or other similar parts is open for any length of time, cover the opening with cloth or canvas to prevent entry of foreign matter.

l. After cleaning and filling the system with lubricating oil, and prior to operation of the ship, circulate the lubricating oil through the system for at least 15 minutes daily while the turbines are being jacked over.

050-11.19 PROPULSION STEAM TURBINES (STEAM SIDES)

050-11.19.1 General. Most ships inactivated after 1953 under standard Navy procedures use dry air for preservation of the propulsion steam turbines, in lieu of the contact types of preservative compounds previously used. However, for those ships that received applications of preservative compounds, methods of removal during ship activation are described below. The choice of the method to use should be made by the activating activity, based on facilities and experience available, and on a preliminary check of the removability of the preservative. The procedure for conducting the preliminary check is also described below. The details of the procedure to be used should be developed locally to suit particular machinery installation and berthing conditions. The turbine should be cleaned after the cleaning of main and auxiliary steam piping has been completed, but before the condenser is cleaned.

050-11.19.2 Preliminary Check of Preservative Removability. Determine, if possible, from available records what compound was used to preserve the turbine. Experience and tests have indicated that:

a. Grade 3 rust-preventive compound or solvent cutback corrosion preventive (MIL-C-972.52C18, or MIL-C16173) is sometimes hard to remove using wet steam.

b. Compounds conforming to MIL-C-15205 are generally easy to remove using only wet steam. This is the compound normally used in turbines preserved under Maritime Administration standards.

c. The commercial compound, Tectyl-511M is generally easy to remove using only wet steam.

050-11.19.2.1 Test The Removabilty. To test the removability of the preservative compound, first, open turbine-exhaust-casing manhole or other access opening that will give access to an area covered by the compound. Using a steam lance, lance this area with wet steam, and note whether or not the compound is removed. Note in particular whether or not the lancing coagulates the preservative. If the preservative is not satisfactorily removed by the wet steam, using the cleaning compound described in paragraph 050-11.7.1 in the lance. It is not considered

likely, but if the cleaning solution does not remove the preservative satisfactorily, try wiping the area with a rag soaked in mineral spirits, such as solvent used in dry cleaning (NSN 9G6850-00-274-5421 specification P-S-661). If mineral spirits are required to remove the preservative, special procedures for extreme caution should be developed by the activating activity.

050-11.19.3 Cleaning With Wet Steam. The following procedure shall be utilized for cleaning using wet steam:

a. Open all turbine and throttle-valve drains and gland steam system casing.

b. Remove access-opening closures. Clean accessible areas and parts removed by hand or with a steam lance.

c. Admit gland steam to clean gland steam supply piping. Secure gland steam when supply piping is cleaned.

d. Replace gland packing and access closures.

e. Line up condensate to the bilge or otherwise dispose of it.
   1. Use of saturated steam at a pressure of about 1/4 normal operating pressure is recommended.
   2. Warm up steam line, stop valve, and ahead and astern control valves.

f. . Start lubrication system (previously activated) and turn turbine with jacking gear.

NOTE

Ascertain proper turbine clearances and general conditions prior to operating turbine.

g. Admit gland steam.

h. Put saturated steam at low pressure up to first stop valve ahead of turbine ahead and astern control valves.

i. Disengage jacking gear, put steam up to ahead and astern control valves, and commence turning turbine by opening the astern control valve.
   1. Close astern valve and spin turbine with ahead steam.
   2. Alternately spin turbine astern and ahead until turbine is well warmed up. Do not allow the turbine to stand without rotating for more than one minute at a time.
   3. Limit rpm as necessary.
   4. With turbine rotating ahead at a low speed, open astern control valve to lower this speed. Then open ahead control valve enough to, gain lost ahead speed. Low speed will depend upon rated speed of the propulsion machinery. A recommended low speed is 15 percent of rated full power speed (15 percent of the propeller rpm corresponding to full power). Adequately moor the ship to withstand the propeller speed to be used.
   5. Allow turbine to turn on ahead and astern steam simultaneously for about one hour and then close the astern control valve (close ahead controls as necessary to limit rpm of shaft - refer to step 9.d.).
   6. On turbines having individually controlled nozzle valves, open each valve (with all others closed) to clean the nozzles under the valve. On turbines having all nozzle valves controlled by a single handwheel, limit the inlet pressure as necessary and open all valves full.
   7. Ensure steam flow through stage bypass valves.
   8. Ensure circulation in, and cleaning of, extraction valves.
   9. Observe the discharged condensate. Continue steam cleaning until discharged condensate is free of preservative.

050-11.19.4 Cleaning With Cleaning Compound. The following relates to cleaning using cleaning compound:

a. Perform steps a through c in paragraph 050-11.19.3 but use the cleaning compound described in paragraph 050-11.7.1 in the steam lance.

b. Ensure adequate ventilation and personnel protection.

c. Remove crossover pipe between H.P. and L.P. turbine. Blank the connection at H.P. turbine if necessary.

d. Vent H.P. turbine casing through a suitable opening. Close all drain valves.

e. Fill H.P. turbine approximately 1/2 full with cleaning compound solution.

CAUTION

Cleaning solution that leaks from turbine glands must be prevented from filling waste-oil and water-drain pockets and entering lubrication system via the bearings.

1. Start lubrication system (previously activated) and turn turbine with jacking gear.
2. Admit gland steam.
3. Admit steam to H.P turbine via a drain connection to keep cleaning solution boiling. Add makeup solution as necessary.
4. Periodically, open turbine-casing drains to flush.
5. Inject hot-cleaning solution into steam chest through gage-line opening. Open nozzle-control valves to flush. Open steam-chest drain.

f. While turbine is turning, inject hot-cleaning solution into L.P turbine and astern elements via steam inlets and other available openings. Recirculate solution from condenser.

g. Flush throttle valves and steam inlet piping by injecting hot-cleaning solution into throttle-valve-drain connections or other available openings.

h. After preservative has been removed, flush completely with distilled water (feed water).

i. A steam cleaning similar to that described in paragraph 050-11.19.3 is recommended after cleaning with clearing solution, and prior to cleaning the condenser.

050-11.20 ACTIVATION OF GASOLINE SYSTEMS

050-11.20.1 General. The following procedure shall be utilized for activation of gasoline systems:

NOTE

Perform steps 1, 2, 8, 9, 13, and 14 regardless of information found in ship's records or results of inspection of equipment

a. Replace all gaskets in flanged joints with cork impregnated Buna N.

b. Remove plugs from all grease sealed plug cocks, clean out old grease; regrease.

c. Remove seals and take out static D/H from tanks, piping, tubing, and fittings.

d. Remove rust-preventive compound from all fittings, valves, gages, and pumps.

e. Remove salt water pressure reducing valves, gravity tank float valves, gravity tank overboard discharge glove valves, and overboard discharge clapper check valve; overhaul and test before reinstallation.

f. Free up all remote operating gear for drainage valves.

g. Remove both water turbine pumps, both electric pumps, and salt water hand pump to the shop; overhaul as necessary and shop test both for tightness and for proper operation before reinstallation.

h. Calibrate all pressure gages and gasoline meters.

i. Shop test relief valves and set for proper pressures.

j. Conduct tightness tests on entire system including tanks, cofferdams, piping, filters, and inert gas system.

k. Overhaul and shop test automatic inert gas operating valves.

l. Overhaul and adjust liquidometer.

m. Conduct operational test of fixed eductors by actual eduction of water.

n. Conduct operational test of entire system using kerosene or safety test fluid including actual fueling of small amounts from each station. Do this as soon as possible after all equipment is reinstalled leaving ample time to correct deficiencies found. Inspect fueling hose and nozzles for leakage.

o. Check gasoline trunk and pump room ventilation system including presence of flame arresters in system.

p. Test CO_2 protective system for tightness and proper operation.

q. Conduct electrical continuity test of all gasoline hoses.

r. Install sight glasses, bulls-eyes, or reflex type gages in a vertical section of pipe in the draw-off line from each tank to augment the differential gage in securing the system since the differential gage may not be entirely reliable.

050-11.20.2 Safety Regulations. Safety regulations governing entry into and work performed on tanks, equipment, and systems associated with aviation fuel are to be followed implicitly.

050-11.20.3 Inert Gas Protective System. Remove preservative from valves and lines in the inert gas system. Disassemble and clean air compressor. Reassemble and install battery.

050-11.20.4 Gasoline Filling Stations. Remove preservative from all valves, repack all plug valves with lubricant as prescribed in current upkeep manual. Calibrate all filling station pressure gages and reinstall. Remove blank flanges from lines (if installed) and connect lines to proper connection. Remove and clean all strainers. Reinstall strainers.

050-11.20.5 Defueling Pumps. Remove preservative; check for proper operation. Overhaul as necessary.

APPENDIX A

TECHNICAL MANUAL DEFICIENCY/EVALUATION REPORT (TMDER)

NOTE

Ships, training activities, supply points, depots, Naval Shipyards, and Supervisors of Shipbuilding are requested to arrange for the maximum practical use and evaluation of NAVSEA technical manuals. All errors, omissions, discrepancies, and suggestions for improvement to NAVSEA technical manuals shall be reported to the Commander, NAVSURFWARCENDIV, 4363 Missile Way, Port Hueneme, CA 93043-4307 on NAVSEA/ SPAWAR Technical Manual Deficiency/Evaluation Report (TMDER), NAVSEA Form 4160/1. To facilitate such reporting, print, complete, and mail NAVSEA Form 4160/1 below or submit TMDERS at web site http://nsdsa.phdnswc.navy.mil/tmder/tmder.htm. All feedback comments shall be thoroughly investigated and originators will be advised of action resulting therefrom.

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