TECHNICAL BULLETIN

PREPOSITIONED WATERCRAFT: PRESERVATION AND ACTIVATION PROCEDURES

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CHANGE

NO. 2

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DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 9 NOVEMBER 1992

Technical Bulletin

PREPOSITIONED WATERCRAFT: PRESERVATION AND ACTIVATION PROCEDURES

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TB 55-1900-231-15, 17 March 1989 is changed as follows:

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By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
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MILTON H. HAMILTON
Administrative Assistant to the Secretary of the Army
02892

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NO. 1

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Washington, DC, 17 March 1989

PREPOSITIONED WATERCRAFT: PRESERVATION AND ACTIVATION PROCEDURES

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CHAPTER I
GENERAL

1. INTRODUCTION:

This procedure is prepared for organizations tasked to prepare watercraft for storage on-board a float on/float off Heavy Lift Prepositioned Ship (HLPS) or Semisubmersible Barge (SSB). This procedure will be used for: Four (4) each Landing Craft Utility (LCU) Design 1466A; Six (6) each Tug, Harbor, 100 Foot, Design 3006; Two (2) each Crane, Floating, 100 Ton, Design 264-B; Twelve (12) each Landing Craft Mechanized, LCM-8, MOD I, and Two (2) Reverse Osmosis Water Purification Barges (ROWPU).

A. Chapter II provides the tabulated data of watercraft designs identified in this HLPS storage procedure.

B. Chapter III details preservation requirements applicable to each identified watercraft.

C. Chapter IV details in-storage maintenance, (COSIS), requirements for watercraft processed for storage IAW this procedure.

D. Chapter V details depreservation/activation requirements for all watercraft identified by design.

E. Chapter VI details represervation requirements after completion of activation and tests.

F. Appendix A, B, C, D, and E provides requirements by design for exterior sealing, dehumidification (D/H) zones, location of D/H sensors and humidistats, air flow, routing of interior D/H flexible lines and the estimated volume of air in each zone, Manhours by skill and material requirements to accomplish underwater hull protection, preservation, COSIS, activation and represervation are also provided.

G. Appendix F gives instructions for the Surge Team Fueling Plan.

H. Appendix, MIL-S. 53021 contains the procedures governing the use of diesel fuel stabilizer additives for fuel placed on stored watercraft.

2. CONCEPT:

This procedure was prepared to establish instructions for preservation and rapid activation of HLPS and SSB stored watercraft. This procedure provides minimum sealing of exterior openings, contact preservation on machinery and provides for dehumidification in machinery and habitable areas inside the watercraft.

A. Watercraft processed for storage in accordance with these procedures will be protected from corrosion and deterioration for a period of 24 months.

B. The concept of these procedures provides for activation within two (2) days.

C. Each HLPS and SSB watercraft will be activated, tested, repaired and represerved as prescribed by Third U.S. Army.

D. Dehumidification (D/H) machines, four (4) inch PVC D/H piping, sensing elements and humidistats will be provided and installed by the Military Sealift Command (MSC) contractor. The D/H external piping (PVC) will be installed between the D/H Machines and the four (4) inch PVC hull (coupling) penetration previously installed during preservation HLPS Watercraft shall have a sufficient quantity of D/H machines to dehumidify a total estimated 428,000 cubic feet of air. The run time on any D/H machine should not exceed 50 percent during at two (2) week period. SSB Watercraft will have sufficient quantity of D/H machines to dehumidify a total estimated 128,400 cubic feet of air. The sensing

elements and humidistats will be installed by MSC's contractor, in locations within the D/H zones as indicated in the appendixes. Humidistats will be set to maintain a 40 percent humidity, plus or minus 5 percent, within all D/H zones.

E. Dry charged starting batteries will be installed, in battery trays, in sufficient quantity on each watercraft. Electrolyte in sufficient quantity will be stored near the batteries. These batteries will be activated and used during watercraft activation.

F. MSC'S contractor will provide and store four (105-135 VAC/6-24 VDC) battery chargers on board the HLPS and two onboard the SSB vessel for use during activation, tests and represervation.

3. REFERENCES:

A. TB 740-97-4 Preservation of Vessels for Storage, February 1975.

B. TB 43-0144 Painting of Vessels, 9 March 1987.

C. TB 55-190--201-45/1 Guide to Army Watercraft Survey, Inspections, Repair Procedures and Repair Specification Preparation, 18 May 1981.

D. TB 43-0153 Water Supply Afloat, 27 October 1982.

4. PROPONENT:

U.S. Army Troop Support Command
Directorate for Maintenance
AMSTR- MMT
4300 Goodfellow Blvd.
St. Louis, MO 63120-1798

5. RECOMMENDED CHANGES:

It is recognized that more expedient methods will become apparent, resulting in an enhanced storage posture of watercraft. All activities and organizations utilizing these procedures are encouraged to submit their recommendation for changes to this procedure on DA-2028 forms, entitled "Recommended Changes to Equipment Publications", to:

Commander
U.S. Army Troop Support Command
ATTN: AMSTR-MMTS
4300 Goodfellow Blvd.
St. Louis, MO 63120-1798

CHAPTER II
TABULATED DATA

1. Tug, Harbor, 100 Foot, 1,200 Horsepower, Design 3006, (Flight I & II)

Designation	LT
NSN:	1925-00-275-3003
Type classification:	STD-C
Speed:	Light-12.75 Knots (23.6 km/hr) Loaded with tow-variable
Cruising range:	Light-3,323 nautical miles (6154.2 km)
Construction:	Steel
Length, overall:	107 feet (32.6 m)
Beam, molded:	26 feet 6 inches (8 m)
Depth, molded	14 feet 10 inches (4.5 m)
Displacement:	Light-295 long tons (299.7 t) Loaded-390 long tons (396.2 t)
Draft:	Light: Forward-6 feet 2 inches (1.8 m) Mean-8 feet 10 inches (2.6 m) Aft-11 feet 6 inches (3.5 m) Loaded: Forward-9 feet 5 inches (2.8 m) Mean-10 feet 9-1/2 inches (3.2 m) Aft-12 feet 2 inches (3.7 m)
Freeboard, mean:	Light-6 feet (1.8 m) Loaded-4 feet (1.2 m)
Capacity	Fuel-21,146 gallons (80,037 kg) Lube Oil-450 gallons (1703 kg) Potable water-2,756 gallons (10,431 kg) Sea water ballast: Fore peak-2,903 Aft peak-5,493
Crew accommodations:	16
Dehumidification area:	40,000 cu. ft. (1 zone)

2. Landing Craft, Utility, 115 Feet (35 M) Design LCU 1466A

Designation:	LCU
NSN:	1905-01-031-6077
Type classification:	STD-B
Speed:	Light-8 knots (14.8 km/hr) Loaded-6.5 knots (12.0 km/hr)
Cruising range:	Light-850 nautical miles (1574.2 km) Loaded-700 nautical miles (1296.4 km)
Fuel consumption:	34 gallons per hour (128.6 L/hr)
Construction:	Steel
Length, overall:	115 feet 1 inch (35.1 m)
Molded breath, extreme:	34 feet (10.4 m)
Molded depth:	6 feet (1.83 m)
Displacement:	Light-180 tons (163.3 lt) Loaded-347 tons (314.7 lt)

Draft:	Light:	Forward-2 feet (60.96 cm)
		Mean--2 feet 11 inches (89.1 cm)
		Aft-3 feet 11 inches (1.06 m)
	Loaded:	Forward-3 feet (81 cm)
		Mean-3 feet 6 inches (1.06 m)
		Aft-4 feet (1.2 m)
	Beaching:	Forward-1 foot 6 inches (45.7 cm)
		Aft-3 feet 10 inches (1.17 m)
Freeboard, mean:	Light:	3 feet 10 inches (1.2 m)
	Loaded:	1 foot (30.5 cm)
Capacity:	Fuel-(100% full) 3,700 gallons (14,004 L)	
	Lube Oil-200 gallons (757 L)	
	Fresh water-9,564 gallons (36,199.7 L)	
	Salt water ballast-6,908 gallons (26,146.7 L)	
	Cargo:	Bulk--150 long tons (152.4 t)
	Cargo space:	Length-52 feet (16.8 m)
		Width-29 feet 6 inches (8.9 m)
		Height-4 feet 6 inches (1.3 m)
		Additional space forward:
		Length-22 feet (6.7 m)
		Width-14 feet 4 inches (4.3 m)
	Ramp opening-14 feet 4 inches (4.3 m)	
	Passengers-300 combat-equipped	
	Crew-14	
	Dehumidification area-16,000 cubic feet (2 zones)	

3. Landing Craft, Mechanized, 69 Feet (21 M), LCM8 MOD I

Designation:	LCM MARK VIII MOD I	
NSN:	1905-00-935-6057	
Type classification:	STD-A	
Mobility and Engine Data:		
Speed:	Light-9 knots (loaded) (16.7 km/hr)	
Cruising range:	271 nautical miles (loaded) (277.8 km)	
Fuel consumption:	24.16 gallons per hour (91.5 L/hr)	
Construction:	Steel	
Length, overall:	74 feet (22.6 m)	
Beam, molded:	21 feet 0-5/8 inch (6.4 m)	
Length between perpendiculars:	63 feet 3.5 inches (19.3 m)	
Beam, molded:	21 feet 5 inches (6.5 m)	
Depth, molded amidships:	9 feet 4 inches (2.74 m)	
Depth, molded:	9 feet 5 inches (2.8 m)	
Displacement:	Light:	58.81 long tons (59.8 t)
	Loaded:	116.07 long tons (117.9 t)
Draft, loaded, mean:	4 feet 7 inches (1.4 m)	
Freeboard, loaded, mean:	4 feet 10 inches (1.4 m)	
Capacity:	Fuel-(95% full) 870 gallons (3292.9 L)	
	Cargo-60 short tons (54.5 t)	
	Cargo space:	Length-42 feet 9 inches (13 m)
		Width-14 feet 6 inches (4.4 m)
	Ramp opening-14 feet 6 inches (4.4 m)	
	Passengers-200 combat-equipped	
	Crew-6	
	Dehumidification area-4,000 cubic feet (1 zone)	

4. Crane, Barge, 100-Ton, Design 264B

Designation:	BD
NSN: 1935-00-264-6219	1935-00-264-6219
Type classification:	STD-A
Construction:	Steel
Length, overall:	140 feet (42.7 m)
Beam, molded	70 feet (21.3 m)
Depth, molded	12 feet 6 inches (3.8 cm)
Displacement full load:	1,630 long tons (1656.1 t)
Draft full load:	Mean-6 feet 3-1/4 inches (1.9 m)
Freeboard full load:	Mean-6 feet 2-3/4 inches (1.9 m)
Capacity:	Fuel-15,000 gallons (56775 L) Fuel-15,000 gallons (56775 L) Lube Oil-110 gallons (416.3 L) Fresh water-6829 gallons (25,814 L) Dehumidification area-36,000 cu. ft. (1 zone)
Cargo-Handling Equipment:	
Main block:	Capacity-89 long tons (90.4 t) @ 80 foot radius (24.4 radius) 75 long tons (76.2 t) @ 104 foot 6 inch radius (31.8 m radius) Auxiliary: (Modernized) Capacity-25 long tons (25.4 t) @ 122 foot 6 inch radius (37.3 m) Speed-79 feet per minute (24.1 m/min) Reach below waterline-25 feet (7.6 m) Operating range-360 degrees Wire rope: Type-improved plow steel Main block-6 x 37, 1-1/8 inch dia., 2,530 feet (1.8 m x 11.2 m, 28.6 mm dia., 771.5 m) Boom luffing-(2 each) 6 x 30, 1-1/4 inch dia. 320 m) Auxiliary-6 x 37, 7/8 inch dia., 1,100 feet (1.8 m x 11.2, 22.2 mm dia., 320 m)

5. Reverse Osmosis Water Purification Barge (ROWPU)
(Modified Barge, Deck Cargo, Non-Propelled, Design 231 A)

Designation:	ROWPU	
NSN:		
Type classification:		
Construction:	Steel	
Overall length:	120 feet	
Beam, Molded:	33 feet	
Depth Molded:	10.5 feet	
	Light:	425 Tons
	Loaded:	505 Tons
Draft:	Light:	5 feet
	Loaded:	5 feet 8 inches

Tank Capacities

Drinking Water Tanks (4) each:	15,000 gals total
Water Reserve Tank (1) each:	250 gals
Fuel Oil Tanks (2) each:	7,200 gals total
Sludge Oil Tank (1) each:	500 gals
Ballast Tank (1) each:	10,000 gals
P. E. 250 Fire & Bildge Pump	
Gasoline Tank (1) each:	6 gals
Fuel 0.1 Daytank	350 gals

Capabilities

The barge is capable, under ideal conditions, of producing a maximum of 300,000 gallons of drinking water during a 24 hour period in sea conditions not exceeding Sea State 3.

Engines

RO System:

Type:	Diesel
Number:	2 installed 1 spare
Power Rating:	325 hp @ 2100 rpm's 250 hp @ 1800 rpm continuous

Ships Service Power:

Type:	Diesel
Number:	2
Power Rating:	155 KW

Auxiliary Power:

Type:	Diesel
Number:	1
Power Rating:	20 KW

Anchoring Equipment

Anchor Winches 4 each:	2 left hand 2 right hand
a. Type:	Electric w/mechanical brake
b. Rated line pull:	8,000 lbs approx.
c. Wire rope:	600 ft 1 in dia galvanized

Anchors 4 each:

Type:	1000 lb Standard Danforth cast steel */1 in bending shackle & No 2 detachable connecting link

Safety Equipment

Fire Fighting Equipment:

a. 100 lb $C0^2$ system 2
b. 15 lb $C0^2$ portable 8
c. 1301 Halon Installed

Life Rafts:

1 Inflatable 15 person

Beach Winch

Type:	Model 150 6 Ton

Work Boat

Type:	Monark 23 ft
Engine:	6 cyl Volvo Penta AQAD
Power Rating:	155 shp @ 35600 RPM

Bow Crane

Manufacturer:	GRU IDRAULICHE (Morgan Crane Company)
Type:	Single Arm, Hydraulic Articulating
Capacity:	
Maximum Lift:	Reach
41,895 Lbs.:	6 Ft. 7 Inc.
2,425 Lbs.:	47 Ft. 0 Inc.
Operating Loads:	Reach
33,000 Lbs.:	8 Ft. 8 Inc.
8,800 Lbs.:	30 Ft. 0 Inc. (Maximum)

CHAPTER III
PRESERVATION REQUIREMENTS

1. INTRODUCTION:

A. The watercraft listed in Chapter II, Section I., 2., 3., 4., and 5. will be preserved, placed under dynamic dehumidification and dry stored. The preservation is modified to enable the craft to be deprocessed/activated with (2) days, yet remain in storage for a period up to 24 months in a relative static condition. The modified preservation of these craft is based upon the assumption that they are in material Condition Code "A":

(a) the mechanical and electrical systems are in the highest state of material readiness;

(b) that the hull interior and exterior is in good condition and protected with an intact paint system:

(c) that all doors, hatches, port lights, and vent covers are in good condition with proper fitting gaskets and operable dogs/dogging devices/securements;

(d) all watercraft will have a complete BII set including C & E equipments/components.

B. This chapter contains general preservation procedures, which are applicable to all watercraft considered in this procedure. Procedures applicable to only a specific craft are provided in Appendices A, B, C, D, and E.

2. UNDERWATER HULL PROTECTION: Prior to accomplishing the general preservation instructions contained in paragraph 3 below and respective appendices, the underwater hulls will be cleaned and preserved. Accordingly, all watercraft will undergo drydocking for required underwater hull repairs, overhaul of the sea valves and strainers, cleaning and painting, and renewal of the cathodic protection system (sea chest and hull zincs), shaft alignments, cutlass bearing renewal, etc. Drylock specification shall include:

(a) Indefinite items for underwater weld repair, hull plug welds and plate renewal, all of which will be determined after drydocking.

(b) Routine overhaul of sea valves and strainers.

(c) An item for cleaning and painting to be IAW TB 43-0144, 9 March 1987.

(d) The cathodic protection system (zinc configuration) shall be type ZHS (bolt-on) zincs and shall be installed IAW TB 43-0144.

CAUTION

To alleviate a potential deterioration problem with the underwater paint system, all underwater surfaces must be washed down with fresh water immediately after each craft is stored on the HLPS vessel. It is important that all marine growth and slime be removed. Extreme care shall be exercised to prevent damage to the underpaint systems during wash down. The fresh water washdown is the responsibility of the storing agency.

3. GENERAL PRESERVATION INSTRUCTIONS: Equipment, systems, and machinery of each watercraft will be processed IAW the following general instructions. Dehumidification will be accomplished IAW Appendices A thru D. Once the watercraft are preserved (and subsequently stored aboard the HLPS vessel), the interiors will remain in an unlighted condition to preclude or minimize common bacteria growth.

A. Engine: Main Propulsion, Generator, Fire Pumps, and Anchor Winch.

(1) Lubricating Systems: At the beginning of preservation the crankcases and lubricating systems of all engines will be drained and refilled to operating level with P-10, Type I, Grade 30 preservative lubricating oil. Upon completion of preservation the preservative oil will remain in the engines. A tag will be prepared for each engine and attached to or near to lube oil fills: "'THIS CRANKCASE IS FILLED TO OPERATING LEVEL WITH PRESERVATIVE LUBRICATING OIL GOOD FOR OPERATION UNTIL THE FIRST REQUIRED OIL CHANGE-DO NOT DRAIN-CHECK OIL LEVEL-IF LOW, FILL TO OPERATING LEVEL WITH OE-30 FROM THE CLEAN OIL STORAGE TANK."

(2) Fuel Systems: Engines will be cranked, thoroughly warmed up, and shut down. The fuel supply valve from the day tank will be secured. The fuel supply line to the engine will be broken at the most accessible/convenient location before the fuel supply pump. A flexible line/hose leading from a container of P-9 preservative oil shall be attached to the fuel supply pump line. The fuel return line shall be disconnected at the most accessible/convenient location. A transparent plastic line will be attached to the broken engine fuel return line and the unattached end shall be inserted into a recovery container to collect the returned fuel. Crank the engine and run at 1/2 speed until undiluted preservative oil (P-9) (as observed thru the transparent flex) is flowing into the recovery container.

Shut the engine down and reconnect the fuel supply and return lines. Ensure that all air is bled from the fuel supply line.

NOTE

On the Design 3006 Tug, the main engine will require several 5 gallon cans of i9 to preserve the system EXERCISE CARE TO PREVENT THE FUEL SYSTEM BECOMING AIR BOUND DURING THE PROCESS. The fuel oil from the recovery container will not be used for preserving other engines.

(3) Combustion Chambers: Upon completion of the fuel system preservation and. after the engines have cooled to a cylinder head temperature of 100° F or less, the combustion chamber/each cylinder of each engine shall be fogged with P-10, Type I, Grade 10 as per (a) and (b) below. Air pressure for fogging shall not exceed 25 psi.

(a) Two cycle engines with intake port and valves: Remove the air box covers and jack the engine until the piston in the cylinder to be fogged is below the ports. The P-10 will be fogged thru the ports. Continue jacking and fogging until all cylinders have been fogged, after which the air box covers will be reinstalled.

(b) Four cycle engines: Remove the injector nozzles and fog the P-10 into each cylinder thru the opening with the piston at BDC (bottom dead center). This will entail jacking and fogging until all cylinders are fogged, after which the injectors and nozzles will be reinstalled and timed.

NOTE

The amount of P-10, Type 1, Grade 10 to be fogged into each cylinder is 1-1/2 oz. on the Detroit 71 series engines and 2 oz. on the Design 3006 Tug main engine and the Design 264B main generator engines.

CAUTION

DO NOT RUN ENGINES AFTER COMPLETION OF CYLINDER FOGGING.

(4) Cooling Systems: All engine fresh water cooling systems will be filled with a 50/50 solution of water and permanent anti-freeze, ensuring the engines are in a ready to run status. Each cooling system should be tagged with this information. The system must be tagged with the date the antifreeze is installed.

(5) Raw Water Systems: Engines raw water systems, including piping, coolers, and engine mounted pumps, shall be drained and flushed with fresh water. This shall be accomplished by removal of installed drain plugs, and/or breaking of lines at convenient/accessible low points for the fresh water flush and blowing dry with compressed air. At the beginning of this evolution the system sea valves shall be secured (wired closed) and not reopened until activation. After all systems/lines/pumps are drained, flushed, and blown dry, plugs shall be reinstalled and broken lines shall be reconnected, leaving the system intact and ready for service, except on pumps having rubber impellers. They will be removed and stored in a container/bag with cover plate, gasket, and screws attached to the pump.

(6) Governors: Hydraulic type, applicable to the main generator engines on the Design 264B Crane only. Fill to operating level with OE-30 oil. All other engines that are equipped with governors are the wet mechanical type lubricated from the engine system.

B. Reduction Gears: Hydraulic type. Prior to engine preservation, the hydraulic reduction gear systems will be inspected for proper fluid level and contamination. Add approved fluid (OE-30) to bring to operating level or, if contaminated, drain and flush with operating fluid (OE-30). Cleaned systems will be filled to operating level with approved fluid (OE-30) and operated during the preservation cycle of the engines. Any exposed ferrous surfaces, control rods/linkages, etc., will be coated with P-10, Type I, Grade 30 preservative oil. This is applicable to the landing craft, LCM-8's and LCU's, as none of the other watercraft being preserved have reduction gears.

C. Inclosed Gears: Oil lubricated gears not otherwise provided for will be inspected for level of lubricant and for evidence of water and contamination of lubricant. Add lubricant specified by the applicable lubrication order to raise to operating level or if contaminated, drain the lubricant and flush the gear housing. The cleaned gear case will be filled to operating level with approved lubricant and operated under no load to insure coating of all interior surfaces and components.

D. Exposed Gears: Non-precision exposed gears subject to the weather will be coated with P-1 preservative; all other exposed gears will be coated with P-2 preservative.

E. Drive Belts and Pulleys: Drive belts will be left fully tensioned and ready for service. Pulley grooves shall be coated with a thin film of rust inhibiting lacquer resisting synthetic primer (Glyptol).

F. Exposed Drive Chains: Exposed drive chains will be coated with P-2 preservative.

G. Hydraulic System: Brake, ramp, or steering systems shall be filled to operating level with approved fluid required by the applicable lubrication order or the Technical Manual.

H. Brakes: The brake disc and/or drum facings shall be coated with a thin film of rust inhibiting lacquer resisting synthetic primer (Glyptol).

I. Air Compressor: The operating lubricant will be drained and the compressor crankcase refilled to operating level with P-10, preservative lubricating oil, Type I, Grade 30. The air line will be disconnected from the compressor. The air cleaner will be removed, and while the compressor is operated, spray 4 or 5 ounces of P-10 preservative lubricating oil, Type I or II, Grade 30, into the air intake. The compressor will be operated a sufficient length of time to assure coverage of all internal surfaces. The air cleaner and line will be reinstalled, leaving the compressor ready for service.

J. Tanks:

(1) **Diesel Oil Day Tanks**: Upon completion of cleaning each tank will be filled to 90% capacity with diesel fuel in a ready for service condition. LCM-8's have no day tanks, therefore, the LCM fuel storage tanks will be filled to 90% in a ready for service condition. Additives will be added to diesel fuel stored in storage and/or day tanks IAW MIL-S. 53021 (Appendix G).

(2) **Diesel Oil Storage Tanks**: Except for the LCM-8's, diesel fuel oil storage tanks will be cleaned and atomize sprayed with P-10, Type I, Grade 30 preservative. Excess preservative accumulating in the bottom of the tanks shall be removed, and the tanks closed, ready to be filled with diesel fuel.

(3) **Lubricating Oil Storage Tanks**: Lube oil storage tanks shall be filled with oil as specified in the applicable lubrication order or technical manual to place watercraft in a ready for service condition.

(4) **Dirty Oil and Sludge Tanks**: Dirty oil and sludge tanks shall be drained, cleaned, closed up and left in a ready condition.

(5) **Raw Water/Ballast Tanks**: Shall be drained and blown dry. In the case of large tanks (ballast tanks, etc.) they will be pumped, cleaned and dried out. Reinstall access covers and leave any installed vents open. Depending on paint system condition, the raw water/ballast tanks may require the removal of corrosion and painting in accordance with TB 43-0144.

(6) **Potable Water Tanks**: Potable water tanks shall be inspected prior to preparation of Specifications for Underwater Hull Protection work. For tanks severely deteriorated (needing more than touch-up painting) an item shall be included in the Underwater Hull Protection Specifications to sandblast the tank(s) and Paint IAW TB 43-0144. Potable water tanks (pressure tanks, hot water heater/tanks, etc.) will be drained and blown dry with compressed air. Potable water storage tanks will be drained/pumped, dried, cleaned and painted as required. Reinstall access covers and leave installed tank vents open. Preservatives will not be applied or introduced into the potable water systems. Chlorine for sanitizing water and tanks at the time of activation shall be placed aboard the respective craft in a cool dry place with a copy of TB 43-0153, water supply afloat.

(7) **Air Tanks**: Air tanks will be bled down. The valves for purging moisture from the tanks will be left open until activation. No other preservation required.

(8) **Oil and Water Separator Vessels**: Shall be drained. No other preservation required.

K. Pumps: (Other than engine mounted)

(1) **Raw Water Pumps**: Raw water pumps shall be drained and flushed with fresh water, and then blown dry with compressed air. Drain plugs shall be reinstalled.

(2) **Fresh Potable Water Pumps**: Fresh/potable water pumps shall be drained and blown dry with compressed air. Drain plugs shall be reinstalled.

NOTE

Do not drain and blow dry the engine cooling water pumps since these systems have antifreeze protection.

(3) **Fuel and Lubricating Oil Pumps**: No preservation required. Leave primed and ready for service.

(4) **Pump Packing**: Pump shaft packing shall be replaced when packing glands are taken up more than 50 percent.

L. Oil Purifiers and Filters. No preservation required. Leave primed and ready for service. New filters will be tied to the equipment after activation and maintenance cycle.

M. Heat Exchangers: The raw water sides of heat exchangers shall be drained and blown dry with compressed air. Drain plugs shall be reinstalled.

N. Refrigeration Units: No preservation required. Belts and pulleys shall be preserved IAW 3. E. above. Doors on refrigerators inside the watercraft should be blocked and wired open.

O. Electrical Equipment:

(1) Rotating Electrical Equipments: Motor and generators can endure a lengthy period of exposure without deterioration. No preservation is required. Ensure that sealed motors exposed to the elements are properly sealed.

(2) Switch Boards, Panels, and Controllers: No preservation required. Tie doors on panels and controllers located within the dehumidified area in an open position. Ensure that sealed controllers on the exterior, exposed to the elements are properly sealed and protected with herculite covers.

(3) Receptacles: Non-watertight receptacles exposed to the elements will be sealed with glue and pressure sensitive tape.

(4) Horns, Bells, Buzzers and Lights: All externally mounted horns, bells, buzzers and lights provided with waterproof protection will remain in place. Units not provided with waterproof protection will be removed, identified and stowed in the dehumidified area.

(5) Gauges and Instruments: No preservation required.

P. Sewage Collecting, Holding and Transfer (CHT) Systems:

(1) CHT Systems with Raw or Fresh Water Flush: Applicable to the Design 3006 Tugs and the Design 1466A LCU's. While the vessel's power systems are still operational (early on in the preservation evolution) the system shall be operated IAW posted instructions, that is flushing and pumping the collecting tank into the holding tank, then flushing the holding tank into a shore sewage receptacle leaving both the collecting and holding tanks empty and ready for service. Pumps shall be preserved IAW 3. K. (1) and (2).

(2) CHT Systems with Mineral Oil Flush Medium: Applicable to the Design 264B (Modified) cranes. While the vessel's power systems are still operational, flush the commode with the oil pressure pump switch off to relieve the system pressure. Pump the collecting tank into the holding tank. Pump the holding tank to a shore sewage receptacle leaving both the collecting and holding tanks ready for service. The oil pressure pump does not require preservation. Sewage pumps shall be preserved IAW 3. K. (1).

Q. Heating Boilers:

(1) Water Sides and Systems: Shall be drained and thoroughly dried with dry compressed air. Drain plugs will be removed and lines disassembled sufficiently to effect complete draining of water. After drying, reinstall plugs and reassemble lines to assure that the boiler is left in a ready for service condition.

(2) Fire Sides: Fire sides of the boilers shall be cleaned, closed and left in a ready for service condition.

(3) Oil Burners: Pot and atomizing type oil burners will be removed, drained, cleaned, dried and reinstalled in a ready for service condition. No other preservation required.

R. Valves:

(1) Weather Exposed Valves: Valves will be turned to a fully open position, the stems will be coated with P-2 preservative, and then closed. Unpainted ferrous metal surfaces remaining exposed will be coated with P-1 preservative.

(2) Sea Valves and Overboard Discharge Valves: Will be secured in a closed position with wire to prevent accidental opening. Sea strainers baskets will be cleaned and left in place with covers installed and secured, ready for service.

(3) Other Valves Within Compartments: Valves will be left in an open position unless preservation procedure/configuration dictates otherwise in which case the valve/valves would be closed. Example: "the fuel oil day tanks supply valves shall remain closed until such time as the craft are activated. "

S. Capstans, Winches and Windlasses: The above deck portions of capstans, winches, and windlasses such as exposed gears and pinions will be preserved IAW 3. D. Gear boxes (inclosed gears) shall be preserved IAW 3. C. Brake drums will be preserved IAW 3. H. Al exposed ferrous metal surfaces of shafts, linkages, and threaded adjustments shall be coated with P-1 preservative. Herculite covers shall be installed for protection from the elements. These covers must be tied down securely.

T. Piping Systems:

(1) Raw Water Piping Systems: All raw water systems (Bilge and Ballast, Firefighting, Sanitary, and Engine Cooling) shall be drained, flushed with fresh water and blown dry. Lines or fittings broken or removed to effect draining and/or flushing shall be reinstalled leaving the system ready for service. This shall be accomplished in conjunction with the preservation of raw water pumps, 3. K. (1).

(2) Fresh Water Piping Systems: All fresh water systems including potable, heating and hot water shall be drained and blown dry with dry compressed air. Lines and/or fittings removed to effect drainage shall be reinstalled leaving the system ready for service. This shall be accomplished in conjunction with potable water pumps, 3. K. (2).

U. Davits: Davits rigged, or unrigged and stowed on deck, shall have the bearing surfaces and matching davit socket bearing surfaces coated with P-2 preservative.

V. Deck Fitting: Flush deck fittings (sounding and fill for oil, water and fuel) shall have the threads coated with P-2 preservative and reinstalled.

W. Anchors: Any bare ferrous metal surfaces and unpainted fittings of anchors rigged or stowed on deck shall be coated with P-1 preservative.

X. Wire Rope, Rigging and Fittings:

(1) Rigging, standing rigging and related fittings will remain in place and will be cleaned and slushed/coated with rust resistant lubricant (MIL-G-18458) or VV-L751. Threaded fittings such as turnbuckles, shackles, and ramp load binders shall be turned sufficiently to assure a coating of preservative on the mating surfaces.

(2) Wire Rope:

(a) Wire rope on all of the craft will remain reeved and/or rigged. Wire rope on drums such as winches and similar gear will be unwound, cleaned and coated with rust resistant lubricant (MIL-G-18458) or VV-L-751. The exposed surfaces of the drums will also be cleaned and coated. The cleaning and/or coating may be accomplished as the wire rope is rewound on the drums. Precautions shall be taken to insure wire ropes on the landing craft that are faired thru the voids and/or ramps are not overlooked. Ensure that tension is maintained, with proper lay, as the wire rope is rewound onto the drums.

(b) On the Design 264-B Cranes, it is not feasible nor necessary to unwind all of the wire rope from the auxiliary, main hook, and luffing drums. The wire rope exposed to the elements (outside of the rotate machinery house) including the unpainted surfaces of the sheaves shall be thoroughly cleaned and slushed/coated with rust resistant lubricant (MIL- G-18458) or VV-L-751. The wire rope within the rotate machinery house, from the house penetrations to the top layer on the drums shall also be coated.

(3) Sheaves: All sheaves shall be lubricated IAW the design watercraft's applicable lubrication order.

Y. Steering Systems: Unpainted surfaces of quadrants, rods, linkages, exposed to the weather/ elements shall be coated with P-1 preservative. Exposed surfaces of hydraulic rams shall be coated with P-10, Type I, Grade 30.

Z. Galley Equipments: A light coat of cooking oil/crisco will be applied to those surfaces of galley equipments vulnerable to corrosion such as grill tops, etc. Oven doors will be left open. Oil burners of galley ranges will be drained. Door on refrigerators will be blocked open for ventilation.

AA. Sanitary Drains: All drain traps shall be drained.

BB. Fixed Fire Fighting Systems: Systems shall be ready for service. No preservation required.

CAUTION

The Design 1466A LCU's have a HALON System that is controlled by a manual/automatic switch located in the switchboard room. During storage the switch will be placed in manual position.

4. SPECIFIC PRESERVATION INSTRUCTIONS:

A. Batteries: After all other preservation has been accomplished and the need for the installed batteries no longer exist, the battery cables shall be disconnected. The old batteries shall be removed and turned into the preservation facility supply section for disposition. New starting batteries (dry charged) shall be installed and secured in the battery storage trays. All interconnecting cables will be connected and coated with grease to prevent corrosion. The positive and negative terminals will be sealed in plastic. Electrolyte for the batteries to be used when the craft are activated shall be placed and secured in close proximity of the batteries. Exception, on the Design 1466A LCU's the electrolyte shall be stowed in the crew's quarters or mess deck.

B. Dehumidification: Critical areas of each craft shall be placed under dehumidification IAW Appendices A through E each of which pertains to a specific design craft. Sealing of the watercraft shall be accomplished in as much as possible utilizing installed doors, scuttles, covers, port lights, etc., augmented with tape, glue and strip coat, plywood and duct seal. The humidistats and sensing elements to be installed by the (HLPS) or (SSB) Storage Vessel IAW the locations depicted in Appendices A through E shall be compatible with the (HLPS) or (SSB) vessel dehumidification and monitoring systems. The (HLPS) Storage Vessel shall also make up the ducts from the dehumidification system to the dry and humid air connections on the craft which are identified in Appendices A through E, by a stencil on each craft applied by the activity performing preservation.

C. Lubrication: Each craft will be lubricated IAW the applicable lubrication order, except those areas requiring the application of contact preservatives.

D. Hazardous Material: Materials considered hazardous include, but are not limited to, open or used containers of paint, thinners, solvents or other flammable materials and pyrotechnics.

(1) Paint, Thinners, Solvents, etc.: Open or partially used container of flammable materials shall be removed from the craft by the preserving activity. Disposal shall be by approved methods.

(2) Pyrotechnics: Shall be inventoried, boxed/packaged, identified by respective craft and removed from the craft. The pyrotechnics will be turned over to the HLPS ship for storage and returned to the respective craft at the time of activation.

(3) For design 3006, tug 100 ft., the two (2) oxygen and two (2) acetylene cylinders normally supplied empty as part of the BII (Basic Issue Items), shall be filled to capacity and placed in a rack or crate constructed so as to support the bottles in an upright position on the deck of the vessel. For reasons of safety the oxygen and acetylene storage racks shall be separated within the limited deck area of the design 3006 tug. For instance one forward and the other aft, or port and stbd., respectively.

E. Machinery and Miscellaneous Equipment Covers: Normally machinery and miscellaneous equipments exposed to the elements are enclosed and protected with dehumidified air and/or sealed with pressure sensitive tape, glue, strippable and bituminous coatings. In lieu of performing the above, machinery and miscellaneous equipments will be protected from the elements with covers manufactured from herculite.

(1) The herculite, a commercial trade name for Nylon Chloroprene, NSN 8305-00-641-5598, Color 3644Q light gray, covers shall be provided by the activity or organization.

(2) The herculite covers will be manufactured with grommets and nylon draw strings in order to secure the cover to machinery and miscellaneous equipment. The seams should be stitched with ultra-violet resistant thread to prevent separation during storage.

(3) The cover must be tied down securely to prevent damage from the wind.

(4) It is the responsibility of the storage activities and organizations to lift the actual dimensions from the watercraft for each cover to be fabricated by local vendors.

(5) Research reveals that herculite is the best material to use for covering machinery and miscellaneous equipments exposed to the elements. The herculite cover will breathe a small amount of air and will provide for air circulation within the cover.

(6) Requirements and quantities for each watercraft are identified in Appendices A through D.

(7) ROWPU equipment covers are form fitted. They are identified in Appendix E.

F. Plywood Blanks: Blanks are normally used in preservation procedures to introduce dehumidification to a watercraft. They are normally sealed with pressure sensitive tape, glue, stippable and bituminous coatings over large openings penetrating the dehumidified area which are not air tight. It is the responsibility of the storage activity/organization to lift the actual dimensions from the watercraft for each blank to be fabricated and to design, procure and install the simple quick-acting dogging devices or strongback securing devices. The locations and quantities of blanks required are identified in Appendices A through D.

G. BII (Basic Issue Items): Boat sets are provided for each watercraft as the minimum authorized requirements for the operation, maintenance, health, safety, and welfare of the crew. All watercraft operating equipment, operating supplies, repair parts, and accessory items will have been previously inventoried, replenished, represerved, and repackaged by the storage activity/organization. The storage activity/organization will also have had previously restowed on each watercraft all items in their appropriate stowage brackets, bins, lockers, and storerooms, except accessory items normally stored on the exterior (fire hoses, nozzles, fire axes, spanner and dog wrenches), which shall be tagged with identification/location and stored inside the dehumidification zone. All watercraft technical manuals, lubrication orders, drawings, support publications and operating logs and records shall be inventoried, replenished and stowed in lockers aboard the watercraft. All BII having shelf life will be stored separately in a readily accessible location for inspection and replacement during extended storage periods.

H. Gaskets, Packing and Fasteners: New gaskets, packing, seals and fasteners in good condition shall be used during reassembly of equipment upon completion of preservation. This procedure does not provide for openings in fuel, raw water, fresh water, etc., systems to D/H areas.

I. Fresh Water Chlorination: Reference TB 43-0153. It is the responsibility of the storage activity or organizational tasked to prepare HLPS watercraft for storage to provide and store calcium hyprochorite technical (HTH) or chlorinated lime, face shield and rubber gloves on board watercraft in quantities listed in Appendix A through D. The calcium hyprochorite technical or chlorinated technical (HTH) or chlorinated lime will be stowed in a cool dry place inside the watercraft in a readily accessible location for inspection and replacement.

J. RECORDS: It is the responsibility of the Storage Activity or Organization tasked to prepare Watercraft to establish Equipment Log Folder (green binder), preservation file and initially prepare required forms. The Equipment Log Folder and Preservation file will be stored in a conspicuous place in the mess area of each watercraft, on the LCM-8 they will be stored in the engine room.

(1) The Equipment Log Folder (green binder) will be used to store forms for record purposes in accordance with DA PAM 738-750, "Maintenance Management".

(a) Two (2) each DA form 2408-9, "Equipment Control Record" are required and will be inserted in the Equipment Log Folder. One (1) DA 2408-9 will be used for the “Transfer Report" and distributed in accordance with DA PAM 738-750. The “Transfer Report" will be prepared by the Storage Activity or Organization initially preparing Watercraft for storage. The Transfer Report is applicable to watercraft designs LCU, LCM-8, LT-3006 and BD-264B.

(b) DA Form 2408-20, "Oil Analysis Log" will be inserted in the Equipment Log Folder for design LCU and LCM-8. One (1) form will be required for each engine on the watercraft, i.e., LCU six (6) engines, LCM-8 four (4) engines. The Storage Activity preparing the Watercraft for storage shall annotate the first entry on each form. See Figure III-1.

(c) DA Form 2409, "Maintenance Inspection Record". Two (2) DA 2409(s) will be inserted in the Equipment Log Book, for recording dates when the six (6) month inspections, COSIS, activation and represervation actions were completed. It is the responsibility of the Storage Activity or Organization preparing the Watercraft for storage to record the first entry on the form. This entry will be the date when preservation was completed. See Figures I-2 and 2A. AOAP will be used during actual operation of watercraft

(2) Prepare two (2) copies of DA Form 3256, "Preservation and Depreservation Guide for Marine Equipment" and place on board each watercraft. One (1) copy of the form will be placed in a waterproof envelope and secured in a conspicuous location in the pilot house. One (1) copy will be placed in the preservation file folder. The DA 3256 will require to be annotated to reflect preservation accomplishments in accordance with requirements specified in this preservation procedure. The information that is annotated on the DA 3256 should be detailed in such a manner that it leaves no doubt what has to be accomplished by the activation team, i.e., "Sea and overboard discharge valves secured with wire in closed position. "Provide additional information by stating the quantity of sea valves that are wired closed or state location. Use the blank spaces on DA 3256 as necessary to annotate pertinent information. See Figure II1-3, 3A, 3B and 3C.

(3) List all outstanding deficiencies on DA Form 2404, "Equipment Inspection and Maintenance Worksheet: in duplicate, for each watercraft. One (1) copy will be inserted in the preservation file folder on board each watercraft. This copy will be used by the COSIS team who will per- form repairs during periodic maintenance. The duplicate copy of the DA 2404 with a cover letter stating the purpose of the DA 2404 will be forwarded to the address listed below. The duplicate copy will be used for planning purposes.

COMMANDER
WESTCOM
U.S. ARMY WESTERN COMMAND
ATTN: APLG-MM
FT. SHAFTER, HI 96858-5100

(4) Provide and place one (1) pad of blank DA Form 2404, "Equipment Inspection and Maintenance Worksheet" on board each watercraft. The blank DA 2404 forms will be inserted in the preservation file folder.

(5) Insure that the vessel files are replaced on board each watercraft.

(6) Insure that vessel log books are placed on board each watercraft. These log books are identified in AR 56-9, '"Watercraft" dated 30 April 1988. Applicable log books are as follows:

(a) DA Form 4640, Harbor Boat Deck Department Log for Class A and C-1 Vessels and DA Form 4993, Harbor Boat Engine Department Log for Class A and C-1 Vessels will be placed in a conspicuous place in the mesa area of each design LCU, LT-3006 and BD-264B watercraft.

(b) DA Form 5273, Deck and Engine Log for Class B Vessels will be placed in a conspicuous place in the engine room of each LCM-8.

(c) Original log book will be maintained on board each watercraft as a permanent record. During activation and operation the next available blank pages will be used. This will provide a continuous record of equipment operation.

For use of this form, see DA PAMs 738-750 and 738-751; the proponent agency is DCSLOG

1. END ITEM				2. SAMPLE FREQUENCY	3. COMPONENT	
a. NOMENCLATURE: LANDING CRAFT UTILITY					a. NOMENCLATURE AND TYPE: CENTER MAIN ENGINE 6-71	
b. MAKE OR TYPE: DESIGN 1466-A					b. SERIAL NUMBER: 1256834	
c. SERIAL NUMBER: LCU 1510					c. TIME SINCE NEW OR OVERHAUL: 502 HOURS	
4. DATE	5. HOURS			6. REASON FOR SAMPLE	7. RESULTS	8. SIGNATURE
	END ITEM a	COMPONENT b	LAST OIL CHANGE c			
4-20-85	1200	502	24	ROUTINE	NORMAL	R.S. Blackhead

SAMPLE

DA FORM MAY 81 2408-20 OIL ANALYSIS LOG

FIG. III-1

SECTION A - GENERAL

1. STOCK NUMBER	2. MODEL NUMBER	3. SERIAL NUMBER	4. LOCATION	5. FREQUENCY OF MAINT INSPECTION	
1905-01 031 6077	DESIGN 1466-A	LCU 1510			
6. NOMENCLATURE			7. EXPECTED USEFUL LIFE (In years)	8. EXPECTED DATE OF RETIREMENT	
LANDING CRAFT UTILITY (LCU)					
9. TECHNICAL REFERENCES			10. MANUFACTURER	11. DATE PUT IN SVC	12. UNIT COST
HLPS PRESERVATION PROCEDURE					

SECTION B - MAINTENANCE INSPECTION RECORD

DATE a	INITIAL b	REMARKS c	DATE a	INITIAL b	REMARKS c
5-10-85	R.B.	INITIAL PRESERVATION			
10-12-85	R.B.	6 MONTH INSPECTION			
10-29-85	R.B.	COSIS			
4-20-86	R.B.	6 MONTH INSPECTION			
10-24-86	R.B.	COSIS			
5-25-87	R.B.	ACTIVATION OPERATION INSPECTION			
6-20 87	R.B.	REPRESERVATION			

SAMPLE

DA FORM 2409
1 APR 62

EQUIPMENT MAINTENANCE LOG *(CONSOLIDATED)*
(TM 38-750)

FIG. III-2

SECTION C - REPAIR AND COST RECORD

DATE a	WORK ORDER NO. b	NATURE OF REPAIR c	MAN-HOURS d	COST PARTS e	COST LABOR f	COST TOTAL g
4-24-86	105682-R.B.	REPLACED 4 INJECTORS ANCHOR WINCH ENGINE	4	$145.00		

SAMPLE

SECTION D - MODIFICATION RECORD

MODIFICATIONS REQUIRED					MODIFICATIONS COMPLETE			
MWO NO. a	DATE OF MWO (Day - Month - Year) b	PRIORITY c	ECH d	MWO TITLE OR KIT NUMBER(S) e	DATE MWO APPLIED (Day - Month - Year) f	MAN-HOURS g	ORGANIZATION APPLYING MWO h	SIGNATURE (Certification of MWO Application)

GPO : 1983 O - 409-156

FIG. III-2A

PRESERVATION AND DEPRESERVATION GUIDE FOR MARINE EQUIPMENT

For use of this form, see TB 740-93-4; the proponent agency is the United States Army Materiel Command.

FEDERAL STOCK NUMBER	NOMENCLATURE	DESIGN NUMBER
1905-01-031 6077	LANDING CRAFT UTILITY (LCU)	1466-A
USA NUMBER	**PRESERVED BY (Name)**	**DATE PRESERVED**
LCU-1510	CHARLESTON STORAGE ACTIVITY	14 MAR 1985

PREPARATION INSTRUCTIONS: Complete all applicable entries on form to reflect preservation applied and depreservation required. Indicate the preservation applied by placing an "X" in the appropriate block, opposite the operation performed. Annotate the type and grade of material used in the blank spaces provided. Use blank spaces at end of form to annotate any operation not covered by the pre-printed information. Also, use blank spaces to include instructions on the replacement and/or readjustment of any component or system which was disassembled or had any adjustment disturbed during preservation. Prepare this form in duplicate. Place one copy in a waterproof envelope and secure in a conspicuous location in the pilot house. Place one copy in the vessel record file.

SAMPLE

DEPRESERVATION INSTRUCTIONS: This equipment has been preserved and is not ready to operate until the necessary depreservation and operating services have been performed. *(Consult the applicable technical manual and lubrication guide.)* The depreservation required appears on this form opposite the preservation required.

PRESERVATION		DEPRESERVATION
COOLING SYSTEM RAW WATER DRAINED FLUSHED WITH FRESH WATER BLOWN DRY ~~FLUSHED WITH PRESERVATIVE CONFORMING TO MIL-C-16173, GRADE 3 AND DRAINED~~.	X	READY FOR USE ~~CLEAN WITH COMPOUND CONFORMING TO MIL-C-10697. FLUSH AND FILL WITH WATER. ADD ANTIFREEZE WHEN REQUIRED FOR PROTECTION~~.
FRESH WATER DRAINED AND BLOWN DRY.	NA	REFILL WITH WATER AND/OR ANTIFREEZE.
FILLED WITH A CLEAN PREMIXED SOLUTION OF 50% ANTIFREEZE, CONFORMING TO FED O-A-548, TYPE I AND 50% WATER.	X	READY FOR USE. DO NOT DRAIN.
FILLED WITH ARCTIC ANTIFREEZE CONFORMING TO MIL-C-11755.	NA	READY FOR USE. DO NOT DRAIN OR DILUTE WITH WATER.
CRANKCASES, ENGINES AND ENGINE ACCESSORY WET SUMP P-10 FILLED TO OPERATING LEVEL WITH TYPE I, GRADE 30, PRESERVATIVE LUBRICATING OIL CONFORMING TO MIL-L-21260.	X	DO NOT DRAIN. GOOD UNTIL FIRST REQUIRED OIL CHANGE. CHECK OIL LEVEL, IF LOW, FILL TO OPERATING LEVEL WITH OIL CONFORMING TO MIL-L-2104, APPLICABLE GRADE.
DRY SUMP INTERIOR SURFACES COATED WITH TYPE ____, GRADE ____, PRESERVATIVE LUBRICATING OIL CONFORMING TO MIL-L-21260.	NA	NO DEPRESERVATION REQUIRED.
AIR CLEANERS DRY TYPE INTERIOR SURFACES COATED WITH TYPE ____, GRADE ____, PRESERVATIVE LUBRICATING OIL CONFORMING TO MIL-L-21260.	NA	NO DEPRESERVATION REQUIRED.
OIL-BATH TYPE AUX AND ANCHOR WINCH ENGINE FILLED TO OPERATING LEVEL WITH TYPE OB, GRADE 30, PRESERVATIVE LUBRICATING OIL CONFORMING TO MIL-L-21260.	X	READY FOR USE ~~CHECK LEVEL OF OIL. IF LOW, ADD OIL AS REQUIRED~~.
GOVERNORS HYDRAULIC FILLED TO OPERATING LEVEL WITH APPROVED OPERATING LUBRICANT.	NA	DO NOT DRAIN. ADD FLUID WHEN REQUIRED.
WET-TYPE MECHANICAL LUBRICATED by ENGINE SYSTEM FILLED TO OPERATING LEVEL WITH TYPE NA, GRADE NA, PRESERVATIVE LUBRICATING OIL CONFORMING TO MIL-L-21260.	X	READY FOR USE ~~CHECK LEVEL OF OIL. IF LOW, ADD OIL AS REQUIRED~~.
DRY TYPE MECHANICAL MECHANISMS WITHIN HOUSING COATED WITH TYPE ____, GRADE ____, PRESERVATIVE LUBRICATING OIL CONFORMING TO MIL-L-21260.	NA	NO DEPRESERVATION REQUIRED.
REDUCTION GEARS HYDRAULIC TYPE FILLED TO OPERATING LEVEL WITH APPROVED OPERATING FLUID. OE-30	X	DO NOT DRAIN. ADD FLUID WHEN REQUIRED.
MECHANICAL TYPE FILLED TO OPERATING LEVEL WITH APPROVED OPERATING LUBRICANT.	NA	DO NOT DRAIN. ADD LUBRICANT WHEN REQUIRED.
INCLOSED GEARS FILLED TO OPERATING LEVEL WITH APPROVED OPERATING LUBRICANT.	NA	DO NOT DRAIN. ADD LUBRICANT WHEN REQUIRED.
CLUTCHES DRY-DISC TYPE INTERIOR SURFACES COATED WITH PRIMER CONFORMING TO FED TT-P-664. SPRING LOADED TYPE CLUTCHES BLOCKED PARTIALLY OPEN.	NA	REMOVE BLOCKS.

DA FORM 1 NOV 71 3256 REPLACES DA FORM 3256, 1 JUL 67, WHICH IS OBSOLETE.

FIG. III-3

PRESERVATION		DEPRESERVATION
CONE TYPE UNLINED SURFACES, INTERIOR AND EXTERIOR CONTROL MECHANISMS COATED WITH PRIMER CONFORMING TO FED TT-P-664.	NA	NO DEPRESERVATION REQUIRED.
JAW TYPE CLUTCH JAWS, SHIFTER YOKES AND MACHINED SURFACES OF SHAFTS COATED WITH PRESERVATIVE CONFORMING TO MIL-C-16173, GRADE 2. INTERIOR CLUTCH CONTROL MECHANISM COATED WITH PRIMER CONFORMING TO FED TT-P-664.	NA	NO DEPRESERVATIVE REQUIRED.
BAND AND SHOE TYPE DRUM FACING, INTERIOR AND EXTERIOR CONTROL MECHANISMS COATED WITH PRIMER CONFORMING TO FED TT-P-664.	NA	NO DEPRESERVATION REQUIRED.
EXPOSED GEARS ANCHOR WINCH COATED WITH PRESERVATIVE CONFORMING TO MIL-C-16173, P-9 ~~GRADE 1 AND/OR GRADE 3~~.	X	NO DEPRESERVATION REQUIRED
DRIVE BELTS TENSION ~~RELEASED~~. IS NOT RELEASED	X	ADJUST TENSION. AS REQUIRED
EXPOSED DRIVE CHAINS ANCHOR WINCH COATED WITH PRESERVATIVE CONFORMING TO MIL-C-16173, ~~GRADE 3~~ AND PRESERVATIVE CONFORMING TO MIL-G-10924, P-1	X	NO DEPRESERVATION REQUIRED.
BRAKES HYDRAULIC TYPE FILLED TO OPERATING LEVEL WITH APPROVED HYDRAULIC FLUID. BRAKE DISC AND/OR DRUM FACINGS COATED WITH PRIMER CONFORMING TO FED TT-P-664.	NA	CHECK LEVEL OF FLUID. IF LOW, ADD FLUID OF THE TYPE REQUIRED BY THE LUBRICATION ORDER.
MECHANICAL TYPE FILLED TO OPERATING LEVEL WITH APPROVED OPERATING LUBRICANT.	NA	DO NOT DRAIN. ADD LUBRICANT WHEN REQUIRED
PARKING BRAKES DRUM ANCHOR/RAMP WINCH BRAKING SURFACES, PULLY GROOVES, LINING CARRIERS, PINS, LEVERS, LINKAGE AND SIMILAR PARTS COATED WITH PRIMER CONFORMING TO FED TT-P-664. CABLES COATED WITH LUBRICANT CONFORMING TO FED VV-L-751, TYPE II, GRADE B.	X	NO DEPRESERVATION REQUIRED.
TANKS NO PRESERVATION, DRAIN VALES OPEN AIR INTERIOR ~~SURFACES~~ COATED WITH TYPE NA, GRADE NA, PRESERVATIVE LUBRICATING OIL CONFORMING TO MIL-L-21260.	X	CLOSE DRAIN VALVES NO DEPRESERVATION REQUIRED.
WATER POTABLE CLEANED AND PAINTED DRAIN PLUGS REMOVED. VALVES IN OPEN POSITION.	X	CHLORINATION REQUIRED ~~REINSTALL DRAIN PLUGS. CLOSE VALVES.~~
GASOLINE, DIESEL AND OIL P-10 INTERIOR SURFACES COATED WITH TYPE I, GRADE 30, CONFORMING TO MIL-L-21260.	X	NO DEPRESERVATION REQUIRED.
AIR COMPRESSORS P-10 CRANKCASE FILLED WITH TYPE I, GRADE 30, PRESERVATIVE LUBRICATING OIL CONFORMING TO MIL-L-21260. AIR RECEIVER TANK DRAIN PLUGS REMOVED. DRAIN COCKS OPEN. COMPRESSOR CHAMBERS FOGGED WITH P-10	X	DO NOT DRAIN. GOOD UNTIL FIRST REQUIRED OIL CHANGE. CHECK OIL LEVEL. IF LOW, FILL TO OPERATING LEVEL WITH OIL CONFORMING TO MIL-L-2104, APPLICABLE GRADE. REINSTALL DRAIN PLUGS. CLOSE DRAIN COCKS.
PUMPS *(Other than engine mounted)* RAW WATER DRAINED FLUSHED BLOWN DRY INTERIOR SURFACES COATED WITH TYPE NA, GRADE NA, PRESERVATIVE LUBRICATING OIL CONFORMING TO MIL-L-21260. PUMP PACKING REMOVED AND PACKAGED METHOD IC-1 AND SECURED TO PUMP.	X	ADJUST ~~REINSTALL~~ PUMP PACKING. READY FOR USE
POTABLE WATER SYSTEM DRAINED AND BLOWN DRY PUMP DRAINED. DRAIN PLUG AND PUMP PACKING REMOVED, PACKAGED METHOD IC-1 AND SECURED TO PUMP.	X	REINSTALL DRAIN PLUGS AND PUMP PACKING. READY FOR USE
FUEL AND OIL SYSTEMS ARE NOT DRAINED FILLED WITH TYPE NA, GRADE NA, PRESERVATIVE LUBRICATING OIL CONFORMING TO MIL-L-21260.	X	DRAIN THE PRESERVATIVE OIL FROM THE PUMPS. READY FOR USE
OIL PURIFIERS DRAINED AND COATED WITH TYPE _____, GRADE _____, PRESERVATIVE LUBRICATING OIL CONFORMING TO MIL-L-21260.	NA	FILL WITH PRESCRIBED LUBRICATING OIL.
HEAT EXCHANGER RAW WATER SIDES FLUSHED WITH PRESERVATIVE CONFORMING TO MIL-C-16173, GRADE 3. POTABLE OR DOMESTIC SIDES DRAINED. OIL SIDE OF OIL COOLER FLUSHED WITH TYPE _____, GRADE _____, PRESERVATIVE LUBRICATING OIL CONFORMING TO MIL-L-21260.	NA	NO DEPRESERVATION REQUIRED.

FIG. III-3A

PRESERVATION		DEPRESERVATION
REFRIGERATION UNITS NO PRESERVATION ~~REFRIGERANT PUMPED DOWN, VALVES CLOSED, COMPRESSOR CRANKCASE FILLED TO OPERATING LEVEL WITH APPROVED OPERATING LUBRICANT.~~	X	READY FOR USE ~~OPEN VALVES. CHECK LEVEL OF LUBRICANT IN COMPRESSOR CRANKCASE, IF LOW ADD LUBRICANT OF THE TYPE REQUIRED BY THE LUBRICATION ORDER.~~
HEATING BOILERS INSTALLED DRAINED AND BLOWN DRY. DRAIN PLUGS ~~REMOVED~~, PACKAGED AND SECURED TO BOILER.	X	READY FOR USE ~~REINSTALL DRAIN PLUGS.~~
OIL BURNERS DRAINED NO PRESERVATION POT TYPE CARBURETOR FLUSHED WITH PRESERVATIVE OIL CONFORMING TO FED VV-L-800. INTERIOR METAL SURFACES OF BURNER POT COATED WITH TYPE NA, GRADE NA, PRESERVATIVE LUBRICATING OIL CONFORMING TO MIL-L-21260.	X	READY FOR USE NO DEPRESERVATION REQUIRED.
ATOMIZING TYPE FUEL SYSTEM AND ATOMIZING AIR SYSTEM FLUSHED WITH PRESERVATIVE OIL CONFORMING TO FED VV-L-800. ATOMIZER COATED WITH TYPE ———, GRADE ———, PRESERVATIVE LUBRICATING OIL CONFORMING TO MIL-L-21260.	NA	NO DEPRESERVATION REQUIRED.
CAPSTANS, WINDLASSES AND WINCHES EXPOSED SHAFTS, LINKAGES, THREADED ADJUSTMENT, GEARS AND PINIONS COATED WITH PRESERVATIVE CONFORMING TO MIL-C-16173, GRADE 2. GEAR BOXES FILLED TO OPERATING LEVEL WITH TYPE GO, GRADE 90 PRESERVATIVE LUBRICATING OIL CONFORMING TO MIL-L-21260. BRAKE BANDS AND DRUMS COATED WITH FED TT-P-664 PRIMER. UNITS COVERED WITH SHELTERS TO PREVENT ENTRY OF WATER.	X	READY FOR USE ~~REMOVE SHELTERS. DRAIN GEAR BOXES AND REFILL TO OPERATING LEVEL WITH PRESCRIBED OPERATING OIL.~~
PIPING SYSTEMS RAW WATER FLUSHED ~~WITH PRESERVATIVE CONFORMING TO MIL-C-16173, GRADE 3.~~ WITH FRESH WATER BLOWN DRY	X	READY FOR USE NO DEPRESERVATION REQUIRED.
FRESH WATER DRAINED AND BLOWN DRY.	X	READY FOR USE NO DEPRESERVATION REQUIRED.
FUEL AND OIL NOT DRAINED FLUSHED WITH TYPE NA, GRADE NA, PRESERVATIVE LUBRICATING OIL CONFORMING TO MIL-L-21260.	X	READY FOR USE NO DEPRESERVATION REQUIRED.
ELECTRICAL EQUIPMENT NO PRESERVATION SWITCHBOARDS, PANELS AND CONTROLLERS FERROUS METAL BUS BARS AND OTHER FERROUS SURFACES, NOT REQUIRING REMOVAL OF PRESERVATIVE FOR ACTIVATION, COATED WITH TYPE NA, GRADE NA, PRESERVATIVE LUBRICATING OIL CONFORMING TO MIL-L-21260.	X	READY FOR USE NO DEPRESERVATION REQUIRED.
MOTORS AND GENERATORS NO PRESERVATION FERROUS METAL SLIP RINGS COATED WITH PRESERVATIVE CONFORMING TO MIL-G-10924.	X	READY FOR USE NO DEPRESERVATION REQUIRED.
RECEPTACLES RECEPTACLES EXPOSED TO THE WEATHER SEALED WITH TAPE CONFORMING TO FED PPP-T-60, TYPE IV.	X	REMOVE TAPE.
GAGES AND INSTRUMENTS CLEANED BY MOST APPLICABLE PROCESS OF MIL-P-116.	X	NO DEPRESERVATION REQUIRED.
HORN, BELLS, BUZZERS, NAVIGATIONAL AND FLOODLIGHTS ~~REMOVED, PACKAGED AND STOWED IN COMPARTMENTS.~~ ARE INSTALLED	X	READY FOR USE ~~REINSTALL REMOVED HORNS, BELLS, BUZZERS, NAVIGATIONAL AND FLOODLIGHTS.~~
VALVES WEATHER EXPOSED STEMS COATED WITH PRESERVATIVE CONFORMING TO MIL-C-16173, GRADE 2. VALVES CLOSED.	X	NO DEPRESERVATION REQUIRED.
SEA AND OVERBOARD DISCHARGE NO PRESERVATION SEA STRAINER BASKET COATED WITH PRESERVATIVE CONFORMING TO MIL-C-16173, GRADE 3. VALVES SECURED WITH WIRE IN CLOSED POSITION.	X	REMOVE WIRE FROM VALVES. 13
VALVES WITHIN COMPARTMENTS NO PRESERVATION PACKING GLAND NUTS LOOSENED AND VALVES LEFT IN OPEN POSITION.	X	READY FOR USE TIGHTEN PACKING GLAND NUTS AND CLOSE VALVES.
STEERING SYSTEMS UNPAINTED SURFACES OF QUADRANTS, RODS, LINKAGES AND FITTINGS COATED WITH PRESERVATIVE CONFORMING TO MIL-C-16173, GRADE 1. EXPOSED CABLES COATED WITH LUBRICANT CONFORMING TO TYPE II, GRADE B OF FED VV-L-751. EXPOSED SURFACES OF ACTUATING RODS OF HYDRAULIC RAMS COATED WITH PRESERVATIVE CONFORMING TO MIL-C-16173, GRADE 2.	X	NO DEPRESERVATION REQUIRED. READY FOR USE
WIRE ROPE, RIGGING AND FITTINGS CLEANED AND COATED WITH LUBRICANT CONFORMING TO TYPE II, GRADE B OF FED VV-L-751. ANCHOR AND RAMP WINCH WIRE ROPE	X	NO DEPRESERVATION REQUIRED. READY FOR USE

FIG. III-3B

PRESERVATION		DEPRESERVATION
SANITARY FACILITIES ORAINED AND FIUSHED FERROUS METAL LAVATORY, SHOWER AND TOILET PIPING, NOT CONNECTED TO POTABLE WATER SYSTEM, FLUSHED WITH PRESERVATIVE CONFORMING TO MIL-C-16173, GRADE 3.	X	NO DEPRESERVATION REQUIRED. READY FOR USE
FIXED FIRE FIGHTING SYSTEM (HALON) FERROUS METAL SURFACES COATED WITH PRESERVATIVE CONFORMING TO MIL-G-10924. ~~RELEASE MECHANISM WIRED TO PREVENT ACCIDENTAL DISCHARGE.~~ NO PRESERVATION	X	HALON CONTROL SWITCH IN ~~REMOVE WIRE FROM RELEASE MECHANISM~~. MANUAL POSITION
GALLEY EQUIPMENT COATED WITH COOKING OIL FOOD HANDLING AND PROCESSING EQUIPMENT AND MESS GEAR COATED WITH PRESERVATIVE CONFORMING TO MIL-C-10382. FIRE SIDES OF STOVES COATED WITH PRESERVATIVE CONFORMING TO MIL-C-16173, GRADE 1.	X	REMOVE PRESERVATIVE FROM FOOD HANDLING AND AND PROCESSING EQUIPMENT AND MESS GEAR. READY FOR USE
DAVITS BEARING SURFACES AND THREADS COATED WITH PRESERVATIVE CONFORMING TO MIL-G-10924.	X	NO DEPRESERVATION REQUIRED.
DECK FITTINGS RECESSED FITTINGS AND THREADED SURFACES OF DECK PLATES AND PLUGS COATED WITH PRESERVATIVE CONFORMING TO MIL-G-10924. RECESSES SEALED WITH TAPE CONFORMING TO FED PPP-T-60, TYPE IV AND STRIPPABLE COATING CONFORMING TO MIL-C-16555, CLASS 1.	X	REMOVE TAPE AND STRIPPABLE COATING.
SOCKETS AND BEARINGS DAVIT, STAFF AND STANCHION SOCKETS AND BEARINGS COATED WITH PRESERVATIVE CONFORMING TO MIL-G-10924 AND SEALED, AGAINST ENTRY OF WATER, WITH TAPE CONFORMING TO FED PPP-T-60, TYPE IV AND STRIPPABLE COATING CONFORMING TO MIL-C-16555, CLASS 1.	X	REMOVE TAPE AND STRIPPABLE COATING.
ANCHORS NO PRESERVATION FERROUS SURFACES OF ANCHORS, CHAINS AND FITTINGS COATED WITH PRESERVATIVE CONFORMING TO MIL-C-16173, GRADE 1.	X	NO DEPRESERVATION REQUIRED.
COMPONENTS REMOVED NONE PLACED AND SECURED IN PILOT HOUSE OR OTHER COMPARTMENTS.	NA	REINSTALL COMPONENTS IN ACCORDANCE WITH MATCHMARKING.
COMPONENTS REMOVED NONE PACKED IN BOX AND SECURED ON DECK OR INSIDE PILOT HOUSE OR OTHER COMPARTMENTS.		UNPACK AND REINSTALL COMPONENTS IN ACCORDANCE WITH MATCHMARKING.
DYNAMIC DEHUMIDIFICATION SYSTEM AND/~~OR COCOON INSTALLED~~	X	REMOVE DEHUMIDIFICATION SYSTEM. ~~REMOVE COCOON SKIN AND FRAMEWORK~~.
COMPONENTS LOOSENED AND/OR PLACED IN OPEN POSITION FOR PROVIDING VENTILATION NONE	NA	TIGHTEN AND/OR PLACE IN CLOSED POSITION COMPONENTS LOOSENED OR LEFT OPEN FOR VENTILATION.
MAIN AUXILIARY AND ANCHOR WINCH ENGINE COMBUSTION CHAMBER FOGGED WITH P-10, TYPE-1 GRADE 10 PRESERVATION OIL		NO DEPRESERVATION REQUIRED READY FOR USE
ENGINE FUEL SYSTEMS PRESERVED WITH P-9 PRESERVATIVE OIL	X	READY FOR USE
CHT SYSTEM FLUSHED WITH FRESH WATER AND DRAINED		READY FOR USE
FUEL OIL DAY TANKS FILLED TO 95% CAPACITY, TREATED WITH STABLIZER	X	READY FOR USE

FIG. III-3C

CHAPTER IV
CARE OF SUPPLIES IN STORAGE (COSIS)

A. Watercraft that are processed for storage in accordance with this procedure will require periodic surveillance and visual inspections.

The HLPS vessel crew is charged with this responsibility and will ensure that:

1. The dehumidification (D/H) level of 40 percent, plus or minus 5 percent is constant throughout the D/H zones.

2. Contact preservation on machinery and other components has not deteriorated to a level allowing corrosion to occur.

3. Exterior sealing has not deteriorated to a level allowing excess humid air to enter the D/H zones.

B. Surveillance is a system where equipments are subject to, but not limited to cyclic, scheduled and special inspections and continuous actions to ensure that the equipment is maintained in a ready to use status.

C. Visual inspections are inspections by visual means to observe the condition of preservation to detect deficiencies.

D. Deficiencies found during surveillance and visual inspections will be classified as major or minor deficiencies and are defined as follows:

1. Major defect is a defect that:

   (a) Will affect the material readiness posture of watercraft.

   (b) Will limit or restrict the watercraft from performing its intended functions.

   (c) Will probably cause operating failure of the watercraft.

   (d) Will probably allow the watercraft to deteriorate and degrade during storage.

   (e) Will cause excessive downtime and increased maintenance.

2. A minor defect is one that does not reduce the usability of the watercraft for its intended purpose or has no significant bearing on the effective use or operation of, or affects the overall appearance.

E. Corrosion that is found during surveillance and visual inspections will be reported as Stage I, II, III and IV corrosion and are defined as follows:

1. Stage I corrosion. Discoloration, staining. No direct visual evidence of pitting, etching or other surface damage.

2. Stage II corrosion. Loose rust, black or white corrosion accompanied by minor etching and pitting of surface. No scale or tight rust.

3. Stage III corrosion. Rust, black or white corrosion accompanied singly or in combination with etching, pitting or more extensive surface damage. Loose or granular condition.

4. Stage IV corrosion. Rust, black or white corrosion progressed to the point where fit, wear, function or life of the item has been affected. Powdered or scaly condition, with pits or irregular areas of material removed from the surface of the item.

F. Once the watercraft are stored on the HLPS or SSB vessel and dehumidification machines and PVC piping are installed, the surveillance shall be performed during the intervals specified below:

1. Check the dehumidification (D/H) level within each zone daily.

   (a) The relative humidity factor (RH) of 40 percent plus or minus 5 percent should be achieved within three (3) weeks after D/H machines are in operation.

   (b) If the RH factor is not achieved within three (3) weeks, additional exterior sealing will be required.

   (c) Once the RH factor of 40 percent, plus or minus 5 percent is achieved, check each zone every two (2) weeks.

2. Adjust the humidistat(s) as required to maintain the required RH factor.

3. The psychrometer, NSN 6685-00-826-1662, shall be used physically to verify the relative humidity within the D/H zones. The exterior accesses to the zones should not be left opened for a prolonged period of time, to prevent the entry of humid air from entering the D/H zone. Verification of relative humidity within the zones shall be accomplished in more than one compartment, i.e., on the tug, design 3006, verification should be accomplished, but is not limited to, the engine room, crews' quarters, mess area and pilothouse.

4. Records of relative humidity readings shall be maintained on each watercraft. Figure IV-1 is a sample of a form, titled, "D/H Log" that will be utilized for record purposes.

G. The following inspection procedure shall be followed and records shall be maintained to verify that watercraft stored in accordance with this procedure do not deteriorate while they are in storage.

1. During activation, and/or every six (6) months inspect contact preservatives on all watercraft equipment for deterioration, the first signs of deterioration will be the presence of Stage I corrosion.

   (a) When the scheduled six (6) month inspection falls during the month that watercraft are scheduled for activation, the inspection will be performed during activation.

   {b) A variance of twenty-five (25) percent (45 days) plus or minus, is authorized for performing the six (6) month inspection from the scheduled inspection date.

   (c) On completion of activation and represervation the next inspection will be scheduled and performed six (6) months from the date represervation was completed.

2. Each month inspect the contact preservation on equipment protected with equipment covers for deterioration. The reeved cables on the Crane, Barge, 100 Ton, Design 264-B are exposed to elements and shall be inspected monthly. The first sign of deterioration will be the presence of Stage I corrosion.

3. Each month inspect the exterior, including underwater hull surfaces, of each watercraft for paint and sealing deterioration. Depending on the age of the paint system, deterioration will vary from Stage I to Stage IV corrosion.

4. Inspect the contact preservatives in fuel oil storage tanks and paint system in fresh water tanks on all watercraft during the activation The first signs of deterioration will be the presence of Stage I corrosion

5. The attached Figures IV-2-A/E is an inspection check list to be used as a guide for performing. inspections as specified above. The check list may be reproduced locally and utilized by the inspection contact team. The inspection check list shall be annotated to reflect the specific stage of corrosion found during the inspection. Enter the roman numeral I, II, III or IV between the words "Stage" and "Corrosion", on the inspection check list. Also place a check " " mark in the appropriate classification column. In the event corrosion is not detected enter the word "satisfactory" or "sat" across the classification columns.

6. Spaces under D/H will not be opened for inspection unless problems are suspected.

H. Deficiencies found during the inspections shall also be recorded on DA 2404 forms, "Equipment Inspection and Maintenance Worksheet". Column d. will be utilized to describe corrective action required for each deficiency entered. In addition, estimated manhours and material costs will be listed in column d. or e. Completed DA 2404 forms will be forwarded to the following address for guidance on COSIS requirements:

COMMANDER
WESTCOM
ATTN: APLG-MM
FT. SHAFTNER, HI 96858-5100

1. Exterior sealing deficiencies shall be accomplished by the Care of Supplies in Storage (COSIS) contact crew as soon as discovered. This is required in order to maintain the RH level in the zone and alleviate excessive D/H machine run time.

2. Preservation deficiencies will be corrected by applying new contact preservatives in accordance with the instructions provided in Chapter III. This will be performed by a contact team designated by WESTCOM.

3. Exterior and interior paint deficiencies will be corrected in accordance with TB 43-0144, "Painting of Vessels". Mobilization paint scheme will be applied. This will be accomplished by a contact team designated by WESTCOM.

I. The DA 2409 form, "Equipment Maintenance Log", Section B, shall be annotated to reflect the dates when the six (6) month inspections and COSIS (in-storage maintenance) was accomplished.

VESSEL _____

D/H LOG

PAGE NO. _____

	SENSING ELEMENT (R/H%)					D/H MACHINE RUN TIMES (HRS)				
DATE	1	2	3	4	5	ZONE 1	ZONE 2	ZONE 3	ZONE 4	REMARKS

FIGURE IV-1

INSPECTION CHECK LIST
FOR
HLPS
WATERCRAFT

HULL NUMBER/NAME_____

DATE_____

Item	Defect	Classification		
		Major		Minor
HULL AND DECK PLATING	Stage corrosion; cracked or broken welds; damage affecting the water tight integrity ...			
	Stage corrosion			
MANHOLES, HATCHES, AIR-PORTS AND DOORS	Stage corrosion; gaskets deteriorated or missing			
	Stage corrosion on hinge bolts, fasteners, and/or securements			
FUEL SYSTEM:				
Tanks:				
Internal surfaces	Stage corrosion			
	Stage corrosion; coating, peeling or flaking ..			
External surfaces	Stage corrosion			
	Stage corrosion			
	Stage corrosion			
Lines, hoses and connectors	Cracked or checked; kinked; broken; fungus growth			
Filters, and sediment bowls	Stage corrosion on internal surfaces; cracked or broken			
	Stage corrosion on internal surfaces; element deteriorated or contaminated			
	Stage corrosion on internal surfaces			
Injectors or nozzles	Stage corrosion; cracked or broken			
	Stage corrosion; contaminated			
Seals	Deteriorated; leaks or seeps			
ENGINE ASSEMBLY:				
Valves, rocker arm assembly and combustion chambers	Stage corrosion			
	Stage corrosion			
Piston assy and cylinder wall	Stage corrosion			
	Stage corrosion			
Pulleys	Cracked; broken; stage IV corrosion			
	Stage corrosion			
	Stage corrosion			
Water pump	Stage corrosion on internal surfaces; frozen; leaks			
	Stage corrosion on internal surfaces			
	Stage corrosion on internal surfaces			
Flywheel and ring gear	Stage corrosion; ring gear shipped, cracked or broken			
	Stage corrosion			
	Stage corrosion			
Air cleaner and crankcase breather	Stage corrosion			
	Stage corrosion			
	Stage corrosion			
LUBRICATING SYSTEM:				
Lines, hoses and fittings	Kinked; broken; leaks or seeps, checked or cracked, fungus growth			

FIG IV-2-A

Item	Defect	Classification		
		Major		Minor
LUBRICATION SYSTEMS —Continued				
Filters	Stage corrosion on internal or external surfaces			
	Stage corrosion on internal surfaces; element deteriorated or contaminated			
Lubricant	Contaminated			
Seals	Deteriorated; leaks or seeps			
EXHAUST SYSTEM:				
Rain cap	Stage corrosion; cracked, broken or missing			
	Stage corrosion			
	Stage corrosion			
Brackets and hangers	Stage corrosion; cracked or broken			
	Stage corrosion			
	Stage corrosion			
Intake and exhaust manifolds muffler and pipes	Stage corrosion; punctured			
	Stage corrosion			
	Stage corrosion			
COOLING SYSTEM:				
Raw water system	Stage corrosion; valves damaged or inoperable; damaged piping and fittings			
	Stage corrosion			
	Stage corrosion			
Fresh water system	Stage corrosion; valves, piping and fittings damaged or inoperable			
	Stage corrosion			
	Stage corrosion			
Seals and gaskets	Deteriorated; leaks or seeps			
Hoses and belts	Checking or cracking; frayed or cut; loss of flexibility; fungus growth; broken reinforcing			
BILGE PUMPS	Stage corrosion; damaged or frozen shafts			
	Stage corrosion			
	Stage corrosion on interior surfaces			
ELECTRICAL SYSTEM:				
Wiring	Broken strands; cracked insulation; fungus growth			
	Frayed; checked; loss of flexibility			
Terminals and connections	Stage corrosion; broken terminals			
	Stage corrosion			
Switches, regulators, relays, magnetos and controllers	Stage corrosion; broken; frozen			
	Stage corrosion			
Generator assemblies, electric motors and starters	Stage corrosion; frozen			
	Stage corrosion			
Lights and reflectors	Stage corrosion; cracked or broken			
	Stage corrosion			

FIG IV-2-B

Item	Defect	Classification	
		Major	Minor
AIR HEATER ASSEMBLY	Stage corrosion; damaged electrode assembly		
	Stage corrosion		
	Stage corrosion		
ANCHOR AND RAMP WINCH	Stage corrosion on drums, barrels or cable; broken strands or kinks in cable		
	Stage corrosion		
	Stage corrosion		
DRIVE BELTS AND HOSES	Checking; cracking; broken reinforcing; frayed; *cut; loss of flexibility and resiliency; fungus* growth		
CONTROLS AND INSTRUMENTS	Stage corrosion; cracked or broken; inoperable; dial face illegible		
	Stage corrosion; linkage frozen		
PROPELLER ASSEMBLY:			
Shaft	Stage corrosion; distorted, bent or broken		
	Stage corrosion; bearing deteriorated or damaged		
	Stage corrosion		
Propeller	Stage corrosion; chipped or broken		
	Stage corrosion		
	Stage corrosion		
STEERING SYSTEM:			
Emergency tiller	Stage corrosion		
	Stage corrosion		
Rudders	Stage corrosion		
	Stage corrosion		
Quadrant	Stage corrosion		
	Stage corrosion		
Cable and sheaves	Stage corrosion; broken strands		
	Stage corrosion		
Marine & reduction gear	Stage corrosion on shafts, gears, bearings or chains; deteriorated seals; leaks		
	Stage corrosion on internal surfaces, lubricant contaminated		
BRAKE ASSEMBLY:			
Drum and/or shoes	Stage corrosion		
	Stage corrosion		
	Stage corrosion		
Springs, anchors, cable, yokes and/or linkage	Stage corrosion; distorted or broken		
	Stage corrosion; frozen		
	Stage corrosion		
Fluid reservoirs, wheel and master cylinders	Stage corrosion on internal surfaces; stage corrosion on external surfaces; leaks; boots deteriorated; frozen		

Item	Defect	Classification	
		Major	Minor
BRAKE ASSEMBLY—Continued			
	Stage corrosion on external surfaces; stage corrosion on internal surfaces		
Cylinder actuating rods	Stage corrosion		
	Stage corrosion		
	Stage corrosion		
Lines, hoses and fittings	Checked; cracked; kinked; split or cut; leaks; loss of flexibility		
CLUTCH ASSEMBLY:			
Bearings, shafts, linkage and springs	Stage corrosion; frozen		
	Stage corrosion		
Metal disks and plates	Stage corrosion		
	Stage corrosion		
Fiber disks and bands	Deteriorated; punctured or torn		
Lubricant	Contaminated		
COMPONENTS AND ACCESSORIES	Missing; incomplete		
	Deteriorated or damaged		
LIFTING BRIDLE	Stage corrosion		
	Stage corrosion		
WATER AND FUEL PUMPS	Stage corrosion; frozen shafts		
	Stage corrosion on internal surfaces		
RAMP AND GASKET AND HINGES:			
Gaskets	Checking or cracking; loss of flexibility		
Hinges	Stage corrosion; exposed rubber surfaces checked, cracked, torn or punctured; fungus growth		
SEA SUCTION AND OVERBOARD DISCHARGE VALVES	Stage corrosion; deteriorated gaskets and packing		
	Stage corrosion		
FIRE, BILGE & SALVAGE PUMPS	Stage corrosion; shafts frozen		
	Stage corrosion		
STANCHIONS, LIFELINES & MAST	Stage corrosion; broken strands or kinks in lifelines		
	Stage corrosion		
PIPING AND VALVES	Stage corrosion; deteriorated gaskets and/or packing; leaking or damaged valves or pipes		
	Stage corrosion		
FIRE EXTINGUISHER SYSTEM	Ten percent or more loss of charge; hydrostatic test date exceeded; stage III corrosion		

Item	Defect	Classification		
		Major		Minor
BERTHING SPACE:				
Bunks	Stage corrosion; damaged			
	Stage corrosion			
Lockers	Stage corrosion			
	Stage corrosion			
HOT WATER HEATER	Stage corrosion on internal working mechanisms			
ANCHORS	Stage corrosion			
	Stage corrosion			
HEATING SYSTEM:				
Controls and instruments	Stage corrosion; deteriorated or damaged			
Electric motor and wiring	Stage corrosion on contractor points and/or wiring			
	Stage corrosion on contractor points			
Burner	Stage corrosion on interior surfaces; leaks; damaged valves			
Boiler	Stage corrosion on interior surfaces; leaks; damaged valves			
	Stage corrosion on interior surfaces			
Circulating pumps	Stage corrosion; shaft frozen			
	Stage corrosion			
SANITATION SYSTEM:				
Water closets and lavatory sinks	Stage corrosion on metal surfaces; cracked or broken			
	Stage corrosion on metal surfaces			
Piping and valves	Stage corrosion; deteriorated gaskets or packing; valves frozen or inoperable			
	Stage corrosion			
Showers	Stage corrosion on metal surfaces			
	Stage corrosion on metal surfaces			
WIRE ROPE	Stage corrosion; broken strands			
	Stage corrosion			
COMPRESSORS	Stage corrosion on internal surfaces; stage corrosion on external surfaces			
	Stage corrosion on internal surfaces; stage corrosion on external surfaces			
GALLEY EQUIPMENT:				
Fuel oil range and tank	Stage corrosion on range; stage corrosion in tank; breaks or kinks in fuel line; valves damaged or inoperable			
	Stage corrosion on range; stage corrosion in tank			
Sinks	Stage corrosion			
	Stage corrosion			
Refrigerator	Stage corrosion; cracked or broken fittings and lines; leaks; broken strands or fungus growth on wiring			

CHAPTER V
DEPRESERVATION/ACTIVATION

1. INTRODUCTION:

A. Preservation procedures for HLSP and SSB watercraft facilitate periodic maintenance and quick reaction for use in contingency operations. Depreservation provides for routine activation during a recurring maintenance cycle as well as quick reaction depreservation and activation in a contingency operation. The watercraft have been preserved to enable total activation within two (2) days.

B. It is pertinent to review the level of preservation applied to better understand the requirements for depreservation. A copy of DA Form 3256, "Preservation and Depreservation Guide for Marine Equipment", is located in the wheel house. The DA 3256, reflects the preservation applied and depreservation required. The depreservation instructions shall be used with the instructions stated herein for activating watercraft.

(1) The machinery and habitable areas are under dehumidification.

(2) Sealing, ducting, removals, and blanking was kept to the absolute minimum.

(3) Machinery, electrical equipment and piping systems are in a ready for service status.

(4) The fuel oil day tanks are 95 percent full on all watercraft except the LCM-8, which have but their two (2) fuel tanks filled to 90 percent. The main fuel tanks on all other watercraft are empty.

(5) The starting batteries on all watercraft are in a dry charged state.

(6) Lubricating oil storage tanks on all watercraft are full, except the LCM-8's which have none. There are three (3) five (5) gallon cans of spare lubricating oil stored in each LCM-8 lazarette.

(7) All sea valves are wired closed.

C. Activation.

(1) In the case of depreservation/activation in a contingency operation the sealing, ducting, flex hoses, humidistats, sensing elements, plywood blanks, etc., would be removed and disposed of in a manner most expedient for the situation or as directed by the senior officer present.

(2) In the case of activation for inspection and maintenance, removals will be commensurated with the scope of the test/activation. Removed items shall be retained on board each watercraft for reuse during represervation.

(3) In either case the Herculite equipment covers shall be retained for reuse during represervation and routinely used on a fully operational watercraft.

D. The BII contains tool sets and special tools applicable to each watercraft. These tools are of sufficient quantity and types required to activate and test each HLPS and SSB watercraft.

E. The Maintenance Facility will provide preservation materials required to reprocess the watercraft for storage on completion of activation and tests. The materials required are listed in Chapter VI, "Represervation".

F. The teams required to activate and test HLPS watercraft are listed in paragraph 4 of this Chapter. This concept will provide for the availability of 3552 manhours in a 48 hour period. These manhours include 48 manhours for supervision and 1008 hours for relief of crews as required. For SSB watercraft this concept will provide for the availability of 1620 manhours in a 48 hour period. This includes 48 manhours for supervision and 480 manhours relief crews.

G. As stated in paragraph I B(5) above, the compliment of starting batteries that are installed in battery trays on each watercraft are in a dry charged state and shall be used for activation. Insure that vent caps on the batteries are open. Four (4) each 105-125VAC/6VDC battery chargers are stored on the HLPS vessel and two (2) on each SSB, one for each ROWPU. On completion of represervation, the wet charged batteries will be removed from the watercraft for disposal and replaced with new starting batteries.

2. Depreservation: The preservation storage of all craft is such that little is required and consist of opening the vessel by removing the sealing, dehumidification ducting, flex hoses, sensing elements, humidistats, and plywood blanks, etc. This can be accomplished concurrently with the preliminary activation. It is anticipated that most of the depreservation would be accomplished prior to float off/launching of the craft. The following order of removal/depreservation is recommended.

A. Remove dehumidification disconnect and remove dry and humid air PVC piping from host (HLPS) ship. Remove exterior PVC piping from the craft. ROWPU barges are equipped with two (2) dehumidification machines located in the ro-ro compartment. See Appendix E.

B. Open up and air out craft Remove tape and plywood blanks, open doors, port lights, scuttles, and hatches as deemed appropriate under the prevailing climactic conditions. Remove the internal flex hose/ducting, humidistats and sensing elements. Reinstall port lights, doors, and/or whatever may have been removed for the introduction and circulation of dehumidified air.

3. Activation: As stated in I.B(3) above, the machinery, electrical equipments, and systems are in a ready for service status. However, there are certain preliminary requirements that must be accomplished prior to activation and testing that cannot commence until the craft are waterborne. The following order of activation is recommended.

A. For total activation, activate the batteries by filling the electrolyte that is stored in proximity thereof, except in the LCU 1466A class, the electrolyte is stored in the crews quarters. Let batteries stand for approximately one (1) hour, then connect cables and batteries are ready for service.

CAUTION

Electrolyte is a mixture of sulfuric acid and water, that is highly corrosive, and will cause severe burns if allowed to come in contact with the skin and/or eyes, and is destructive to clothing. Extreme caution shall be exercised in handling the electrolyte. As a minimum, personnel shall wear rubber gloves and a face shield. Prior to commencement of battery activation, ensure the space is open and well ventilated. No open flame or smoking is permitted in the space during the process. During activation, batteries give off hydrogen gas which is highly explosive.

B. Load and sanitize/chlorinate potable water in tanks. The potable water tanks were left clean and dry at preservation and should require nothing more than filling and chlorination to a potable level of 0.2 ppm. The procedure to be used is listed in TB 43-0153 which is on board each watercraft having potable water tanks.

CAUTION

Personnel handling chlorine shall wear rubber gloves and face shield to prevent skin and eye contact. Any contact of chlorine on the skin will be washed off immediately with fresh water. Any contact of chlorine in the eyes will be flushed out immediately with fresh water and examined by a medical doctor as soon as possible.

Avoid breathing chlorine vapors for a prolonged period as they are hazardous to health and can be fatal.
Follow the safety precautions posted on chlorine containers.

C. Prior to floating the watercraft, accomplish the following:

(1) Ensure that the HLPS or SSB watercraft communication and electronic equipments are in working order.

(2) Ensure that there are no openings in the hulls that will allow sea water to enter the interior of the vessels. The sea water suction and discharge valves should not be opened until the watercraft are waterborne.

(3) Open diesel fuel valves (suction and discharge) to the engine fuel pumps.

(4) Open the suction and discharge valves on the engine fresh water systems.

(5) Insure that all rudder and shaft locks have been removed.

(6) Insure all raw water pump impellors are installed on engines so equipped.

D. The watercraft are ready for floating off the HLPS or SSB vessel Communications between the watercraft and the vessel control are essential (recommended hand held radios) and shall be established before the (HLPS) vessel starts flooding down. When watercraft are refloated after having been drystored the following precautions shall be adhered to.

(1) Soon as water touches bottom of the watercraft, the crew shall continuously check the interior to establish the watertight integrity of the craft. With coordination between all respective watercraft and the (HLPS) or SSB vessel control, the watertight integrity of each watercraft shall be established prior to floating free. This will reduce the time for the (HLPS) or SSB vessel to pump back up should flooding occur in a watercraft.
(2) The stern tube shaft packings warrant special attention. Having been dry stored, the packings will have dried out to some extent, causing abnormal leak-off at first and may require adjustment. The packing will absorb moisture and swell after a period, requiring readjustment prior to turning the shaft/shafts.
(3) Open sea valves, vent raw water systems and check for leaks. This can be accomplished concurrently with (1) above. Once the integrity of the raw water systems are established, light off for activation/test can commence. The activation/light off shall be accomplished IAW normal procedures for the design watercraft and applicable Technical Manuals and Publications which are on board each watercraft.

4. Manhour Requirements, Materiel and Special Equipments:

A. Manhour requirements and materiel estimates for HLPS watercraft are by design and number of units as indicated in (1), (2), (3) and (4). Manhour requirements for the Officer In Charge (OIC) are depicted in (5). The number of positions shown in (1), (2) and (4) are the personnel available for each unit to activate within 48 hours. In (3) the number of positions shown is that required to activate 10 units. The positions shown in (3) will be available for a total of 1440 hours. Although only 180 manhours are required to activate ten (10) units, the remaining 1260 manhours should be utilized by the OIC to provide for relief of other crews prior to float off.

(1) Tug, 1200 H.P. Design 3006, Four (4) Units:

Master Chief	1-M/Hrs. 48 X 4 =	192
Engineer	1-M/Hrs. 48 X 4 =	192
Engineman	1-M/Hrs. 48 X 4 =	192
Deckhands	2-M/Hrs. 96 X 4 =	384
		960 Total M/Hrs.

(2) Landing Craft, Utility, 115 Ft. LCU Design 1466A, Four (4) Units:

Master Chief	1-M/Hrs. 48 X 4 =	192
Engineer	1-MlHrs. 48 X 4 =	192
Engineman	1-MlHrs. 48 X 4 =	192
Deckhands	2-M/Hrs. 96 X 4 =	384
		960 Total M/Hrs.

(3) Landing Craft, Mechanized, 69 Ft., LCM-8 MOD I, Ten (10) Units:

Operator	1-M/Hrs. 6 X 10 =	60
Engineer	1-MlHrs. 6 X 10 =	60
Deckhand	1-M/Hrs. 6 X 10 =	60
		180 Total M/Hrs.

(4) Crane, Barge, 100 Ton, Design 264-B, Two (2) Units:

Crane Operator	1-MlHrs. 48 X 2 =	96
Engineer	1-M/Hrs. 48 X 2 =	96
Engineman	1-M/Hrs. 48 X 2 =	96
Deckhands	2-M/Hrs. 96 X 2 =	192
		480 Total M/Hrs.

(5) Activation Coordinator Overall:
Officer in Charge 1--M/Hrs. 48 X 1 = 48 Total M/Hrs.

B. Estimated Material for HLPS Watercraft

The depreservation/activation estimated materiel are listed by design and the number of units indicated in 4.A. (1), (2), (3) and (4). The materiels required for depreservation/activation are diesel fuel and potable water. The chlorine that is expended during activation and test shall be replenished by the represervation activity and stored on the watercraft in a cool dry place.

The diesel fuel and potable water will be furnished by the HLPS vessel.

(1) Tug, 1200 H.P., Design 3006, Four (4) each:

NSN	NOMENCLATURE	UNIT OF ISSUE	REQUIRED PER WATERCRAFT	TOTAL REQ.
9140-01-079-5805	Fuel, Diesel, Naval Distillate (MIL-F-16884H)	GL	21000	84,000
	Water, Potable	GL	2756	11,024

(2) Landing Craft, Utility, 115 Ft., LCU 1466A Class, Four (4) each:

NSN	NOMENCLATURE	UNIT OF ISSUE	REQUIRED PER WATERCRAFT	TOTAL REQ.
9140-01-079-5805	Fuel, Diesel, Naval Distillate (MIL-F- 1684H)	GL	3525	14,100
	Water, Potable	GL	9500	38,000

(3) Landing Craft, Mechanized, 69 Ft., LCM-8 MOD I, Ten (10) each:
Fuel Tanks Topped Off, No Day Tanks, No Water Tanks

(4) Crane, Barge, 100 Ton, Design 264B, Two (2) each:

NSN	NOMENCLATURE	UNIT OF ISSUE	REQUIRED PER WATERCRAFT	TOTAL REQ.
9140-01-079-5805	Fuel, Diesel, Naval Distillate MIL-F- 16884H)	GL	15000	30,000
	Water, Potable	GL	6700	13,400

C. Specialized Equipment needed for depreservation/activation are stored on board each watercraft or the HLPS vessel in quantities listed below:

(1) Metallic Rectifier (Battery Charger) NSN 6130-00-699-6659, Input 105-124 VAC, Outport 6V to 24VDC, for charging six (6) and twelve (12) volt batteries. Charges belong to HLPS vessel.
(2) Face shields, NSN 4240-00-542-2048. Rubber Gloves, NSN 8415-00-266-8677, and funnels for use when adding electrolyte to batteries during activation: Kits are located in storage contained in well deck of LCM-8.
(3) All hoses and necessary equipment for fueling the watercraft are located in the storage containers of the well deck of the LCM-8. The fueling plan is located in Appendix V.
(4) A sixty day support package of repair parts are located on the stern of the HLPS ship. These parts are to be used only as a last resort. All usage must be documented to facilitate replacement.

D. Estimated Manhours for SSB Watercraft

Manhour requirements and materiel estimates for SSB Watercraft are by design and number of units as indicated in (1), (2), and (3). Manhour requirements for the Office in Charge (OIC) are depicted in (4). The number of positions shown in (1), (2) and (3) are the personnel available for each unit to activate within 48 hours. The position shown in (1), (2), (3) and (4) will be available for a total 1140 manhours.

(1) Tug, 1200 H.P. Design 3006, two (2) units

Captain	1-M/Hrs.	48 X 2 = 96
Engineer	1-M/Hrs.	48 X 2 = 96
Engineman	1-M/Hrs.	48 X 2 = 96
Deckhand	2-M/Hrs.	48 X 2 = 192
	M/Hrs.	480 TOTAL

(2) Landing Craft Mechanized, 69 Ft., LCM LCM-8 MOD I, two (2) units.

Operator	1-M/Hrs.	6 X 2 = 12
Engineer	1-M/Hrs.	6 X 2 = 12
Deckhand	1-M/Hrs.	6 X 2 = 12
	M/Hrs.	36 TOTAL

(3) Reverse Osmosis Water Purification Barge (Modified 231-A) (300 - ROWPU)

Operator	1-M/Hrs.	48 X 2 = 96
Engineer	1-M/Hrs.	48 X 2 = 96
Engineman	1-M/Hrs.	48 X 2 = 96
Marine Elec	1-M/Hrs.	48 X 2 = 96
Deckhand	2-M/Hrs.	48 X 2 = 192
	M/Hrs.	576 TOTAL

(4) Officer in Charge 1 - M/Hrs. 48 X I = 48 Total M/Hrs.

E. Estimated Material for SSB

The depreservation/activation estimated materiel are listed by design and the number of units indicated in 4D (1), (2), and (3). The materiels required for depreservation/activation are diesel fuel and potable water. The chlorine that is expended during activation and tests shall be replenished by the represervation activity and stored on the watercraft in a cool dry place.

(1) Reserve Osmosis Water Purification Barge (ROWPU) Two (2) each:

NSN	NOMENCLATURE	UNIT OF ISSUE	REQUIRED PER WATERCRAFT	TOTAL REQ.
9140-01-079-5805	Fuel, Diesel Naval Distillate (MIIF-16884H)	GL	7200	14,400
	Water, Potable	GL	250	500

(2) Tug, 1200 H.P., Design 3006, Two (2) each:

NSN	NOMENCLATURE	UNIT OF ISSUE	REQUIRED PER WATERCRAFT	TOTAL REQ.
9140-01-079-5805	Fuel, Diesel, Naval Distillate (MIL-F-16884H)	GL	21,000	42,000
	Water, Potable	GL	1756	5512

(3) Landing Craft, Mechanized, 69 Ft., LCM-8 MOD-I, Two (2) each:
Fuel Tanks Topped Off, No Day Tanks, No Water Tanks

CHAPTER VI
RE PRESERVATION

1. INTRODUCTION:

When watercraft are activated, represervation is required. Represervation requires limited operations of machinery and therefore, must be accomplished before the watercraft are returned to dry storage on the HLPS vessel. The amount of represervation required, depends entirely upon the extent of depreservation/activation.

A. The manhour requirements for represervation will not be appreciably different from initial preservation; however, the materiel requirements may be considerably less: (1) There will be a cost savings by reusing the PVC piping, flex hoses, sensing elements, humidistats, plywood blanks and herculite covers.

(2) Antifreeze in the fresh water cooling systems will require replenishment only. Solution must be checked for PH range. Proper range is PH 8 to PW 9.5 Test Kit, Diesel Engine NSN 6630-00-316-5831 is authorized in Basic Issue Items for this purpose.

(3) Engine fuel system will require preservation (4) Essentially the represervation shall follow pertinent instructions set forth in Chapter m and Appendices A through E.

(5) Represervation materiels are estimated in paragraph 2, 3, 4 and 5 below and will be provided for by the maintenance facility.

(6) Drydocking for underwater hull cleaning and painting should not be required if all underwater surfaces are washed down with fresh water to remove accumulated marine growth and slime. This can be accomplished with the fire hose; however, care should be taken to assure that the paint system is not damaged during wash down.

(7) Dry docking may be required for repairs to hull or paint system.

(8) Specialized equipment will not require replacement.

(9) The lubricating oil storage tanks may need replenishment.

(10) On completion of represervation requirements prepare DA Form 3256, "Preservation and Depreservation Guide for Marine Equipment" in accordance with Chapter III, Paragraph J (2) and Figure III-3, 3A, 3B and 3C. Annotate DA Form 2409, "Maintenance Inspection Record" to reflect the date when represervation was completed.

APPENDIX A
DYNAMIC DEHUMIDIFICATION INSTRUCTIONS
FOR
TUG, HARBOR, 1200 HP, 100 FOOT
DESIGN 3006 (FLIGHTS 1 AND 2)
NSN 1925-00-375-3003

I. GENERAL: These instructions provide details required for preparation and installation of dynamic dehumidification on the 100 foot harbor tug. Material and man hours required to perform the functions herein are specified in the attached listing. The vessel has approximately 40,000 cubic feet of area to be dehumidified.

II. PREPARATION:

A. Herculite covers secured with nylon drawstrings shall be installed over the following items:

1. Flying bridge pelorus stand and gyrocompass repeater.
2. Flying bridge blinker light key.
3. Flying bridge searchlight.
4. Anchor windlass.
5. Anchor windlass master switch.
6. After capstan.
7. After capstan master switch.
8. Cargo loading lights (4 each).
9. Boat deck freezer.
10. Life preserver locker.
11. Stowage lockers on boat deck (4 each).
12. Boat deck engine order telegraph.
13. After steering station control.
14. After steering station sound powered phone box.
15. After steering station voice tubes (2 each).
16. Heating boiler exhaust stack on top of the stack.
17. Ventilation mushroom on the fan room aft. of the pilothouse.
18. Officers washroom mushroom vent.
19. Crews washroom mushroom vent.
20. Exterior intercom stations and loud speakers.
21. A/URC-92 radio antenna coupler.
22. P-250 portable bilge pump.

Stencil each cover with its purpose and/or location.

B. Install the existing metal covers (located at the intakes) over the engine room supply fan intake (main deck port aft.), ventilation cowl adjacent to fidley skylight, the galley exhaust fan outlet (stbd. side aft. on deck house), and the lazarette natural vents (port and stbd. main deck aft. under the bulwark). Seal with pressure sensitive tape, glue and strip coat any visible cracks.

C. Using wooden blanks, pressure sensitive tape, glue and strip coat; seal the louvers on the port aft. ventilation room door and the louvers on the fwd. end of the stack. (See Chapter III, Section 4, paragraph F.)

D. Using pressure sensitive tape, glue and strip coat; seal the following items:

1. Pilothouse window drain.
2. Pilothouse drain hole.
3. Ventilation room drain holes.
4. Captain's stateroom sink drain vent.
5. Officers washroom sink drain vent.
6. Crews' washroom sink drain vent.
7. Interior deck drain vent.
8. Water cooler drain vent.
9. Crews' washroom shower stall drain vent.
10. Galley sink drain vent.
11. Engineer's stateroom sink drain vent.
12. Stack openings underneath overhang.
13. Crews' mess deck drains (3 each).
14. Galley deck dain.
15. Officers washroom shower stall drain.
16. Officers washroom deck drain.
17. Oilskin locker deck drain.
18. Port crews' mess to fidley and engineroom passageway deck drain.
19. Crews' washroom shower stall drains (2 each).
20. Crews' washroom deck drain.
21. Watercooler (crews' mess) drain. (Tape only)
22. Engineroom water bubbler drain. (Tape only)
23. Urinal drain. (Tape only)
24. Galley ventilation supply duct.
25. Crews' mess ventilation supply and exhaust ducts.
26. Captains and Engineers Stateroom ventilation supply diffusers.
27. Crews' quarters ventilation supply and exhaust ducts.
28. Officers and crews' washroom ventilation supply and exhaust ducts.
29. Other holes in the dehumidified area as found.

E. All interior doors will be secured in the open position. These include the following:

1. Accesses to underneath pilothouse wooden deck.
2. Captain's and Engineer's stateroom doors (2 each).
3. Captain's and Engineer's stateroom closet doors (4 each).
4. Crews' mess to pilothouse door.
5. Officers washroom door.
6. Crews' mess to fidley and engineroom passageway door.
7. Galley folding door.
8. Crews' washroom door.
9. Oilskin locker door (in fidley and engineroom passageway).
10. Dry provisions locker door (at base of the ladder to the crews' quarters)
11. Crews' quarters locker door.
12. Engineroom to shaft alley access hatch.
13. Lazarette to shaft alley access hatch.

The doors to the refrigerator, freezer, and ice maker in galley and crews' mess and the freezer on the boat deck will be blocked open with one (1) inch thick wooden blocks.

F. Install the rubber sink stoppers in all five (5) washroom and stateroom sink drains. Shut both galley sink drain valves.

G. Close, lock and/or dog the following exterior openings:

1. Port and stbd. pilothouse doors.
2. Stbd. outboard and port aft. ventilation room hatches.
3. Port and stbd. stack access hatches.
4. Fidley skylight.
5. Stbd. crews' mess access hatch.
6. Stbd. galley access hatch.
7. Engineroom trunk escape hatch.
8. Galley exhaust fan room hatch.
9. Engineroom supply fan room hatch.
10. Port passageway access hatch.
11. Crews' quarters scuttle.
12. Lazarette access hatch.
13. Pilothouse windows.
14. Main deckhouse portholes.
15. All ventilation duct dampers.

Seal with pressure sensitive tape, glue and strip coat any other cracks or holes found.

H. The voice tube covers in the pilothouse, captain's stateroom, engineer's stateroom and engineroom will be secured in the open position, except those connecting to the after steering station which will be properly secured shut and taped as necessary.

I. Onflight 2 tugs, LT-2075 through LT-2096 inclusive, pack the steering cable openings on the main deck aft. port and stbd. sides with duct seal.

J. Close all exterior main deck and boat deck service, fill, firefighting, and overboard discharge valves. Ensure that caps are properly installed on all connections. Fire monitor nozzles will be pointed downward to prevent the accumulation of water.

K. Inspect the flying bridge, top of ventilation room, and boat deck strainers and deck drains for accumulation of dirt and debris. Clean as necessary to prevent standing water.

L. Check all electrical cable stuffing tubes that penetrate the dehumidified area for proper seals. Pack those without proper seals with duct seal.

M. Shut ventilation mushroom ducts in officers' and crews' washrooms.

III. DYNAMIC DEHUMIDIFICATION :

A. The dehumidified area as shown in Figures A-1 and A-2 shall encompass the pilothouse, crews' quarters, both staterooms, crews' mess and galley, fidley and engineroom, shaft alley, lazarette, and both washrooms all in a single zone.

B. Dry air will be introduced into the pilothouse by way of a 4" PVC pipe coupling fitted in a wooden blank that is equipped with a simple quick-acting dogging device or strongback securing device and 1/8" neoprene rubber strips glued to the blank to provide a flexible seal between the wood and seating surface. Install the blank over the port aft pilothouse window which will, of course, be secured open.

C. This blank will also be equipped with a 4" PVC pipe coupling and pipe nipple for the humid air return from the 4" flex hose pickups. Stencil the blank or adjacent surface with "'DRY AIR" and "HUMID AIR" for the benefit of those who will connect the D/H systems.

D. Humid air will be removed from the vessel by way of the crews quarters near the anchor windlass controller and the lazarette through 4' flex hose, hose clamps, 4" PVC pipe nipples, and one (1) 4" PVC tee and out the port pilothouse window.

E. Two (2) sensing elements will be installed: One (1) within three (3) feet of the pickup in the crews quarters, the other within three (3) feet of the pickup in the lazarette.

F. One (1) humidistat will be installed within three (3) feet of the pickup in the lazarette. The humidistat will be set to maintain 40 percent (plus or minus 5 percent) relative humidity.

IV. MATERIAL REQUIREMENTS: The following listing contains an estimate of those materials required for preservation.

*The estimated quantity reflects the requirements for four (4) watercrafts.

A. MATERIALS:

NSN	NOMENCLATURE	UNIT OF ISSUE	EST. QTY
Local Purchase	4' PVC Pipe, Schedule 40	20 Ft. Lengths	4
"" ""	4" PVC Pipe Couplings	EA	9
"" ""	4" PVC Tee	EA	4
"" ""	4" PVC Glue	PT	4
9150-00-111-0210	P-10, Type I, Grade 30 Preservative Oil	DR (55 Gal.)	24
9150-00-231-9062	P-9 Preservative Oil VV-L-800	CN (5 Gal.)	16
9150-00-111-3199	P-10, Type I, Grade 10, Preservative Oil	CN (5 Gal.)	4
8030-00-244-1298	P-2 Preservative	CN (5 Gal.)	4
8030-00-244-1299	P-1 Preservative	CN (5 Gal.)	2
5640-00-103-2254	Tape, 2 Inch, Pressure Sensitive	RL	24
7510-00-074-4996	Tape, 3 Inch, Pressure Sensitive	RL	24
8040-00-754-2685	Adhesive, Fed. Spec.	GL	12
4720-00-809-2430	Hose, Flex 4 Inch MIL-H-8796	FT	600

NSN	NOMENCLATURE	UNIT OF ISSUE	EST. QTY
6810-00-281-2785	Methyl Ethyl Ketone (MEK)	GL	16
8030-00-281-2337	Duct, Seal	BG	8
8020-00-263-3874	Brush, Sash	EA	16
7290-00-291-5815	Brush, Wire	EA	8
9150-00-530-6814	Lubricant, Rust Resistant MIL-G- 18458	CN (5 Gal.)	4
5970-00-583-0401	Glyptol, Synth. Primer	QT	8
5530-00-129-7777	Plywood, 1/2 Inch, Exterior Grade	SH	8
4730-00-908-6294	Clamp, Hose, 4-7 Inch	EA	48
6850-00-181-7929	Antifreeze	GL	600
9140-01-079-5805	Fuel, Diesel, Naval Distillate (MIL-F-16884H)	GL	1200
9150-00-189-6729	Lube Oil, OE-30	DR (55 Gal.)	36
6140-00-263-4608	Battery Starting, Dry Charged 6 VDC	EA	48
6810-00-249-9354	Electrolyte	GL	120
5330-00-261-5761	1/8 Inch Gasket Material	FT	2
6810-00-255-0471	Calcium Hypochlorite Technical, 70% (HTH)	JR (6 Oz.)	48
8030-00-281-2345	Strip Coat	GL	15

V. MANHOUR REQUIREMENTS: The following listing contains the estimated skills, manhours and costs required to accomplish those tasks and procedures as set forth in Chapter III, Storage Requirements, Section 3, Preservation (General), Section 4, Specific Preservation Requirements, and this Appendix. The manhour billing rate is that of USACSA GOCO Contractor, Charleston, S.C.

SKILL	QTY	M/Hrs.	TOTAL M/Hrs.
Mechanic/Processor	2	128	256
Processor	2	128	256
Processor Helper	1	128	128
Support/Quality Assurance	1	32	32
.		**M/Hrs Per Vessel**	672
			X 4 Vessels
		Qty.for 4 Vessels	2,688 M/Hrs.

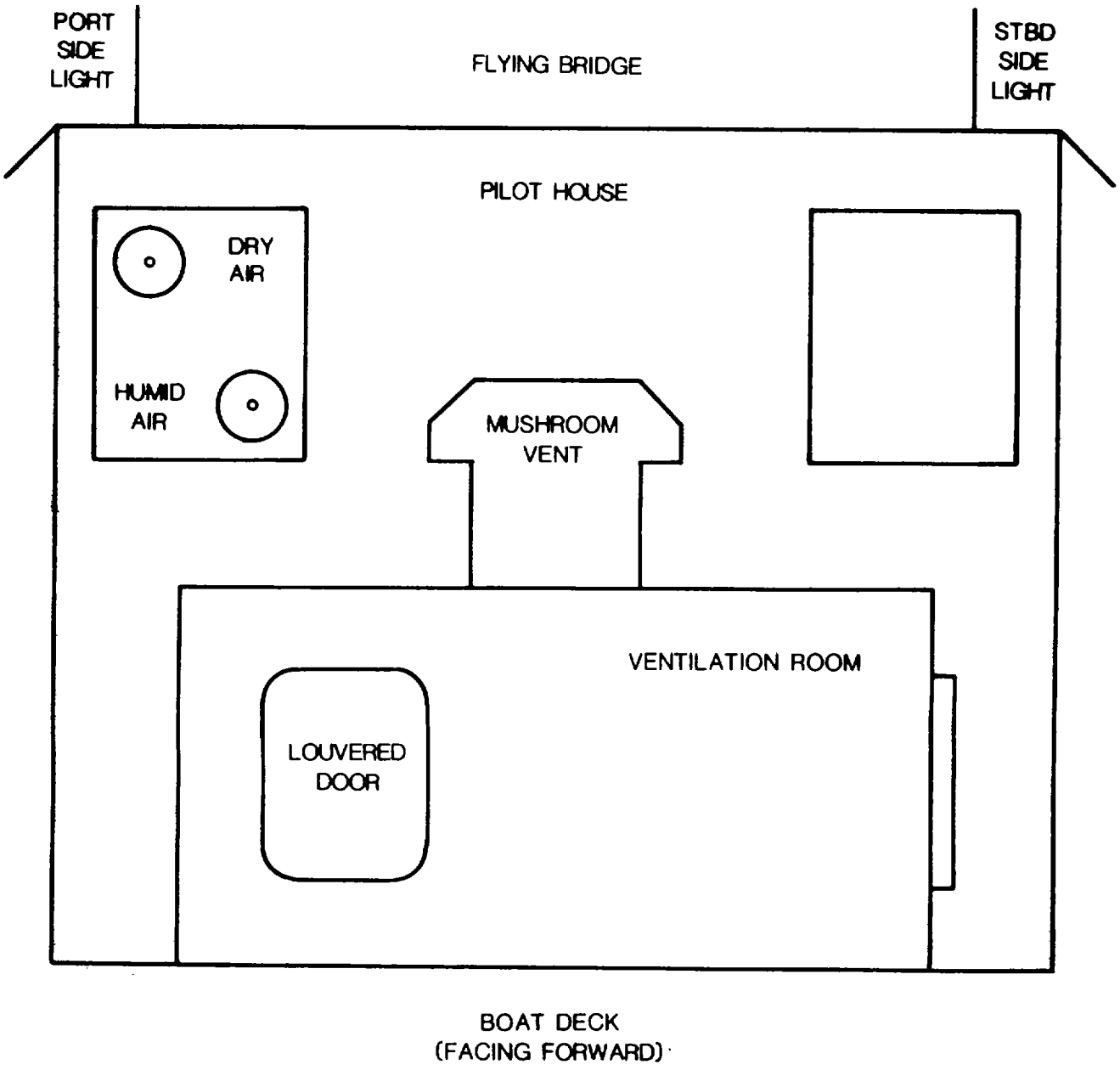


Figure A-1. Design 3006; D/H Connection

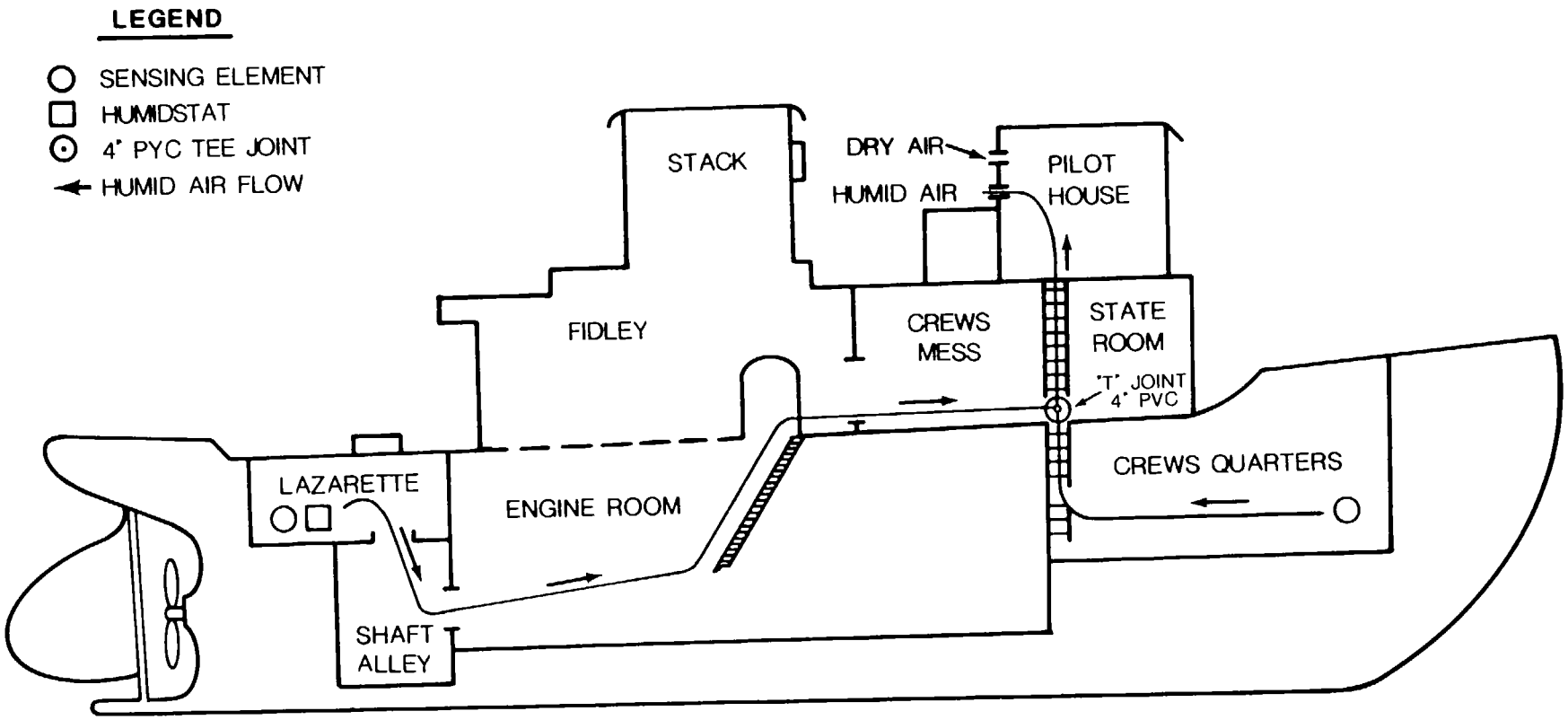


Figure A-2. Design 3006: Air Flow

APPENDIX B
DYNAMIC DEHUMIDIFICATION INSTRUCTIONS
FOR
LANDING CRAFT, UTILITY, 115 FOOT
DESIGN LCU-1466A (MODERNIZED)
NSN 1905-01-31/7

I. GENERAL: These instructions provide details required for preparation and installation of dynamic dehumidification on the utility landing craft. Materials and manhours required to perform the functions herein are specified in the attached listing. The watercraft has approximately 16,000 feet of area to be dehumidified.

II. PREPARATION:

A. Herculite covers secured with nylon drawstrings shall be installed over the following items: (See Chapter III, Section 4, paragraph E.)

1. Pilothouse shelter searchlight.
2. Poop deck signaling searchlight.
3. Poop deck freezer.
4. Stern anchor winch and engine, including one for the swivel.
5. Muffler room exhaust fan mushroom.
6. Galley exhaust fan mushroom.
7. Engineroom natural supply mushroom.
8. Galley supply fan mushroom.
9. Pyrotechnic lockers.
10. Chemical warfare locker.
11. Life preserver locker.
12. Flag locker.
13. Poop deck hawser reel.
14. Port forecastle spare anchor cable reel.
15. Stbd. forecastle hawser reel.
16. Intercom stations and loud speakers. (Exposed to weather only.)
17. P-250 portable bilge pump.
18. AN/URC-92 radio antenna coupler.
19. Shore power receptacle.

B. The heating boiler exhaust stack shall be unfastened at the hinged flange and stowed in a horizontal position on its stowage stanchion. Fabricate and install a notched wooden blank to fit over the exposed exhaust hole and secure with the existing eyebolts, washers and nuts. Unfasten the stern light electrical cable support clips or unplug as required to prevent stress on the cable when the stack is stowed. Install cap on receptacle if unplugged.

C. Using pressure sensitive tape, glue and strip coat, seal the following exterior vents:

1. Dryer air exhaust (under stern anchor winch swivel foundation).
2. Galley sink gravity drain (to port of deck freezer).
3. Heating boiler air intake (aft. of stern anchor winch).
4. Heating boiler room natural (between exhaust stack and anchor winch).
5. CHT room natural (outboard of bulwark). Do not confuse with the holding tank vent. This natural vent may not be installed on all vessels.
6. All other vents are to remain unsealed.

D. Fabricate wooden blanks and install with pressure sensitive tape over the following interior ventilation ducts: (See Chapter III, Section 4, paragraph F).

1. Air conditioner replenishment ducts (2 each).
2. Crews' washroom and watercloset duct.
3. Muffler room exhaust screen.

Using pressure sensitive tape, seal the following interior ventilation ducts:

1. Galley supply plenium.
2. Galley exhaust filter.
3. AMR2 (CHT collecting tank room under crews' washroom) supply and exhaust ducts (2 each).
4. Port and stbd. generator room supply and exhaust ports (2 each room). Close vent duct valves in the port and stbd. main enginerooms.
5. Port, center, and stbd. main engineroom supply and exhaust ducts (2 each room).
6. Pilothouse supply duct.
7. AMR3 supply and exhaust ducts. Close vent duct valve in the port engineroom.

Seal holes on other ducts with pressure sensitive tape. Close all dampers in ventilation ducts. Taping of air conditioner inlet and outlet ducts is not required.

E. Secure the following doors, access hatches and other items in the open position:

1. Port and stbd. muffler room doors.
2. Crews' washroom and watercloset door.
3. AMR2 access hatch (in crews' washroom).
4. Crews' quarters to galley door.
5. Port and stbd. generator room access hatches.
6. Boiler room door.
7. Crews' mess to CPO quarters door.
8. Dry provisions locker door (in crews' mess).
9. CPO quarters to switchboard room door.
10. Switchboard room to center engineroom access hatch.
11. Passageway to AMR3 door.
12. Port main engine room to port generator room door.
13. Stbd. main engine room to stbd. generator room door.
14. Pilothouse to pilothouse shelter access hatch. (Tape over hatch coaming drain.)
15. Port aft. equipage storeroom to port fwd. equipage storeroom door.
16. Port and stbd. equipage storeroom hatches.
17. General purpose storeroom to special clothing storeroom door.
18. General purpose storeroom to dry provisions storeroom access hatch.
19. Block open with one (1) inch thick blocks, the cleaning gear locker, the locker behind the switchboard room door, the safe (only if empty), and the refrigerator/freezer and exterior deck freezer doors.
20. The crews' mess to galley folding door.
21. Well deck to general purpose storeroom door.
22. Well deck to port and stbd. equipage storeroom doors.
23. CPO room access hatch.
24. AMR3 access hatch.
25. Engineers' equipage storeroom access hatch (under ladder to pilothouse).
26. Crews' mess and crews' quarters escape hatches.
27. Close and dog all other doors, hatches and manholes.
28. Lock open the AMR2 to port generator room bilge drain valve.

F. Pack the ramp winch cable openings on the port and stbd. forecastle decks with duct seal to prevent entry of water.

G. Procure and install 1/2 inch pipe plugs in the pilothouse shelter drain holes located in the shelter's mounting coaming in the after port and stbd. corners or seal holes with tape and glue.

H. It is recommended that the ramp be lowered just enough to prevent the accumulation of standing water and dirt and debris between the ramp and the fwd. well deck area. This will require installation of two (2) ramp holding devices consisting of lengths (to suit) of 5/8 inch wire rope and wire clamps to relieve the strain on the ramp winch. If it is not practical to accomplish the above, the forward well deck area should be pumped dry and washed down periodically to prevent deterioration and the accumulation of dirt and debris.

I. Tape over deck drains in the crews' washroom, galley, and boiler room. Install the sink stoppers in the crews' washroom sink drains and shut the drain valves in the galley sink. Seal the water cooler drain and vent lines.

J. Close all exterior service, fill, firefighting, and overboard discharge valves. Ensure that all caps are installed on these connections and all sounding tubes.

III. DYNAMIC DEHUMIDIFICATION:

A. This watercraft shall be divided into two (2) zones.
The first zone shall encompass the following areas (Figures B-1 and B-2):

1. The five (5) enginerooms.
2. The three (3) auxiliary machinery rooms (AMR).
3. The engineroom to auxiliary machinery room passageway.
4. The crews' living quarters which includes:
   a.Crews' quarters.
   b.Crews' washroom and water closet.
   c.Galley.
   d.Crews' mess.
   e.CPO quarters.
5. Muffler room.
6. Heating boiler room.
7. Switchboard room.
8. Pilothouse shelter.
9. Pilothouse.
10. Engineers' equipage storeroom.
11. Deck locker.
12. CHT room.

The second zone shall encompass the following areas: (Figures B-3 and B-4):

1. Port aft. equipage storeroom.
2. Port fwd. equipage storeroom.
3. General purpose storeroom.
4. Special clothing storeroom.
5. Dry provisions storeroom.
6. Stbd. equipage storeroom.

B. **Zone 1** ducting shall be connected in series as shown in Figure B-1 and B-2 and as follows: (Ducting shall be 4" PVC pipe, pickups shall be 4" flex hose attached with hose clamps. Connect long lengths of ducting with 4' PVC pipe couplings and support long runs at 10 to 12 foot intervals with suitable bracing. Connect long lengths of flex hose using 4" PVC pipe nipples and hose clamps.) The pilothouse door, CPO quarters door, crews' quarters door, deck locker door and pilothouse shelter door shall be closed and dogged. A blank with a dry air inlet and humid air outlet (4" PVC pipe couplings) shall be installed over the after stbd. outboard pilothouse shelter window. The sliding window will be secured open or removed and stowed inside the shelter. The voice tube cover in the pilothouse shelter shall also be secured in the open position. The pickup shall be adjacent to the pilothouse steering stand. The humid air outlet from the pilothouse shall be piped to a tee which will supply air to two (2) blanks-one over the crews' mess escape hatch, the other over the crews' quarters escape hatch. The 4" flex hose pickup from the center engineroom shall be ducted from the blank over the AMR3 access hatch to the CHT room whose pickup, in turn, will be ducted to the engineers' equipage storeroom blank. The pickup from the engineers' equipage storeroom shall be ducted to the D/H machine's return by TALS personnel.

Zone 2 ducting shall also be connected in series as shown in Figures B-3 and B-4 and as follows: Wooden blanks with dry air inlets and humid air outlets (4' PVC pipe couplings) shall be installed over the port and stbd. equipage room passage openings and over the opening to the general purpose storeroom. Dry air shall be introduced to the fwd. port equipage storeroom, and the pickup from the after port equipage storeroom's dry air inlet. The 4' flex hose pickup from the dry provisions storeroom shall be ducted to the dry air inlet of the stbd. equipage storeroom. The stbd. equipage storeroom's pickup shall be ducted to the D/H machine's humid air inlet.

C. **Sensing Elements**: Zone 1 shall have one (1) sensing element located within three (3) feet of the pickup in the center engineroom, one (1) in the CHT room, and one (1) in the engineers' equipage storeroom. Zone 2 shall have one (1) sensing element located within three (3) feet of the pickup in the dry provisions storeroom, one (1) in the port aft equipage storeroom, and one (1) in the stbd. equipage storeroom.

D. **Humidistats:** The humidistat for Zone 1 shall be located in the center engineroom. For Zone 2, the humidistat shall be located in the dry provisions storeroom. The humidistats will be set to maintain 40 percent (plus or minus 5 percent) relative humidity.

E. The wooden blanks that are to be installed over the following openings shall be equipped with simple quick-acting dogging devices or strongback securing devices. Strips of %" neoprene rubber will be glued to the blanks to provide a flexible seal between the wood and the hatch or door knife edge: (See Chapter III, Section 4, paragraph F.)

1. General purpose storeroom.
2. Port and stbd. equipage storeroom passage accesses from the well deck.
3. CHT room.
4. AMR3, (air compressor room).
5. Engineer's equipage storeroom.
6. Pilothouse shelter window.
7. Crews' mess escape hatch.
8. Crews' quarters escape hatch.

Any cracks found will be sealed with pressure sensitive tape, glue and strip coat.

F. Stencil the appropriate inlet and outlet wooden blank or adjacent surface with 'DRY AIR" and "HUMID AIR" respectively for the benefit of those who are to connect the D/H systems.

IV. MATERIAL REQUIREMENTS: The following listing contains an estimate of those materials required for preservation and their costs.
*The estimated quantity reflects the requirements for four (4) watercraft:

A. Materials:

NSN	NOMENCLATURE	UNIT OF ISSUE	EST. QTY
Local Purchase	4" PVC Pipe, Schedule 40	20 FT Lengths	32
Local Purchase	4" PVC Pipe Couplings	EA	72
Local Purchase	4" PVC 90 Deg. Elbows	EA	48
Local Purchase	4" PVC 45 Deg. Elbows	EA	8
Local Purchase	4" PVC Tee	EA	4
Local Purchase	PVC Glue	PT	16
9150-00-111-0209	P- l 0, Type I, Grade 30, Preservative Oil	CN (5 Gal.)	32
9150-00-231-9062	P-9, Preservative Oil VV-L-800	CN (5 Gal.)	8
9150-00-111-3199	P-l0, Type I, Grade 10. Preservative Oil	CN (5 Gal.)	2
8030-00-244-1298	P-2 Preservative	CN (5 Gal.)	1
8030-00-244-1299	P-1 Preservative	CN (5 Gal.)	1
5640-00-103-2254	Tape, 2 Inch, Pressure Sensitive	RL	16
7510-00-074-4996	Tape, 3 Inch, Pressure Sensitive	RL	16
8040-00-754-2685	Adhesive, Fed. Spec. MMM-A- 130B	GL	8
4720-00-809-2430	Hose, Flex, 4 Inch MIL-H-8796	FT	600
6810-00-281-2785	Methyl Ethyl Ketone (MEK)	GL	8
8030-00-281-2337	Duct, Seal	BG	4

NSN	NOMENCLATURE	UNIT OF ISSUE	EST. QTY
8020-00-263-3874	Brush, Sash	EA	16
7290-00-291-5815	Brush, Wire	EA	8
9150-00-530-6814	Lubricant, Rust Resistant, MIL-G-18458	CN (5 Gal.)	12
5970-00-583-0401	Glyptol, Synth. Primer	QT	8
5530-00-129-7777	Plywood, 1/2 Inch, Exterior Grade	SH	12
5330-00-261-5761	1/8 Inch Gasket Material	FT	6
4730-00-908-6294	Clamp, Hose, 4-7 Inch	EA	32
6850-00-181-7929	Antifreeze	GL	52
6810-00-255-0471	Calcium Hypochlorite Technical, 70% (HTH)	JR (6 Oz.)	136
9140-01-079-5805	Fuel, Diesel, Naval Distillate (MIL-F-16884H)	GL	800
9150-00-189-6729	Lube Oil, OE-30	DR (55 Gal.)	16

V. MANHOUR REQUIREMENTS: The following listing contains the estimated skills, man-hours and cost required to accomplish those tasks and procedures as set forth in Chapter III, Storage Requirements, Section 3, Preservation (General), Section 4, Specific Preservation Requirements, and this Appendix.

SKILL	QTY	M/Hrs.	TOTAL M/Hrs.
Mechanic/Processor	2	145	290
Processor	2	145	290
Processor Helper	1	145	145
Support/Quality Assurance	1	51	51
	M/Hrs. Per Vessel		776
			X 4 Vessels
	Qty. for 4 Vessels		3,104 M/Hrs.

Figure B-1. ZONE 1. PICKUPS, SENSING ELEMENT, HUMIDISTAT

Figure B-2. ZONE 1. DUCTING

Figure B-3. ZONE 2. PICKUPS, SENSING ELEMENT, HUMIDISTAT

Figure B-4. ZONE 2. DUCTING

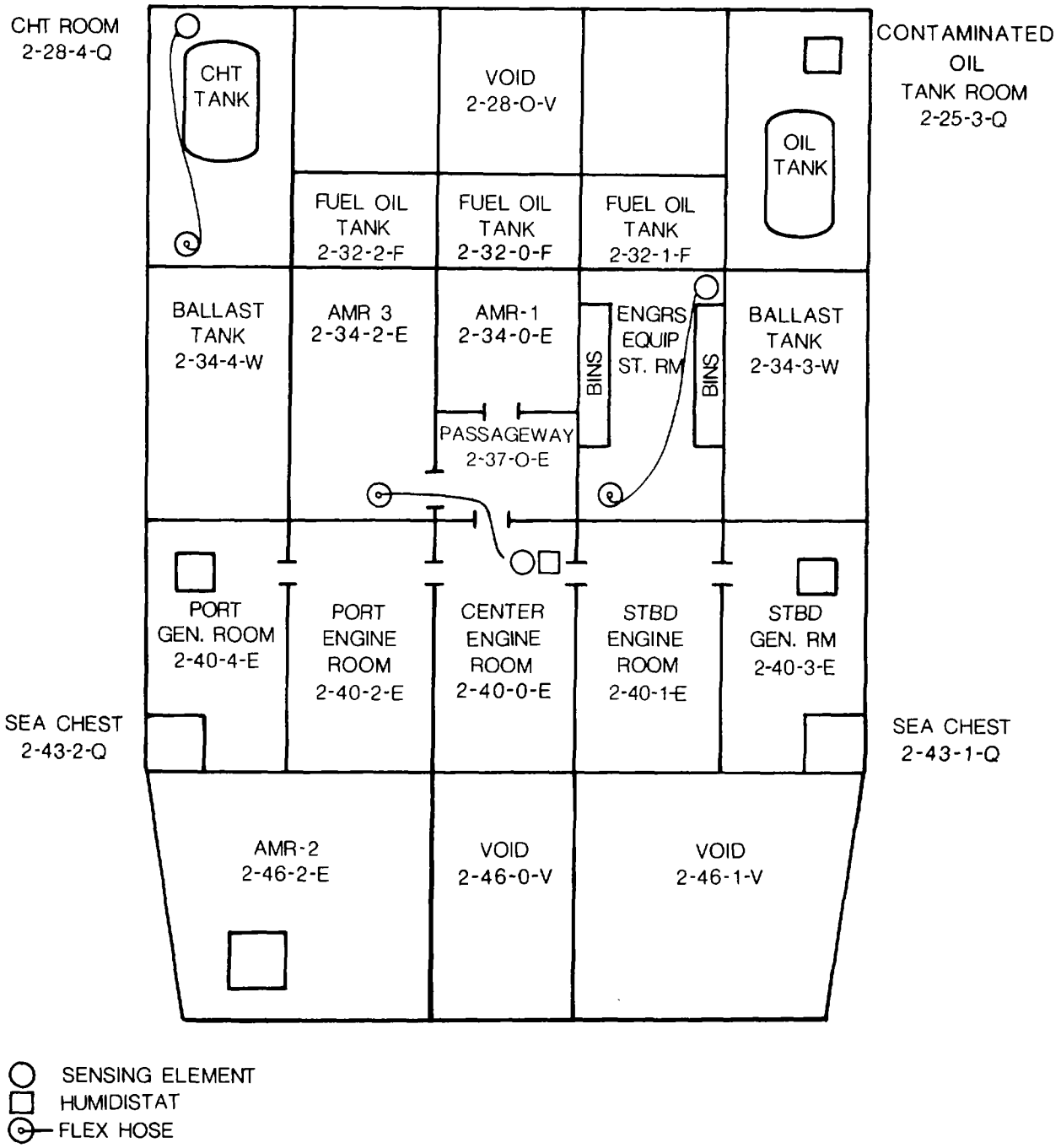
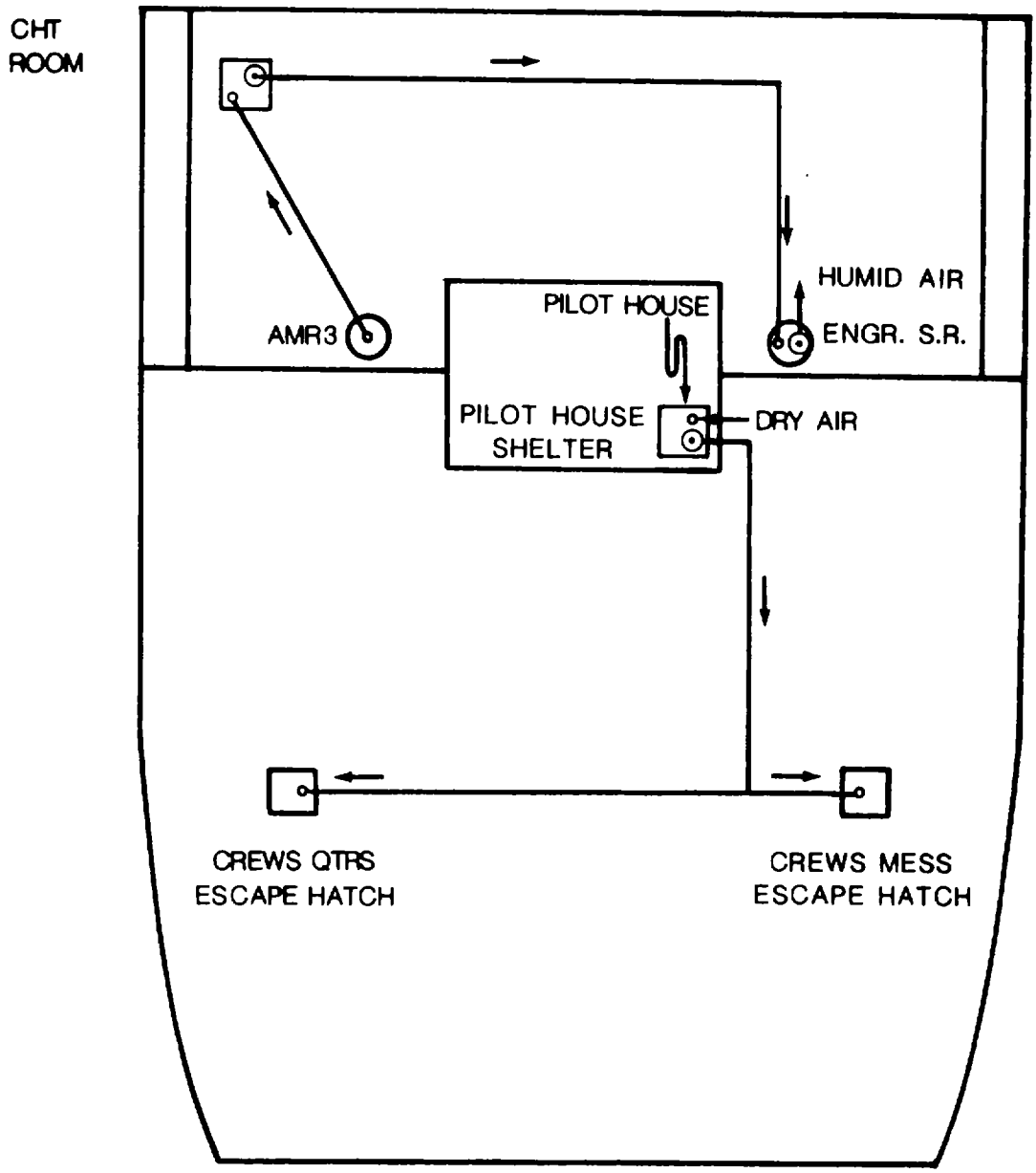


Figure B-1. LCU 1466 A: Pickups, Sensing Element and Humindistat-Zone 1



& FLEX HOSE
- 4' PVC DUCTING
  DRY AIR = D/H MACHINE CONNECTIONS
  HUMID AIR

Figure B-2. LCU 1466 A: Ducting - Zone 1

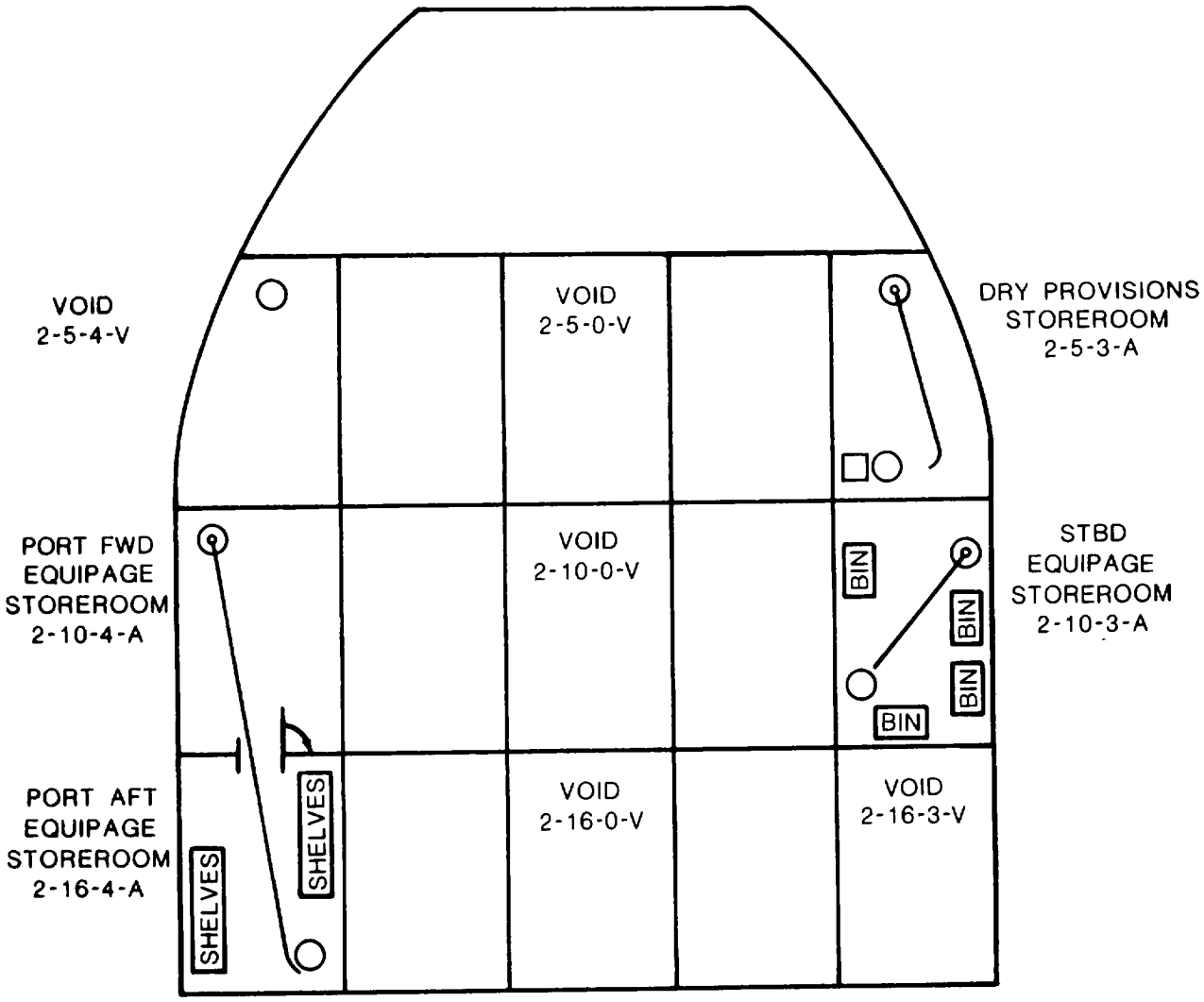


Figure B-3. LCU 1466A; Pickups, Sensing Element, and Humidistat - Zone 2

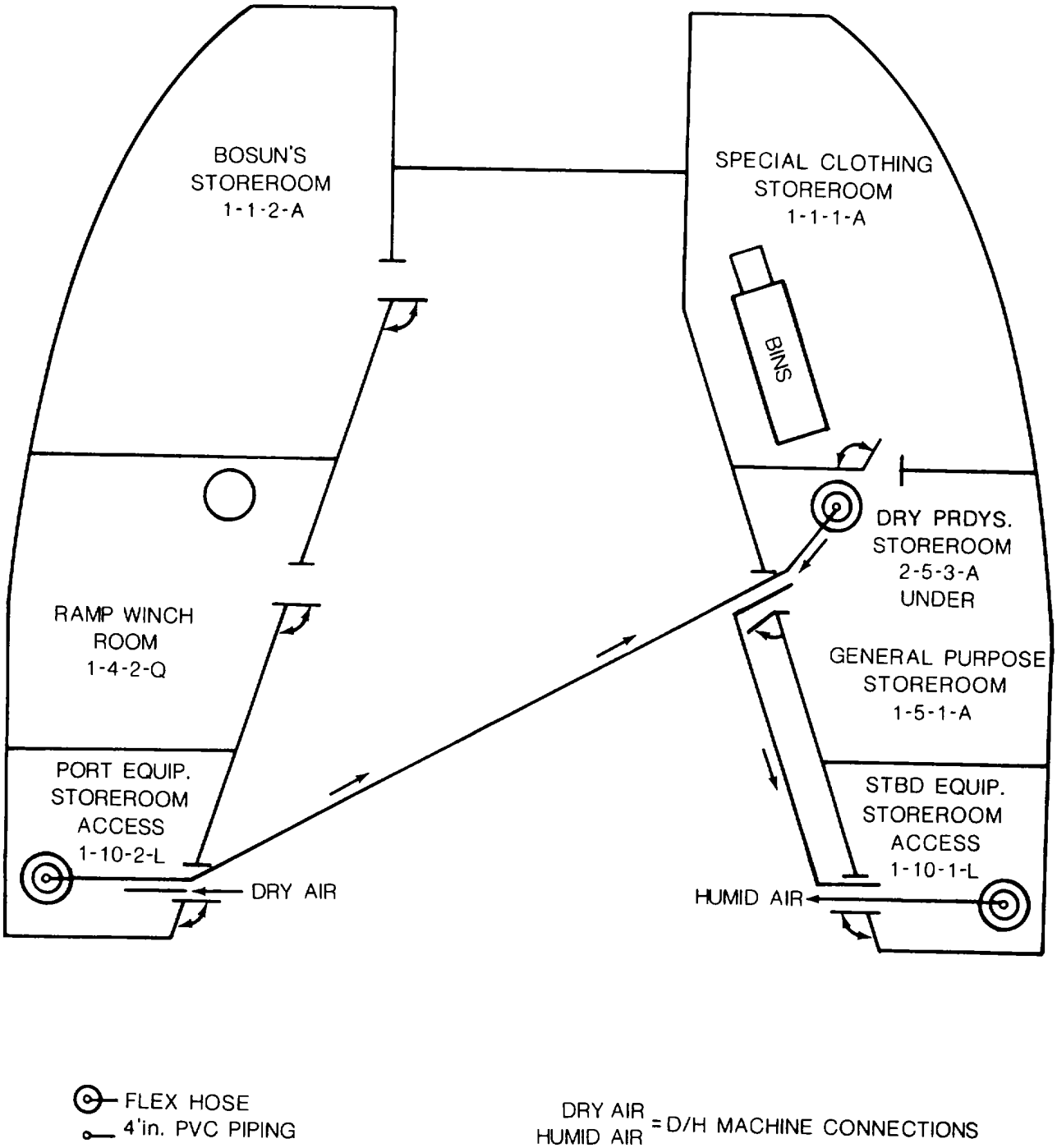


Figure B-4. LCU 1466A; Ducting - Zone 2

APPENDIX C
DYNAMIC DEHUMIDIFICATION INSTRUCTIONS FOR LANDING CRAFT, MECHANIZED, 74 FOOT DESIGN LCM-8, MOD. 1 (ROHR BUILT) NSN 1905-00-4935-6057

I. GENERAL: These instructions provide details required for preparation and installation of dynamic dehumidification for the mechanized landing craft. Man-hours and materials required to perform the functions herein are specified in the attached listing. The Watercraft has approximately 4,000 cubic feet of area to be dehumidified.

II. PREPARATION:

A. A herculite cover secured with nylon drawstring shall be installed over the pilothouse searchlight. Stencil cover with purpose and location.

B. Unbolt and remove the manhole on the stbd. side of the pilothouse control panel. Tag and bag bolts and attach with new gasket to manhole cover.

C. Close, dog, and secure the following:

1. Pilothouse windows.
2. Engineroom access hatch.
3. Lazarette access hatch.
4. Ramp winch access door.
5. All void covers.

D. Using pressure sensitive tape, glue and strip coat, seal the following:

1. Fresh water expansion tank deck fill plugs (2 each).
2. Fuel oil tank deck fill plugs (2 each).
3. Pilothouse limber (drain) holes.
4. Port rudder tiller deck plate.
5. Pilothouse battle ports.

E. Using pressure sensitive tape, glue, strip coat and wooden blanks, seal the following: (See Chapter III, Section 4, paragraph F.)

1. Engineroom natural ventilator cowls (4 each). (These are best sealed from inside the engineroom).
2. Access to the old static inverter cabinet from the pilothouse.
3. Stbd. pilothouse access.

F. The fuel oil tank vent and the dirty oil tank vent shall be left open. Inspect exterior electrical cable stuffing tubes and pack with duct seal as required. Ensure that exterior electrical receptacle caps are installed.

G. The lazarette bilge drain valve (in the engineroom at the after bulkhead) shall be locked or wired open.

H. The main mast shall be stowed in its lowest position and left in place.

I. Seal any other pilothouse openings found with pressure sensitive tape and glue.

J. Ensure that all fill and overboard discharge valves are closed and their caps are installed.

K. It is recommended that the ramp be lowered just enough to prevent the accumulation of standing water, dirt and debris between the ramp and the forward well deck area Remove the load binders and store in the lazarette. Fabricate two (2) ramp holding devices, consisting of 5/8 inch wire rope, clamps and turn buckles and install in way of load binder removal. Provide slack in the ramp winch cable to remove strain on the ramp winch.

III. DYNAMIC DEHUMIDIFICATION:

A. The dehumidified zone as shown in Figures C-1 and C-2 shall encompass the pilothouse, the engineroom, and the lazarette. Dry air will be introduced into the pilothouse by way of a 4" PVC pipe coupling installed in a wooden blank that will be sealed with pressure sensitive tape and glue over the port pilothouse access.

B. The dry air will flow to engineroom through the stbd. control panel manhole and to the lazarette through the locked open bilge drain valve.

C. Humid air will be removed from the zone by way of the stbd. rudder tiller deck plate. The deck plate keeper chain will be detached and the deck plate tagged, bagged and secured to an adjacent stanchion. A wooden blank fitted with a 4" PVC pipe coupling will be sealed with pressure sensitive tape, glue and strip coat over the stbd. rudder tiller access hole.

D. One (1) sensing element and one (1) humidistat will be installed within three (3) feet of the lazarette bilge drain valve in the engineroom. The humidistat will be set to maintain 40 percent (plus or minus 5 percent) relative humidity.

E. The wooden blanks that are to be installed over the following openings shall be equipped with a simple quick-acting dogging or strongback securing device. Strips of 1/8 inch neoprene rubber will be glued to the blanks to provide a flexible seal between the wood and the steel surface. (Refer to Chapter III, Section 4, paragraph F.)

1. Port and stbd. pilothouse accesses.
2. Old static inverter cabinet access from the pilothouse. Any cracks found will be sealed with pressure sensitive tape and glue.

F. Stencil the appropriate inlet and outlet wooden blank or adjacent surface with "DRY AIR" and "HUMID AIR" respectively for the benefit of those who are to connect the D/H systems.

IV. MATERIAL REQUIREMENTS: The following listing contains an estimate of those materials required for preservation.
*The estimated quantity reflects the requirements of ten (10) watercraft.

A. MATERIALS:

NSN	NOMENCLATURE	UNIT OF ISSUE	EST. QTY
Local Purchase	4" PVC Pipe Couplings	EA	20
Local Purchase	PVC Glue	PT	10
9150-00-111-0209	P-10, Type I, Grade 30, Preservative Oil	CN (5 Gal.)	15

NSN	NOMENCLATURE	UNIT OF ISSUE	EST. QTY
9150-00-231-9062	P-9, Preservative VV-L-800	CN (5 Gal.)	10
9150-00-111-3199	P-10, Type I, Grade 10, Preservative Oil	CN (5 Gal.)	3
8030.0-244-1298	P-2 Preservative	CN (5 Gal.)	2
8030-00-244-1299	P-1 Preservative	CN (5 Gal.)	2
5640-00-103-2254	Tape, 2 Inch, Pressure Sensitive	RL	20
7510-00-074-4996	Tape, 3 Inch, Pressure Sensitive	RL	20
8040-00-754-2685	Adhesive, Fed. Spec. MMM-A-130B	GL	10
6810-00-281-2785	Methyl Ethyl Ketone (MEK)	GL	10
8030-00-281-2337	Duct Seal	BG	5
8020-00-263-3874	Brush, Sash	EA	20
7920-00-291-5815	Brush, Wire	EA	10
9150-00-530-6814	Lubricant, Rust Resistant, MIL-G-18458	CN (5 Gal.)	4
5970-00-583-0401	Glyptol, Snyth, Primer	QT	5
5530-00-129-7777	Plywood, 1/2 Inch Exterior Grade	SH	10
5330-00-261-5761	1/8 Inch Gasket Material	FT	20
9150-00-188-9858	Lube, Oil, OE-30	CN (5 Gal.)	30
6850-00-181-7929	Antifreeze	GL	80

V. MANHOUR REQUIREMENTS: The following listing contains the estimated skills, man-hours, and costs required to accomplish those tasks and procedures as set forth in Chapter III, Storage Requirements, Section 3, Preservation (General), Section 4, Specific Preservation Requirements, and this Appendix.

SKILL	QTY	M/Hrs.	TOTAL M/Hrs.
Mechanic/Processor	1	84	84
Processor	1	84	84
Processor Helper	1	84	84
Support/Quality Assurance	1	28	28
	M/Hr. Per Watercraft		280
			X 10 Vessels
	Qty. for 10 Watercraft		2,800 M/Hrs.

Figure C-1. D/H MACHINE CONNECTIONS

Figure C-2. AIR FLOW

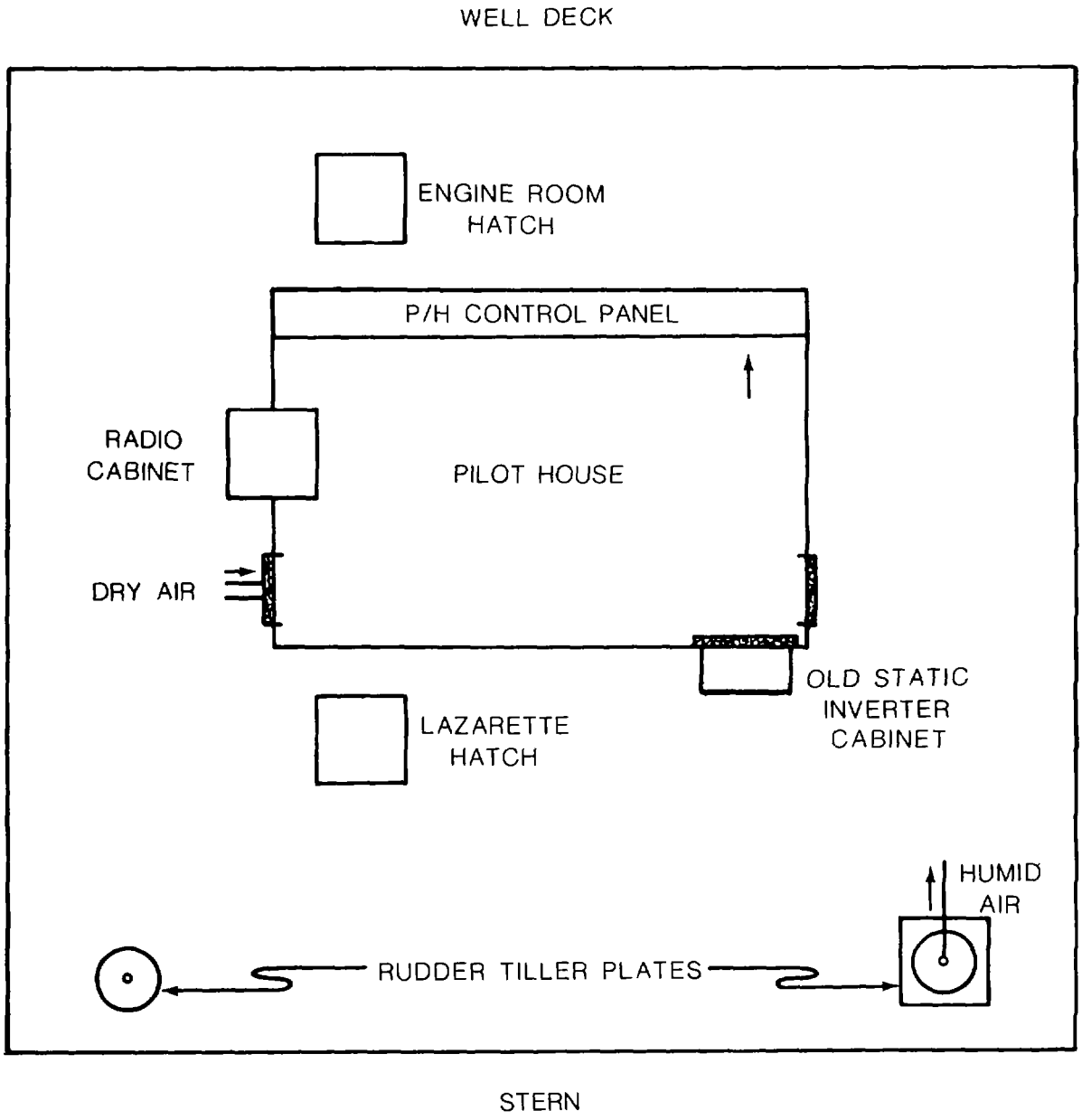


Figure C-1. Design LCM - 8, Mod 1; D/H Machine Connections

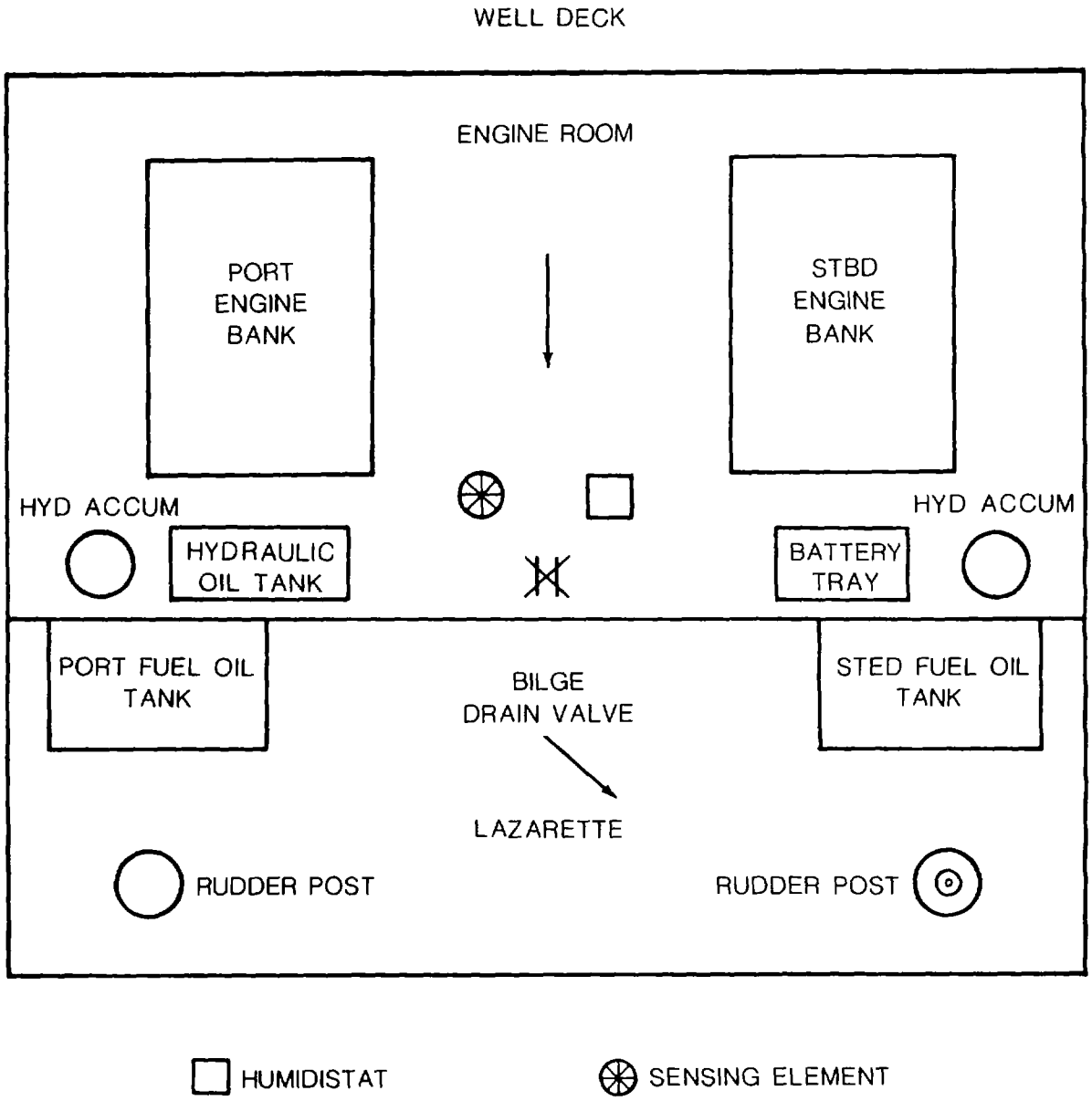


Figure C-2. Design LCM - 8, Mod 1; Air Flow

APPENDIX D
DYNAMIC DEHUMIDIFICATION INSTRUCTIONS
FOR
CRANE, BARGE, FLOATING, 100 TON
DESIGN 264-B (MODIFIED)
NSN 1935-00-264-6219

I. GENERAL: These instructions provide details required for preparation and installation of dynamic dehumidification on the floating barge crane. Man-hours and materials required to perform the functions herein are specified in the attached listing. The watercraft has approximately 36,000 cubic feet of area to be dehumidified.

II. PREPARATION:

A. The boom will be stowed in its rest, the spud engaged, and the boom drum pawl engaged.

B. Herculite covers secured with nylon drawstrings shall be installed over the following items as applicable: (See Chapter III, Section 4, paragraph E.)

1. Port and stbd. engineroom cowl vents.
2. Port fwd. capstan.
3. Port fwd. capstan master switch.
4. Anchor windlass (including motor and brake housing).
5. Anchor windlass master switch.
6. Paint locker including mounted fire extinguisher.
7. Life preserver box.
8. Portable bilge and ballast pump.
9. Heating boiler exhaust stack.
10. Fresh water hose reel.
11. Galley exhaust fan mushroom.
12. Deck stowage lockers (4 each) located at the four corners around the machinery house whirler base.
13. Stbd. aft capstan.
14. Stbd. aft capstan master switch.
15. Machinery house heater exhaust stack.
16. Operator's cab searchlight.
17. Boom floodlights (2 each).
18. Boom travel limit switch (located adjacent to boom heel pin).
19. No. 1 and No. 2 hook's tube-locking limit switches (2 each) located aft of each hooks' sheaves on the boom.
20. Port and stbd. rotate alarms.
21. Operators cab howler (adjacent to searchlight).
22. Shore power receptacle.
23. Fire pump remote start/stop pushbutton (fwd. end of engineroom deckhouse).
24. CHT overboard discharge pump remote start/stop pushbutton (stbd. outboard side fwd. on crews quarters deckhouse).
25. Portable bilge and ballast pump remote start/stop pushbutton (fwd. end of machinery house whirler base).
26. Fuel oil overflow pails (2 each). Stencil each cover with its purpose and/or location.

C. The following items shall be secured in an open position:

1. Stbd. machinery house door.
2. Crews mess stbd. outboard center porthole (above refrigerator).
3. Accesses to living quarters storerooms (2 each).
4. Crews' washroom door.
5. Passageway to living quarters door.
6. CHT room aft scuttle.
7. Ballast tank vents (6 each).
8. Fuel oil day tank vents (2 each).
9. Lube oil service tank vent.
10. Freshwater expansion tank vents (2 each).
11. Fuel oil drain tank vent.
12. Lube oil drain tank vent.
13. OWS dirty oil tank vent.
14. Main fuel oil tank vent.
15. CHT holding tank vent.
16. Main potable water tank vent.
17. Machinery house fuel oil day tank vent.
18. Operators cab door.

All other doors and hatches will be closed and dogged.

D. Install wooden plywood blanks over the boom, main and auxiliary hoist cable penetrations on top and fwd. of the machinery house. (See Chapter III, Section 4, paragraph F.) The blanks will be fitted with 7/8 inch diameter holes for the auxiliary hoist cables, 1-1/4 inch diameter holes for the boom hoist cables, and 1-1/8 inch diameter holes for the main hoist cables. Seal the blanks with pressure sensitive tape, glue and strip coat. Pack duct seal around the cable penetration holes.

E. Install wooden plywood blanks equipped with simple quick acting dogging devices or strongback securing devices and with 1/8 inch neoprene rubber strips that will provide a flexible seal between the wood and its mounting surface over the manhole accesses to the machinery house from underneath the machinery house. Seal any gaps with pressure sensitive tape, glue and strip coat. Ensure that the accesses (2 each) to the rotary collector box are properly secured. One of the two accesses is inboard in the boom trolley extension void.

F. Inspect all penetrations to the machinery house from underneath the machinery house. These shall include electrical cable stuffing tubes, hydraulic line tubing, conduit, piping, and spud and pawl linkage penetrations. Pack gaps and openings with duct seal. Seal any other holes found with pressure sensitive tape, glue and strip coat. After completion of sealing under the machinery house, seal the access to underneath the machinery house from the machinery house with pressure sensitive tape, glue and strip coat.

G. The natural gooseneck vents on top of the machinery house (4 each) will be sealed with pressure sensitive tape, glue and strip coat. Pack any gaps in the electrical cable stuffing tube penetrations with duct seal. Upon completion of sealing on top of the machinery house, shut and dog the access hatch. Seal any gaps with pressure sensitive tape.

H. Inspect all the windows in the machinery house and operators cab. Seal gaps with pressure sensitive tape and glue.

I. Seal the machinery house counterweight deck drains (2 each) in the port and stbd. aft corners adjacent to the boom hoist drum and the exit holes underneath the counterweight outside the machinery house with pressure sensitive tape and glue.

J. Install the shipping cover over the operators cab air conditioner and properly secure. Seal cover junction with pressure sensitive tape and glue.

K. Using one (1) inch thick wooden blocks, block open the refrigerator and oven doors in the crews' mess. Shut the galley sink drain valves. Install the crews' washroom sink stoppers in their drains. Tape over the shower stall deck drain and the water cooler drain and vent. Shut and dog all port- holes and blackout covers in the living quarters except the one above the refrigerator. Install a wooden blank secured with pressure sensitive tape over the galley range exhaust fan intake. Tape or pack with duct seal any other holes found.

L. Close and dog the existing gooseneck vent covers for the following:

1. CHT room natural vent.
2. Living quarters and CHT room supply fan intake.
3. Crews' washroom natural exhaust.
4. Tape over the crews' berthing gooseneck natural vent.

Seal any gaps found with pressure sensitive tape and glue.

M. The voids adjacent to the port and stbd. living quarters storerooms and the port and stbd. enginerooms have cutouts in their longitudinal (running fore and aft) bulkheads at bilge level. Tape over cutouts with pressure sensitive tape.

N. Ensure that all service, fill, drain, firefighting, and overboard discharge connection valves on the main deck, deckhouses, and machinery house are closed and their caps installed.

O. Close the dampers on the engineroom supply fan and natural exhaust ducts.
P. The towing bridle is stowed in Hatch #3, third manhole from centerline stbd. side.

III. DYNAMIC DEHUMIDIFICATION:

A. The dehumidified area as shown in Figures D-1 and D-2 will consist of four (4) areas:

1. The machinery house.
2. The living quarters and the storerooms below.
3. The CHT room.
4. The port and stbd. engineroom.

B. The areas will be connected in series with dry air supplied by way of a 4" PVC pipe coupling to the machinery house and humid air removed from the engineroom by way of 4" flexible hose. Connect long runs of flex hose with 4 " PVC pipe nipples and hose clamps. Connect long runs of 4" PVC pipe with 4" PVC pipe couplings.

C. Dry air will be introduced to the machinery house through a 4" PVC pipe coupling fitted in a wooden blank equipped with a simple quick-acting dogging device or strongback securing device with strips of 1/8 inch neoprene rubber glued to the wood to provide a flexible seal between the wood and the stbd. machinery house door coaming. The dry air pipe coupling shall be installed as high as possible in the blank and the humid air pipe coupling as low as possible through the same blank.

D. Humid air will be removed from the machinery house through lengths of 4" flexible hose routed to pickup air aft of the boom hoist drum and connected to the stbd. machinery door blank's pipe coupling and nipple with a hose clamp.

E. The humid air from the machinery house will be ducted through 4' PVC pipe supplied to the living quarters and storeroom through a blank fitted with two each 4 inch pipe couplings and installed over the stbd. outboard porthole above the refrigerator. The pickup from the fwd. end of the port living quarters storeroom will be ducted to the blank over the after CHT room scuttle. The pickup from the stbd. side fwd. end of the CHT room, in turn will be ducted to the stbd. outboard center porthole on the engineroom deckhouse.

F. Unbolt and remove the stbd. outboard center porthole on the engineroom deckhouse. Stow porthole in the engineroom. Tag and bag bolts and nuts and attach to porthole. Install a circular wooden blank over this opening fitted with two (2) each 4 inch PVC pipe couplings, located top and bottom, and with strips of 1/8 inch neoprene rubber glued to the wood to provide a flexible seal between the wood and the mounting surface. Drill holes as required in the blank so that it can be secured with a minimum of four (4) bolts, nuts, and flat washers through the existing porthole bolt holes.

G. The blank over the living quarters deckhouse porthole will also be fitted with two (2) each 4 inch PVC pipe couplings located vertically. The blank will be installed flush with deckhouse bulkhead, inside the porthole coaming. Remove and stow porthole screen in galley. Any gaps will be packed with duct seal and sealed with pressure sensitive tape and glue.

V. MANHOUR REQUIREMENTS: The following listing contains the estimated skills, man-hours, and costs required to accomplish those tasks and procedures as set forth in Chapter III, Storage Requirements, Section 3, Preservation (General), Section 4, Specific Preservation Requirements, and this Appendix.

SKILL	**QTY**	**M/Hrs.**	**TOTAL M/Hrs.**
Mechanic/Processor	2	175	350
Processor	2	175	350
Processor Helper	1	175	175
Support/Quality Assurance	1	75	75
	M/Hrs Per Watercraft		950
			X2
	Qty. for 2 Watercraft		1,900 M/Hrs.

H. The blank over the CHT room's after scuttle will be equipped with two (2) each 4 inch PVC pipe couplings, a simple quick-acting dogging device or strongback securing device, and strips of 1/8 inch neoprene rubber glued to the wood to provide a flexible seal between the wood and the scuttle's knife edge.

I. Sensing Elements: Four(4) sensing elements will be installed within three (3) feet of the pickups in the machinery house, port living quarters storeroom, CHT room, and port engineroom.

J. Humidistat: A single humidistat will be installed within three (3) feet of the pickup in the port engineroom. The humidistat will be set to maintain 40 percent (plus or minus 5 percent) relative humidity.

K. Stencil the blanks or the adjacent surface near the blanks on the machinery house and engineroom deckhouse with "DRY AIR" and "HUMID AIR" for the benefit of those who will connect the D/H systems.

L. Support the exterior 4 inch PVC pipe ducting runs at intervals of 10 to 12 feet with suitable bracing.

IV. MATERIAL REQUIREMENTS The following listing contains an estimate of those materials required for preservation.

*The estimated quantity reflects the requirements for two (2) watercraft:

A. Materials:

NSN	NOMENCLATURE	ISSUE	QTY
Local Purchase	4" PVC Pipe, Schedule 40	20 FF Lengths	10
Local Purchase	4" PVC Pipe Couplings	EA	20
Local Purchase	4" PVC 90 Deg. Elbows	EA	10
Local Purchase	4" PVC 45 Deg. Elbows	EA	4
Local Purchase	PVC Glue	PT	6
9150-00-111-0210	P-10, Type I, Grade 30, Preservative Oil	DR (55 Gal.)	4
9150-00-231-9062	P-9, Preservative Oil VV-L800	CN (5 Gal.)	8
9150-00-111-3199	P-10, Type I, Grade 10, Preservative Oil	CN (5 Gal.)	2
8030-00-244-1298	P-2 Preservative	CN (5 Gal.)	2
8030-00-244-1299	P-1 Preservative	CN (5 Gal.)	2
5640-00-103-2254	Tape, 2 Inch, Pressure Sensitive	RL	12
7510-00-074-4996	Tape, 3 Inch, Pressure Sensitive	RL	12
8040-00-754-2685	Adhesive, Fed. Spec. MMM-A-130B	GL	5

NSN	NOMENCLATURE	ISSUE	QTY
4720-00-809-2430	Flex Hose, 4 Inch MIL-H-8796	FT	360
6810-00-281-2785	Methyl Ethyl Ketone (MEK)	GL	4
8030-00-281-2337	Duct, Seal	BG	4
8020-00-263-3874	Brush, Sash	EA	8
7290-00-291-5815	Brush, Wire	EA	4
9150-00-530-6814	Lubricant, Rust Resistant MIL-G- 18458	CN (5 Gal.)	12
5970-00-583-0401	Glyptol, Synthetic Primer	QT	12
5530-00-129-7777	Plywood, 1/2 Inch, Exterior Grade	SH	10
4730-00-908-6294	Hose, Clamp 4-7 Inch	EA	30
6850-00-181-7929	Antifreeze	GL	100
9140-01-079-5805	Fuel, Diesel, Naval Distillate (MIL-F-16884H)	GL	100
9150-00-189-6729	Lube Oil, OE-30	DR (55 Gal.)	4
6140-00-190-9831	Batteries Starting, Dry Charged 12 VDC	EA	8
6810-00-249-9354	Electrolyte	GL	20
5330-00-261-5761	1/8 Gasket Material	FT	16
6810-00-255-0471	Calcium Hypochlorite Technical, 70% (HTH)	JR (6 Oz.)	48
8030-00-281-2345	Strip Coat	GL	20

Figure 1. D/H DUCTING

***U.S. GOVERNMENT PRINTING: 1992 - 755-028/60453**

PIN: 065945-002

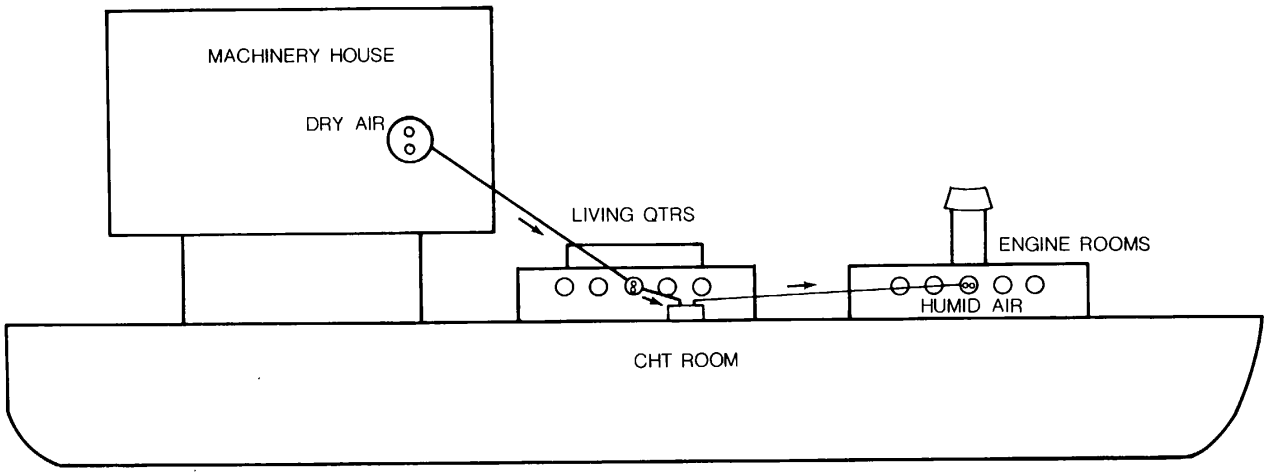


Figure D-1. Design 264B; D/H Ducting

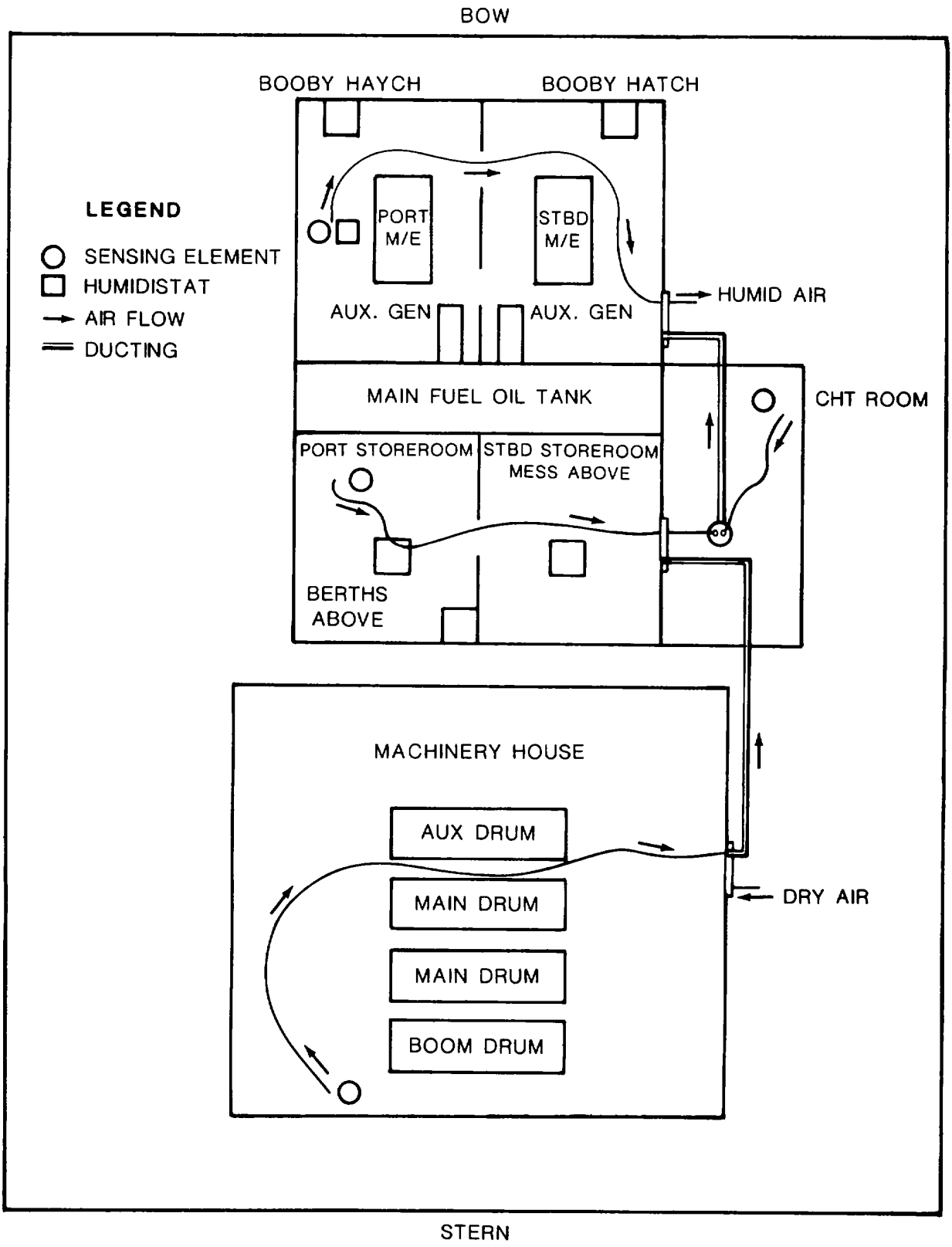


Figure D-2. Design 264B; Air Flow

APPENDIX E
DYNAMIC DEHUMIDIFICATION INSTRUCTIONS
FOR
REVERSE OSMOSIS WATER PURIFICATION BARGE (ROWPU)
MODIFIED DESIGN 231A

I. GENERAL: These instructions provide details required for processing ROWPU equipment and installation of dehumidification. The ROWPU Barges are unique, therefore, complete preservation instructions are provided in this appendix. Generally the instructions follow the procedures provided in Chapter MIL Preservation will, as nearly possible, be accomplished in the order listed.

II. PREPARATION:

A. Form fitted covers will be installed and secured over the following items:

1.	Anchor winches	4 EA
2.	Smoke detector	1 EA
3.	Level wind	1 EA
4.	Beach winch	1 EA
5.	Work boat	1 EA
6.	Crane, hydraulic	1 EA
7.	Crane controls	1 EA
8.	Hose reel	1 EA
9.	Exhaust cover	1 EA
10.	Exhaust round	2 EA
11.	Air vents	6 EA

B. The fabric for the covers are fabricated from material that conforms with MILP-58102 Admendment 1, Type II, Class 1, Grade A, Color Grey. The fabriation specifications conform with MIL-C-58104A. All covers are fitted with straps with quick release fasteners FLEXTE model QR-1.

C. REPAIR KITS. Each ROWPU is furnished with a repair kit for the covers.

Correctly used, the repair kit material is capable of producing a joint with 100% of the strength of base material within 24 hours after bonding. The repair kit is normally stored inside the storage area on the RO deck. The kit contains:

1. Fifty (50) square feet of the same material used to fabricate the basic cover.

2. Six (6) pint cans, with brush of adhesive specified in MIL-P-58102 for bonding repairs.

3. A stowage bag for the repair materials is provided.

The stowage bags will be marked REPAIR-KIT-FLAMMABLE MATERIALS INSIDE. Each kit contains water proof instructions for the preparation and application of the repair kit components.

D. Individual covers, together with the closure tool, if applicable and installation instruction will be considered unit assemblies for identification purposes.

1. All the covers (19) and the repair kit for each ROWPU will be considered a complete assembly and is identified by National Stock Number: NSN 6675-02-230-0273, Cover Set, MULTPLEX on 300 KGPD, ROWPU Barge.

2. The lettering will be capital letters black in color, water proof, nonfading and durable. Letters will be one (1) inch in height, but may reduced to conform with smaller covers. Markings will contain the information listed in 3 below.

3. ROWPU BARGE, NO 2 EQUIPMENT COVER
SEA WINCH (1 of 4)
NAN 6675-01-230-0723
MANUFACTURER GLOBAL CHEMICAL
MFG ASSEMBLY NO. 415-DJCD-111
MFG UNIT NO. None Listed

E. Identification for each individual cover will be marked as follows:

1. Each unit of one assembly is identified for ROWPU No. 2 and one assembly for ROWPU No. 3.

2. Each cover/unit in the assembly is marked by its specific purpose, i.e. Reel covers Vent Covers.

3. All covers in sets will be further identified by set as follows Sea Winch 1 of 4, 2 of 4 etc.

4. Each cover is provided with one (1) durable set of instructions that contain step by step procedures for closing, opening installing and the removal of the covers.

F. MAINTENANCE OF THE COVERS.

The covers are designed to provide for the protection of the machinery under all weather conditions, however routine maintenance must be provided to keep them in an optimum condition.

1. All covers will be inspected monthly for cracks, open seams or tears and repairs made as soon as possible.

2. All straps, and closure will be properly secured. Any damage to the straps and closures will be repaired as soon as practical after the damage is discovered.

3. A periodic cleaning schedule will be established to maintain the covers in good condition

4. When required by the monthly inspections, the covers will be washed free of all grease, soiled spots, and salt deposits, as follows:

(a) The soiled areas will be scrubbed with a water soluble detergent or cleaning compound.

(b) After soiled areas are scrubbed the covers will be hosed down with fresh water.

G. COVER REMOVAL AND STORAGE.

The following procedure will be accomplished when removing the covers and during activation, for stowing them below decks.

1. All straps and securements will be opened or unlatched to prevent the cover from binding when removed.

2. Insure that the cover does not hang up or snag on the machinery.

3. Do not turn the cover inside out.

4. During the regular cyclic operation of the equipment or when the vessel is activated and the covers are stowed in the storage areas in the vessel

(a) All covers will be cleaned and be free of all salt water, grease and other foreign matter. (See Para F.4. for cleaning instructions)

(b) The covers will be thoroughly dried prior to stowage.

(c) Roll or fold the covers in such a manner (from the top down) to facilitate handling when they are reinstalled.

H. REVERSE OSMOSIS SYSTEM

1. Engines No. 1 & 2 - 4 Cycle, turbo changed Caterpillar. Each will be processed as follows:

(a) Crankcases - Change filters, drain oil and fill with P-10 grade 30.

(b) Cooling Systems - Drain, flush/clean, and fill with 50-50 mixture of water and anti-freeze.

(c) Fuel Systems - Change filters, starting with engines hot, run P-9 thru system via fuel supply and return lines, after which the lines will be reconnected, ensuring no air entrapment, ready for light off.

(d) Batteries, Starting - In dry state, secured in tray. Cable Tugs and battery post will be coated with P-11 and left unconnected. The electroyte for the batteries will be stored in the storage cage on the ROWPU deck of each vessel

(e) Torque Converters and Reduction Gears

Torque converters: fill to operating level with P-10 Grade 30 preservative oil.

Reduction Gear: fill to operating level with GO-90 gear oil (MIL-L-2105)

(f) Drive Belts - Position tensioner in relaxed position.

(g) Exhaust (Boat Deck) - Install blanks between muffler and tail pipe elbows. Turn tail pipe elbows 180° down when the blanks are installed.

2. Pumps, Tubes, Piping, and Filters - Will be flushed with fresh water, and processed as follows:

(a) RIO. Pumps No. 1 & 2 - Drain and blow dry with dry compressed air.

(b) Tubes - Will be drained, the end covers will be removed and left off. The covers with new CRES securement bolts will be secured to the tube at the end from which they were removed.

NOTE

The membranes have already been removed from the tubes and will not be renewed until activation.

(c) Piping, Raw and Fresh - will be drained flushed with fresh water and blown dry with dry compressed air.

NOTE

Break at low points as required to effect complete drainage, then reconnect.

(d) Filters - Media & Cartridge - Will be drained and the drain plug placed in a bag and attached to the filter.

NOTE

All valves in system will be left open with exception of raws water overboard.

3. Raw Water System Supply for R.O. Unit - Will have already been flushed with fresh water.

(a) Pumps No. 1 & 2. Drain and blow dry with dry compressed air.

(b) Piping, Raw Water - Drain and blow dry with dry compressed air. All valves in' the system will be left in open position, except sea suctions, inlet to strainers, and overboard, which will be wired closed. The duplex, suction strainers will be drained, dried, and caps reinstalled.

NOTE

Disconnect lines at low points as required to effect complete drainage. Reconnect, leave in ready to operate status.

(c) Chemical Metering Pumps - No preservation required.

4. Electrical Generating System

(a) Switchboard, Controllers, Motors, etc. - No preservation required except controllers/motors installed on the exterior may require some static packing which will be noted in the preservation record for the parent equipments.

(b) Generator Engines - Nos. 1 & 2, are 4 Cycle, turbo, charged, caterpillar, #3 is four cycle non-aspirated. Each will be processed as follows:

(c) Crankcase - Change filters, drain oil and fill with P-10 grade 30. (MIL-L-21260)

(d) Cooling System - Drain, flush/clean and fill with 50-50 mixture of water and anti-freeze.

(e) Fuel System - Change filters, starting with engine hot, run P-9 thru system via fuel supply and return lines after which the line will be reconnected, ensuring no air entrapment, ready for light off.

(i) Raw Water System - Will be flushed with fresh water, drained, blown dry with dry compressed air. The sea strainer caps will be secured in place since there is only one sea chest valve before the strainer. The raw water pumps will be drained flushed, and blown dry along with the system.

NOTE

Lines will be broken at low points as required to effect drainage, then reconnected, in a ready to operate status.

(g) Batteries, Starting - In dry state, secured in tray. Cable lugs and battery post will be coated with P-11 and left unconnected. Electroylyte is stored in the Supply cage on the ROWPU Deck.

5. Product Water Discharge System

(a) Pumps, Shore Discharge - Drain and blow dry with dry compressed air. Replace plugs removed to effect drainage.

(b) Product Water Discharge Piping Tanks to pumps and pumps to reel and deck discharge. Piping will be drained and blown dry with dry compressed air. All valves in the system will be left in the open position, except the discharge into the shore discharge hose reel. The deck opening will have the cap installed.

6. Drinking Water Pressure Set

(**a) Pump** - Drain and blow dry with dry compressed air.

(b) Piping - Includes fill and drain to storage tank, suction to pump, discharge to pressure tank, and distribution from pressure tank thru-out. All piping will be drained and blown dry, with dry compressed air. All valves in this system will be left in the open position.

NOTE

Lines will be disconnected at low points as required to effect drainage, then reconnect, leave in a ready status.

7. Auxiliary Equipments System

(a) Air Compressor - Drain and fill the crankcase with P-10 grade 30. Disconnect the air discharge to tank. Remove the intake filters. Operate the compressor during which time, spray 5 ozs. of P-10 grade 30 into the air intake or until the oil mist is evident in the air discharge. Reconnect discharge line to tank. Clean and reinstall air intake filters. Leave in a ready status.

(b) Air Tank - Drain the tank. Remove plugs, open drain valve. Bag and tag plugs and secure adjacent to tank.

(c) Air Piping - Drain, leave all valves in the open position except on the weather deck, outside D/H envelope.

NOTE

It may be desirable to use this installed system for blowing other systems in which case processing may be delayed until near the final stages of the preservation process.

8. **Welder**- No preservation required. Ensure cable secured.

9. Eye Wash Tanks - Drain, no other preservation required.

10. Fuel Oil Transfer System

(a) Piping - Drain piping back from day tank in conjunction with fuel storage tank preservation item 23.(d).

(b) Pump, Fuel Transfer Close suction and discharge valves. Drain pump, fill with P-10 Type 1 Grade 30 preservation oil (MIL-L-21260), then drain. Reinstall plugs. Install new suction filter.

11. Bilge Pumping System

(a) Piping - Flush entire system from all stations with fresh water, the drain and blow dry. Leave all valves in open position except deck discharge which will also be capped.

(b) **Pump** - Flush with fresh water. Drain and blow dry, drain pot strainer on suction. Attach strainer cap with new gasket/"0" ring adjacent to strainer ready for assembly, leaving strainer open to D/H.

NOTE

This item will be worked in conjunction with item 23.(a). Both should be the last system to process.

12. Air Conditioner and Systems:

(a) **Air Conditioner** - No preservation required.

(b) **Raw Water Circulating Piping/Condenser** - Back flush with fresh water, drain and blow dry. Flush overboard from condenser with fresh water, drain and blow dry. Lines may be disconnected as required to effect flushing and draining, after which all will be reconnected, left in a ready status. All valves in this system will be left in the closed position. The sea chest valve will be wired in the closed position. The duplex strainer shall be drained, dried, and the caps reinstalled. A Red Tag will be placed on the valve as a warning.

(c) **Pump, Raw Water Circulating** - Flush with fresh water, drain and blow dry. Leave drain plugs holes openr Bag and tag drain plugs and hang next to the opening, or on the pump.

CAUTION

In working this system, do not open any of the valves to the chlorination plant.

13. Chlorination Plant - Drain system piping, flush with fresh water and blow dry.

14. Shop Equipment

(a) **Drill Press** - Exposed metal surfaces, (spindle, chuck, post, etc.) clean and coat with light film of P-10 grade 30.

(b) **Bench Vise** - Clean and coat with light film of P-10 grade 30.

(c) **Hand Press** - Clean and coat with light film of P-10 grade 30.

(d) **Bench Grinder** - Clean, no preservation required.

15. Hydraulic System - Located in #1 and #5 voids, respectively.

(a) **Hydraulic System for Crane** - Ensure system reservoir is filled to operating level Fluid to be IAW Instruction Manual Chapter 8.

(b) **Hydraulic System for Hose Reel** - Ensure system reservoir is filled to operating level

16. Equipment, Crew Quarter

(a) **Refrigerator**- Secure power. Secure door by blocking in a slightly open position to allow air circulation No further preservation required.

(b) **Drinking Fountain** - Secure power. Drain no further preservation required.

(c) **Hot plate and coffee pot**- clean, dry and secure in place.

17. Fire Protection System

(a) Smoke Detection System - No preservation required.

(b) Fixed CO2 Systems - No preservation required.

(c) Portable CO2 Extinguishers - Left in place, weighed and tagged, seals intact. No preservation required.

18. Monitoring System - No preservation required. New 24VDC battery, in dry state, will be secured in tray. Coat cable lugs and battery post with P-11 and leave unconnected.

19. Control/Alarm and Shutdown System - No preservation required. New batteries, in a dry state, will be secured in tray. Coat cable lugs and battery post with P-11 and leave unconnected.

20. Salvage Pump (P-250) - Exercise pump for test. When completing exercise, with engine still running shut off gas from tank, let engine continue to run all gas from the carburetor.

(a) Engine - After cylinder heads have cooled to 1000 F or below, remove plugs, spray 1/2 oz. of P-10 grade 30 into each cylinder.

(b) Pump - Flush pump with fresh water and blow dry. Bag and tag plugs and secure on the pump or the frame. Apply P-11 to cap threads, suction and discharge.

21. Spare R. O. Engines - Remove valve covers, fog running gear (rockers, push rods, springs, shafts, etc.) with P-10 grade 30. Reinstall valve covers. Clean exposed shafts (fuel control shaft, etc.) and coat with P-11.

22. Spare R. O. Pumps - Clean exposed shafts, key, and key way and coat with P-11. In the final when the vessel is placed under D/H remove the tape from the suction and discharge.

23. TANKS

(a) Ballast Tank - Dry and clean, offset access cover secured on a couple of studs to leave tank open to D/H. Bag and tag the remaining securements and a new gasket adjacent to access ready for assembly. Cap/close off tank vent

NOTE

The fill and drain piping to this tank will be processed in Item 3.

(b) Product Water Storage Tanks Nos. 1, 2, 3, and 4 - Dry and clean, offset access covers secured on two studs to leave tanks open to D/H. Bag and tag the remaining securements with a new gasket adjacent to the respective tank access, ready for assembly. The vents for these tanks remain open as they vent inside the R. O. Space D/H envelope. Storage tanks are preserved with an epoxy paint system.

NOTE

The fill piping for these tanks will be processed in Item 2. (c). The discharge piping will be processed in Item 5.(b).

(c) Drinking Water Storage Tank - Dry and clean, offset access cover on two studs to leave tank open to D/H. Bag and tag the remaining securements with a new gasket adjacent to the access, ready for assembly. The vent for this tank will be sealed. Storage tank is preserved with an epoxy paint system.

NOTE

Fill and drain piping will be processed in conjunction with Item 5.(b) and 6.(b).

(d) **Fuel Oil Storage Tanks Nos. 1 and 2**. Including fill and discharge piping, work in conjunction with Item 10. (a). Drain and dry. Offset access covers on two studs to leave tanks open to D/H. Bag and tag the reminder of access securements with new gaskets adjacent to the respective access, ready for assembly. Install blanks in vents for each tank on top of deck house. Tanks are preserved with P10 Type 1 Grade 30.

(e) **Fuel Oil Day Tank** - Fill day tank to 95%. Treat fuel with a stabilizer additive meeting the requirements of MIL-S-53021. The vent for this tank will remain open. Fill and drain valves, fuel supply valves to engine will be closed. (See Appendix G for stabilizer handling procedures).

(f) **Contaminated Oil/Sludge Tank** - Pump tank to sludge tank ashore, open, clean, and dry tank Offset access cover on two studs leaving tank open to D/H. Bag and tag the remaining securements with new gasket adjacent to access, ready for assembly. Leave fill and drain valves open. Install blank in vent on top of deck house. Tank is preserved with P10 Type 1 Grade 30.

NOTE

This item should be worked in conjunction with Item 11. Both should be the last system to process.

24. **Winches, Anchor** - Total of four (4), one (1) each located port and stbd, bow and port and stbd, stern. All will be processed as follows:

(a) **Cable and Drums**. The unpainted surfaces of the drums shall be coated with a water resistant lithium based grease (MIL-G 10924 ALVANIA EP2 or equivalent). The cables will be coated with the same lubricant and rewound on the drums.

(b) **Brake Drums** - Coat/spray the unpainted surface with rust inhibiting lacquer-resisting synthetic primer conforming to FED-TT-P-664, commonly called GlyptoL

NOTE

With brake off, rotate drum to apply. Do not apply brake after the application of GLYPTOL.

(c) **Exposed Shafts, Drive Chains, Linkages, and Threaded Adjustments, Etc** - Will be coated with P-2.

(d) **Enclosed Gears** - Fill to operating level with oil specified in lube order or instruction book (GO-90 MIL-L-2105).

25. **Hydraulic Crane**

(a) **Cable and Drum** - Coat the cable and unpainted surfaces of the drum with water resistant lithium base grease (P-11-MIL 10924 ALVANIA EP2 or equivalent).

(b) **Hose Reel** - Shore discharge hydraulic.

(1) Exposed Gears - Coat with P-2

(2) Exposed Shafts, Chains, Linkages, Hydraulic Rame, and Threaded Adjustments, etc - Coat with P-2.

(c) Reel Brake Drum. Coat/spray the unpainted surface with rust inhibiting lacquer-resisting synthetic primer conforming to FED-TT-P-664, commonly called Glyptol.

NOTE

Drum will not be rotated after application of GLYPTOL.

26. Life Rafts - Remove from brackets on bow and stern and stow/secure inside the R. 0. Space. Remove the pressure release devise and attach to the respective rafts.

27. Mufflers - R. O. engines located about center top of deck house. Neutralize the rust with an application of chem-prime, or other rust arresting liquid then apply a heavy coat of heat resisting aluminum paint.

28. Exposed Valves - Turn the valves to full open, coat the stems with P-2, then close. Any unpainted ferrous metal surfaces remaining will also be coated with P-2.

29. Winch, Beaching - The winch will be processed for long term storage without dehumidification and mounted on the bow of the ROWPU. Mounting pads are already provided for securing.

(a) Engine- is GM F-53 series, 2 cycle, will be processed as follows:

(b) Crankcase - Change oil filter, drain oil and fill with P-10, Type 1 grade 30.

(c) Cooling System - Drain, Flush/clean, and fill with a 50-50 mixture of water and anti-freeze.

(d) Fuel System - Change filters, starting with engine hot, run P-9 through system via the fuel supply and return line after which the lines will be reconnected, ensuring no air entrapment, ready for light off.

(e) Torque Convertor- No preservation required. Fill to operating level with P10 Type 1 Grade 10 oil.

(f) Batteries, Starting- In dry state stored/secured in tray. Cable lugs and battery post to be coated with P-11.

(g) Air Systems - Preserve as follows:

(1) Air Compressor - (engine mounted) The crankcase of compressor is lubricated from the engine system, and requires no preservation. Disconnect the compressor discharge to tank Remove the air intake filter. With the compressor operating (while running P-9 through engine) spray 3 ozs. of P-10 grade 30 into intake or until the oil mist is evident in the air discharge. Reconnect the air discharge line to tank. Clean reinstall air intake filters. Leave in a ready to operate condition

(2) Air Tank - Ensure free of all moisture. Fog/spray with P-10 grade 30. Excessive preservative accumulation will be drained from tank after which plugs will be reinstalled, left in a ready to operate condition.

(3) **Brake, Air Cylinders** - Through the air connection or drain plug, spray/fog one (1) oz. of P-9 each, after which reconnect air or reinstall drain plug.

(4) **Clutch Actuators** - (Are air/hydraulic on the air side preserve the same as item 29. (g)(1) above. On the hydraulics, ensure the reservoir is filled to operating level with fluid specified BFB 2190 Hydraulic Oil.

30. Drive System/Drums/Gypsy Heads:

(a) **Gear/Chain Case** - (Enclosed) No preservation required. Fill to operating level with the P-10 Type 1 Grade 30 oil.

(b) **Gears** - (Open) Coat gear teeth with P-2.

(c) **Brake Drums** - Coat/spray the unpainted drum surface with rust inhibiting lacquer-resisting synthetic primer conforming to FED-TT-P-664, commonly called Glyptol.

NOTE

With the brake off, rotate drum as required to apply. Do not apply brake afterwards.

31. **Fuel Tank** - Preserve with P-10 grade 30 using the fill and drain method; that is, drain the fuel from the tank, fill with P-1 grade 30 all the way into neck, then drain the P-1 grade 30. Allow sufficient time for excess/rundown to drain, then reinstall drain plug.

NOTE

All fittings and lubrication points will be lubricated in normal manner in accordance with the lubrication order for that equipment.

32. Sealing Exterior Openings

The D/H envelope shall be established by sealing all outside doors, hatches vents and other openings that lead into the interior of the craft.

(a) Clean all dogs, dogging devices and securements, for all hatches and vent covers. Preserve with P-2. Clean off all knife edges and gaskets.

(b) Chalk all knife edges and dog down all openings. Open the doors or covers and inspect gasket for proper seal.

(c) Dog down all doors and openings as tght as possible to insure the opening is sealed and air tight. Reapply P-2 preservative to dogging devices and securements.

(d) Seal all openings and doors that cannot be dogged down tightly using contact cement, tape and strippable coating.

33. Exhaust Fan Vents, Natural Vents, Overboard Discharges

(a) Unless designated below all exhaust vents, natural vents and overboard discharges will be sealed as follows:

(1) Plywood blanks will be placed over the opening.

(2) Seal edges of the blank with contact cement, tape, and strippable coating.

(b) No. 1 and 2 Generator Engine Exhausts
Blank flange above the muffler at top of deck house level, seal rain cap with plywood blank, contact cement, tape and strippable coating.

(c) No. 3 Generator Engine Exhaust Seal at rain cap with plywood blank, contact cement, tape and strippable coating.

(d) No. 1 and 2 ROWPU Engine Exhaust
Blank flange at rain cap elbow, seal rain cap with plywood blank, contact cement, tape and strippable coating. Turn elbow in a downward position.

(e) Exposed natural vents, seal with contact cement tape and strippable coating.

(f) ROWPU Space Exhaust Fans.

(1) Cover openings with existing covers or plywood blanks seal with contact cement tape and strippable coating.

(2) Provide positive seal gasket for inspection doors seal with contact cement tape and strippable coating.

(g) Engine Space Exhausts.
Blank openings, seal with contact cement tape and strippable coating.

34. Boat Work: The work boat will be processed for long term storage as follows: After processing the boat in its cradle, the boat will be secure in its storage position on top of the deck and the cover made of polyurethane (with nylon shims). Meeting MIL-P-5812, Type II, Class I, requirements will be installed.

(a) **Engine** - AB Volvo Pena, 6 cylinder inline diesel turbo charged with after cooler and heat exchanger. Engine mounted inboard with outboard drive.

(b) **Crankcase** - Change oil filters, drain oil and fill with P-10, grade 30.

(c) **Cooling System** - Drain, flush/clean and fill with 50-50 mixture of water and anti-freeze.

(d) **Outboard Drive** - Drain and fill to operating level with P-10, grade 30.

(e) **Reverse Gear**- Drain and fill to operating level with P-10, grade 30.

(f) **Fuel System** - Change filters, starting with engines hot, run P-3 thru system via fuel and return lines after which the lines will be reconnected, ensuring no air entrapment, ready for light off.

(g) **Power Trim Hydraulic System** - Fill to operating level with SE, SAE 10W/40.

(h) **Raw Water System** - Flush with fresh water remove the line at the intake side of the enqrue and connect the hose to the block. After flushing fill the system with a 50/50 solution of anti-freeze and fresh water.

(i) **Fuel Tank** - Drain tank, refill to 95% with fuel that has been treated with fuel stabilizer additive meeting the requirements of MIL-S-53021. The vent for this tank is to remain open. Fill cap will be tight. Supply to engine will be closed. (See Appendix G for details in handling the fuel stabilizer)

(j) **Batteries** - New, in dry state will be secured in their respective racks. Lugs and terminals will be cleaned and coated with P-11 and left unconnected. Electrolyte is stored in the storeroom on board the ROWPU.

(k) **Helm Pump Hydraulics**- Fill reservoir to operating level with Seastar hydro fluid or Texico Aircraft HO-15.

(l) **Cabin** - Static pack with 480 units (30-16 unit bags) of desiccant. Seal fwd. door and aft. booby hatches with pressure sensitive tape, glue and strippable coating. Install a humidity indicator so as to be visible thru one of the windows.

(m) **Engine Compartment** - Static pack with 480 units of desiccant (30-16 unit bags). Seal hatch with pressure sensitive tape, glue and strippable coating.

NOTE

Store the desiccant in the basket provided and suspend the basket to allow air circulation around the desiccant.

III. DYNAMIC DEHUMIDIFICATION:

A. Dehumidifiers

1. Each ROWPU Barge has two (2) Honeycombe Cargoaier Model HC 150 dehumidifiers installed inside the ROWPU deck just forward to the midships access door.

2. Each machine has the capacity of processing 125 to 150 CFM and removing 2-3 lbs. of moisture from the air per hour.

3. The machines are designed to run for a minimum of five (5) years without any appreciable maintenance problems.

4. A copy of the technical manual for the machines is stored with ROWPU Technical Manuals.

B. Dehumidification Plan: The dehumidification plan for the ROWPUIS is as follows:

1. **Machine Installation**: As stated above, each ROWPU Barge has two (2) machines installed in the ROWPU space, one on the port side and one on the starboard side just forward of the midship access door. The machines are mounted on the bulkhead just aft of vent fans 7 and 8 respectively.

2. Ducting and Air Supply

(a) The dry (dehumidified air) is supplied from the outside through the dehumidifiers from a vent on the outside bulkhead then through the vessel's ventilation system.

(b) The moist air is vented to the outside from the machine through a vent pipe which passes through the bulkhead approximately 18 inches above the deck.

(c) The dry air is circulated throughout the vessel by passing through the vessel's ventilation system and care must be exercised to ensure that all dampers in the ventilation system and all interior doors and hatches within the vessel are open to permit the free passage of the air.

3. Activation and Reprocessing. It should not be necessary to remove any of the ducting during the activation of the craft; however, the following steps must be taken to prevent damage or contamination of the system.

(a) Disconnect the flex hose ducting from the vent system. Blank off opening with a suitable material and tie down the flex hose.

(b) Turn off power to the machines and tag switches to prevent them from being turned on.

(c) Blank off the intake and cap off the outlet on the outer bulkhead.

(d) To reprocess, reverse the procedure and turn on power to the machines.

C. Humidistats and Sensing Elements. The installation of the humidistats and sensing elements is as follows:

1. Humidistats: The humidistats are set to maintain 40 percent relative humidity throughout the dehumidification zone and control the dehumidification machines run time for moisture removal One (1) humidistat is connected to each machine and is located in the lower level in Void #4 for the port side and Void #2 for the starboard side with the opening to the machines.

2. **Sensing Elements**: The sensing elements are installed in close proximity to the humidistats and are connected to digital Humidity/Temperature meter in the D/H envelope. The information is read on the meter outside the D/H envelope. The meter has been precalibrated to furnish accurate information of the relative humidity within the envelope; however, it maybe necessary, after the vessel is reprocessed, to recalibrate the meter. The procedure manual for calibration of the meter is located in the Technical Manual package in the crews berthing area.

3. **Activation/Reprocessing of the Humidistats and Sensing Elements:** It is advisable to leave the sensing elements in place during the cyclic activation/inspection phase; however, if it becomes necessary to disconnect the machines the following procedure will be followed:

   (a) Secure power to the D/H machines and the sensing element recorder.

   (b) Remove the sensing element and humidistat and the cables from the area It is recommended that they be coiled up as a unit tagged and stored in the supply cage.

CAUTION

Exercise caution when handling the sensing element and humidistats to protect them from being damaged.

   (c) Reinstall the sensing elements and humidistats in the original location; keeping them well clear of contact with metal objects.

NOTE

Figure E-1 and E-2 shows the physical location of the D/H machines and sensing elements.

D. D/H Readings. Once the barges are in dry storage on the Float on/Float off vessel and the dehumidification equipment has been installed the dehumidification surveillance will be performed as herein specified.

1. **Set the humidistat to 40 percent.**

   (a) The relative humidity (R/H) factor 40 percent (+ or = 5%) should be achieved within three (3) weeks after the machines are in operation

   (b) Readings will be taken everyday for three (3) weeks. If the R/H factor is not achieved in the prescribed time additional sealing may be required.

   (c) If after additional sealing is applied and the readings are still not within limits it may be necessary to adjust or recalibrate the Humidity/Temperature Meter.

NOTE

The instruction manuals for the meter are located in the Technical Manual Package.

2. **Verification of the relative humidity.**

   (a) The actual relative humidity within the D/H zone will be verified at the end of three weeks and during adjustment of the meter or humidistat by using a sling psychrometer (NSN 6685-00-826-1662) to physically verify the relative humidity.

(b) Verification of the humidity levels will be taken in several locations within the zone, i. e. crews quarters, no. 1 & no. 5 holds, in addition to the compartments, where the sensing elements are placed.

3. Records

(a) Records of relative humidity readings will be maintained on each vessel to verify the watercraft stored in accordance with this procedure do not deteriorate while they are in storage.

(b) Figure IV-1 is a sample copy of the form titled D/H Log that will be utilized for this purpose.

E. Electrical Modification

1. In order to provide adequate electrical power for the dehumidification machines an additional 440V/230V power circuit was installed in each ROWPU space.

2. The circuit runs from an installed 230 VAC Shore Power connection box to a 230V/440V transformer to a 230V D/H power panel that are mounted on the switchboard.

3. Figure E-3 is an illustration of the schematic arrangement of the circuit.

IV. MATERIAL REQUIREMENTS: The following list contains the materials required to represerve the vessels after the cyclic activation. The quantities listed are approximates based on the quantity used in the initial preservation of the craft, and may vary depending on the conditions. The list does not reflect the requirements for the normal maintenance of the craft, and prices may vary.

A. MATERIALS:

NSN	NOMENCLATURE	UNIT OF ISSUE	EST QTY
9150-00-111-0209	P-10, Type I, Grade 30, Preservative Oil	CN (5 gal)	8
9150-00-231-9062	P-9 Preservative Oil VV-L-800	CN (5 gal)	4
9150-00-188-9858	Lube Oil OE 30	CN (5 gal)	4
9150-00-530-6814	Lubricant, Rust Resistant, MILG 18458	CN (35 lb)	2
8030-00-244-1298	P-2 Preservative Soft Film	CN (5 ea)	1
8030-00-244-1299	P-1 Preservative Hard Film	CN (5 gal)	1
8030-00-281-2337	Duct Seal	PG (5 lb)	4
8030-00-281-2345	Strip Coat	GL	20
8040-00-754-2685	Adhesive Fed Spec MMM-A-130B	GL	10
8020-00-263-3874	Brush Sash	EA	16
7920-00-291-5815	Brush Wire	EA	8
6850-00-181-7929	Antifreeze	GAL	60
6910-00-249-9354	Electrolyle	GL	4
6810-00-281-2785	Methyl Ethyl Keytone (MEK)	GL	10
614-00-263-4603	Battery, Starting, Dry Charged 6 V DC	EA	2
7510-00-074-4996	Tape 3 in, Pressure Sensitive	RL	16
5530-00-129-7777	Plywood % inch Exterior Grade	SH	6

NSN	NOMENCLATURE	UNIT OF ISSUE	EST QTY
4720-00-809-2430	Hose Flex, 4 inch MIL-H-8796	FT	20
4730-00-908-6294	Clamp, Hose 4-7 in	EA	6
5330-00-261-5761	1/8 inch Gasket Material	FT	5
5640-00-103-2554	Tape 2 in, Pressure Sensitive	RL	16
5970-00-583-0401	Glyptol, Snythetic Primer	QT	4
Local Purchase	Grease, Lithium Based, Water resistant shell Alvania-EP2 (35 lb)	CN (5 gal)	4
Local Purchase	Battery Carrying Strap	each	1
Local Purchase	Battery Starting Cables 10 ft. heavy duty	pair	1

V. MANHOUR REQUIREMENTS: The following listing contains the estimated skills, manhours, and costs required to accomplish those tasks and procedures as set forth in Chapter III, Storage Requirements, Section 3, Preservation (General), Section 4, Specific Preservation Requirements, and this Appendix.

SKILL	QTY.	M/Hrs.	TOTAL M/Hrs.
Mechanic/Processor	2	180	360
Marine Electrician	1	180	180
Processor	2	180	360
Processor Helper	2	180	360
Support/Quality Assurance	1	80	80
	M/Hrs. Per Watercraft		1340
			X2
	M/Hrs. for 2 Watercraft		2680

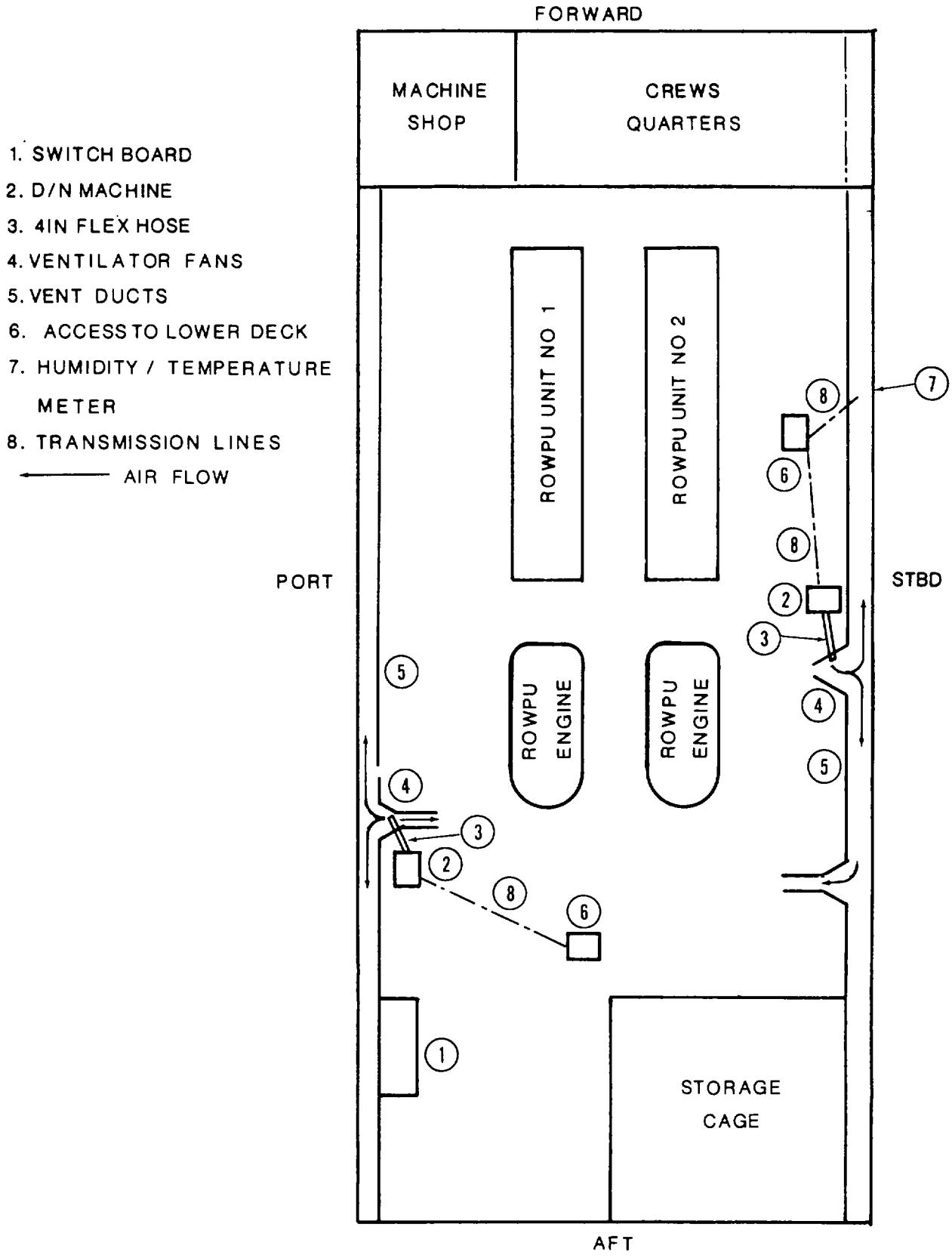


Figure E-1. ROWPU 300WPB Dehumidification equipment layout.

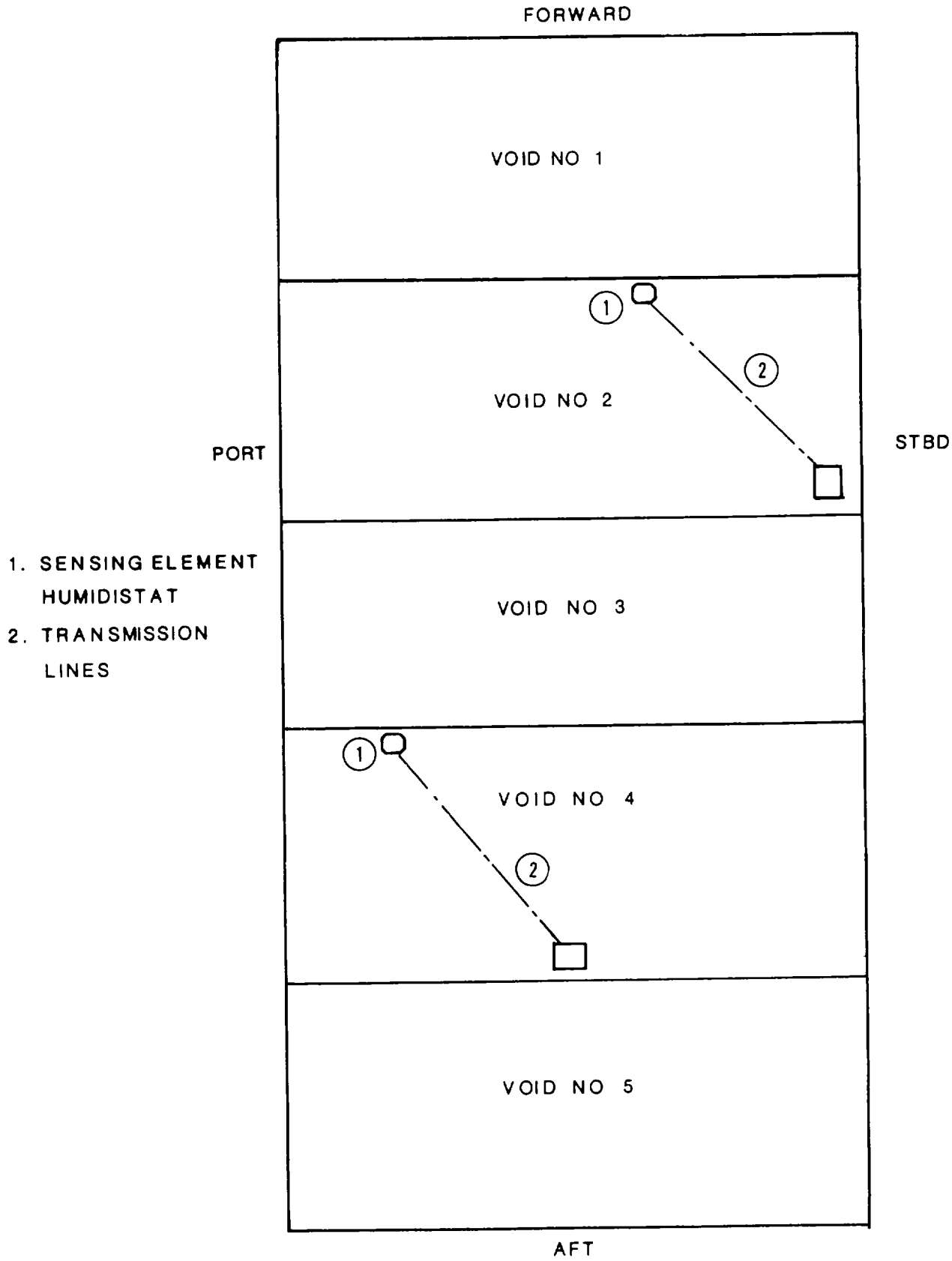


Figure E-2. ROWPU 300WPB Humidistat Sensing Element Placement.

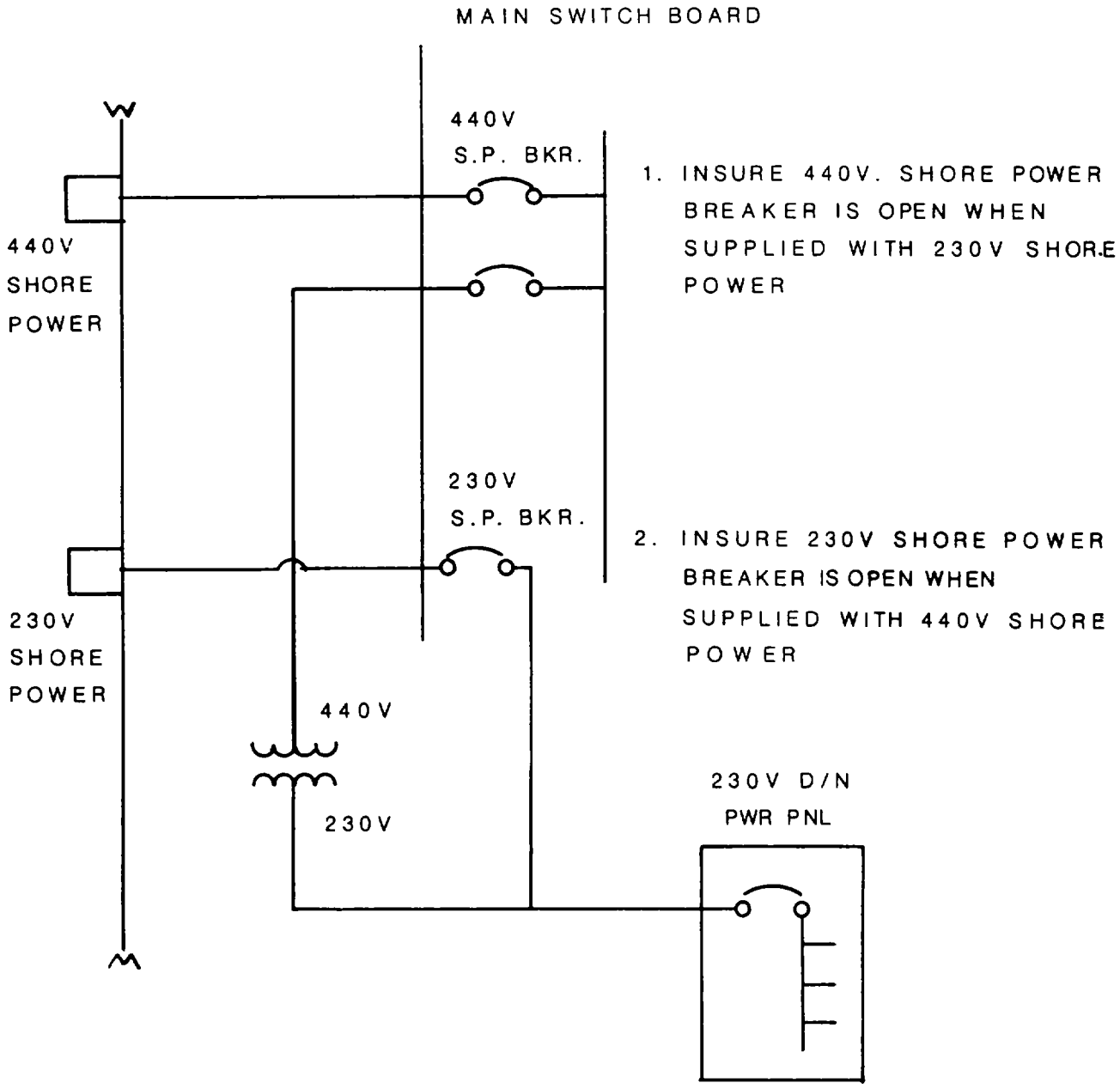


Figure E-3. Dehumidification Electrical Modification ROWPU 300 WPB.

APPENDIX F
SURGE TEAM FUELING SYSTEM

Eight (8) fifty foot (50) fueling hoses
Two (2) quick shut off fueling nozzles
Two (2) fuel sounding tape
One (1) bag chalk

1. The hoses are made to connect to the forward fueling station onboard the American Cormorant. Any combination of hoses can be used as required.

2. Each watercraft to receive the specified amount of fuel in the tank identified.

LT #3 Port & 4 Stbd.-600 gallons each
LCU 1466A center tank or all three even-900 gallons total
B3D Crane only one tank-1800 gallons total

3. The hoses are on pallets for four each, one pallet has the two nozzles, one pallet has the sounding tapes.

4. Hoses must be drained, wiped dry & restowed on the pallets after use. Nozzles are to be removed & boxed. Fuel sounding tapes must be wiped clean, boxed & restowed on the pallet.

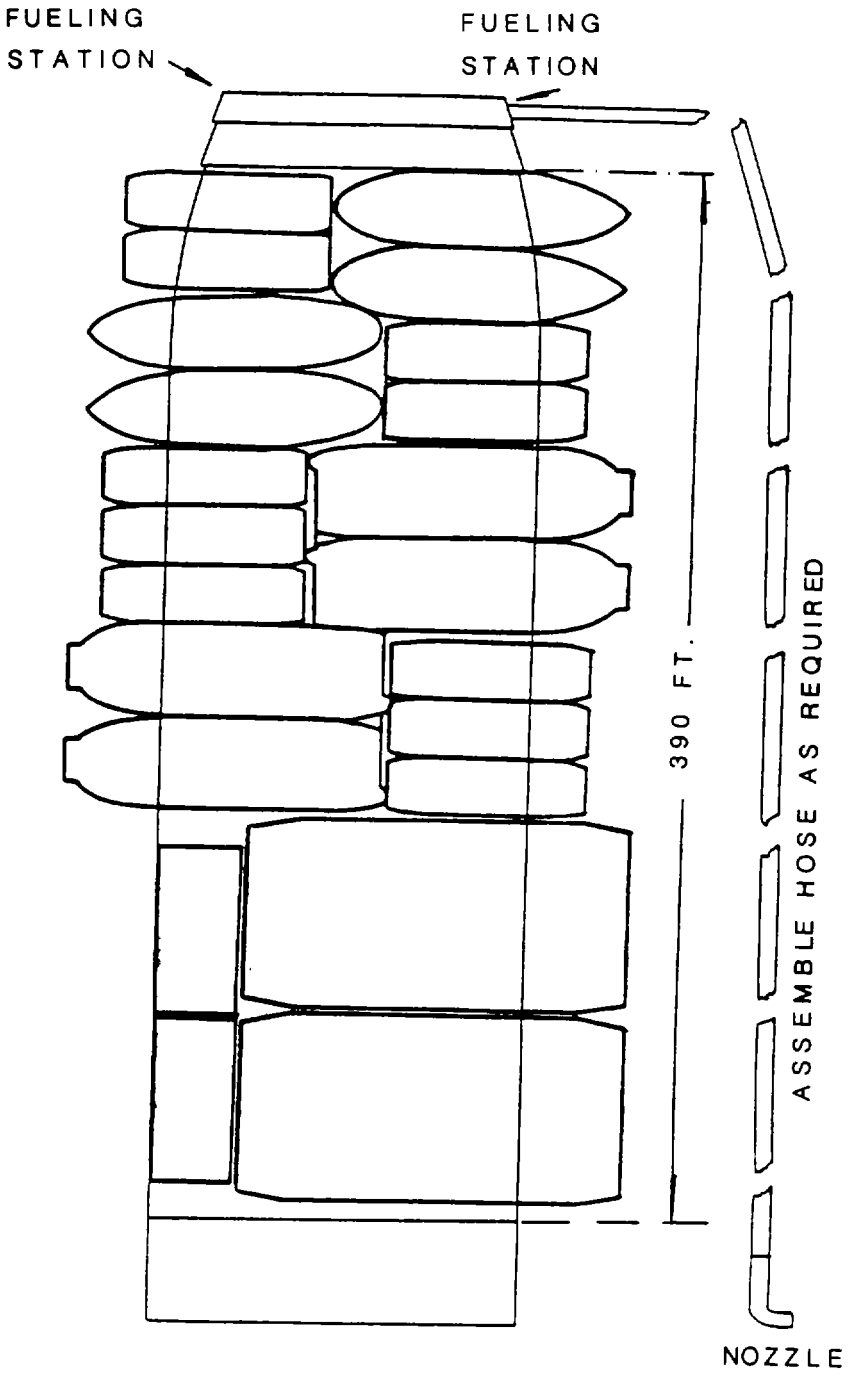

FUELING
STATION
FUELING
STATION
390 FT.
ASSEMBLE HOSE AS REQUIRED
NOZZLE

Figure F-1

APPENDIX G
APPLICATIONS AND PROCEDURES GOVERNING USE OF DIESEL FUEL STABILIZER ADDITIVE MIL-S-53021

I. PURPOSE

This section describes the applications and procedures governing use of stabilizer additive meeting the requirements of Military Specification MIL-S-53021. Personnel responsible for using stabilizer additive should be thoroughly familiar with this manual.

II. BACKGROUND

A. Storage stability and cleanliness requirements are imposed on military fuels at the time of purchase as well as use. These requirements are necessary because of a need to ensure that fuels will be satisfactory for use regardless of the time interval between refinery production and ultimate use. Fuel stability becomes very critical in cases of pre-positioning of fuel stocks, either in bulk storage or in the fuel tanks of pre-positioned, stored, or infrequently used vehicles and equipment.

B. The concept of an additive stabilizer for diesel fuel originated as a result of fuel-related problems, severe fuel system malfunctioning (i. e. , injector sticking, nozzle fouling, filter plugging, etc.), increased fuel system maintenance problems, equipment vulnerability, decreased operational readiness and numerous other engine-related problems, the most frequently reported problem occurring in the field is fuel filter plugging.

C. Each of these problems may be the result of one or more factors. Watercraft diesel fuel delivery systems recirculate the fuel as a means to cool and lubricate the fuel injectors during operation. Upon return to the fuel tank, the hot fuel is exposed to oxygen in the fuel tank air space. Under these conditions, the fuel can undergo both thermal and oxidative degradation to form gum, insoluble particulates, and acids. The products of this degradation cannot only plug filters and fuel injectors but also increase corrosion of fuel-wetted surfaces.

Water can collect in fuel tanks for several reasons (i. e. , condensation, leaking, manhole or filling connection gaskets). Fuel tank design usually prohibits complete fuel usage which means that water bottoms cannot be completely removed. The presence of water bottoms in any fuel system, particularly during dormant periods of fully fueled watercraft during storage, may lead to microbiological growth in the fuel system or allow generation of large amounts of water-in-fuel emulsions and sludge. The microbiological organisms will not grow in the absence of water, but may remain in a dormant state and grow later if water enters the system. This microbiological growth and its metabolic by-products can plug filters, degrade fuel quality, and corrode fuel system surfaces.

D. Based upon knowledge of mobility fuel requirements and recognition of several types of fuel deterioration processes, the need surfaced for a multi-functional additive to retard deterioration and extend the storage life of the fuel. Military specification MIL-S-53021, titled Stabilizer Additive, Diesel Fuel, was developed.

III. DESCRIPTION OF THE STABILIZER ADDITIVE

A. MIL-S-53021 requires that the additive perform five functions; namely, antioxidant, metal deactivator, dispersant, corrosion inhibitor, and biocide. The purpose of each function is summarized as follows:

1. antioxidant-this retards the tendency for autooxidation to occur. Diesel fuels will normally undergo autooxidation and deterioration which causes formation of particulates (i. e. , insoluble organic compounds), gums, and acid complexes.

2. metal deactivator-this prevents free copper and other trace heavy metals from reacting in the autooxidation process and allows the antioxidant to function effectively. Copper will catalyze (i. e. , accelerate) the breakdown of any petroleum fuel. Without the metal deactivator, the effectiveness of the antioxidant would be reduced significantly.

3. dispersant-this causes any deposits or agglomerates (i. e. , organic sediments) present to be maintained in a finely dispersed state. It prevents the formation of large particulates and reduces the tendencies for deposits to occur within critical fuel system components.

4. corrosion inhibitor-this reduces the corrosion of ferrous or metallic surfaces by forming a protective barrier over the surface. It is designed to protect fuel-wetted surfaces from corrosion, but will not function in environments of heavy water contamination (i. e. , water bottoms or sump regions) where the fuel is prevented from contacting the metal by the water.

5. biocide-this functions to kill any micro-organisms that could grow at the fuel-water interface in fuel storage tank environments.

B. The stabilizer additive is most effective when added to clean, fresh fuel as a preventive measure. Once the fuel has started to deteriorate, the additive can only slow down the process, but cannot restore deteriorated fuel to 'hew" condition.

C. The stabilizer additive is, however, not intended for routine use in all diesel fuels, but should be used only in situations where fuel or equipment is subject to storage or infrequent use. Typical applications are to pre-positioned fuel, pre-positioned equipment to be stored fully-fueled, equipment in depot storage, equipment undergoing depot rebuild/modification.

IV. HOW TO USE THE STABILIZER ADDITIVE

A. The stabilizer additive currently qualified under MIL-S-53021 has the designation FSP-55/JF and is packaged as a two-component system. In this publication FSP-55/JF refer to the two-component system, while FSP-55 and JF refer to the two components which make up the system. The FSP-55 component and the JF component are **both required in equal amounts for maximum effectiveness.** FSP-55/JF will always be shipped in pairs of containers, i. e. , two 55-gallon drums, two 5-gallon cans, etc. This is done because environmental regulations require the biocide component to remain in its original container until it reaches the end use. FSP-55/JF is now available through the military supply system. Stock numbers and nomenclature are listed in Paragraph V of this publication.

B. Fuel may be treated with stabilizer additive in bulk storage tanks, tank trucks, tank and pump units, or in individual watercraft.

C. The amount of additive to use is determined from Table I, based on the treatment rate of one gallon each of the two FSP-55/JF components per 5,000 gallons of fuel. Note that **both components** of FSP-55/JF are required for satisfactory treatment.

Table I. Treatment Levels for FSP-55/JF Stabilizer Additive System in Diesel Fuel.

Metric Unit Rule: Fuel (in gallons) X 0.757 = Treatment (in ml)

Fuel (gallons)	FSP-55* Component (ml)	JF* Component (ml)
20,000	15,140	15,140
10,000	7,570	7,570
5,000	3,785	3,785
1,000	757	757
500	378	378
100	76	76
50	38	38
10	8	8

Table 1 (continued)

English Unit Rule: Fuel (in gallons) X 0.0256 = Treatment (in fluid oz.)

Fuel (gallons)	FSP-55* Component (fl. oz.)	JFS Component (fl. oz.)
20,000	512	512
10,000	256	256
5,000	128	128
1,000	26	26
500	13	13
100	2.6	2.6
50	1.3	1.3
10	0.3	0.3

*Divide amounts in ml by 1000 to get results in litres. For example, 15,140 ml = 15.1 litres (rounded off).

**Divide amounts in fluid ounces by 32 to get results in quarts or by 128 to get results in gallons. For example, 512-32 = 16 quarts; 512+ 128 = 4 gallons.

Example 1: Treatment is required for 12,000 gallons of fuel in a storage tank. Using the metric unit rule from Table I, 12,000 X 0. 757 = 9,084 ml. Divide by 1000 and round off to obtain the result, 9. 1 litres. The correct treatment for 12,000 gallons of fuel is 9. 1 litres of FSP-55 component and 9. 1 litres of JF component.

Example 2: Treatment is required for 450 gallons of fuel in a watercraft fuel tank. Using the English unit rule from Table I, 450 X 0. 0256 = 11. 5 fluid ounces. The correct treatment for 450 gallons of fuel is 11.5 fluid ounces of FSP-55 component and 11.5 fluid ounces of JF component.

D. When you are ready to measure out the additive, read the safety labels on the containers. It is recommended that petroleum-resistant gloves and protective glasses be worn when handling the additives. The following precautions should be observed:

1. **DANGER, CAUSES BURNS, COMBUSTIBLE**: Do not get in eyes, on skin, or on clothing. Avoid breathing vapor. Keep container closed. Use with adequate ventilation. Keep away from heat and open flames. Wash thoroughly after handling. Contains hydrocarbon-soluble amines,dioxaborinanes, and petroleum kerosene.

2. **FIRST AID**: In case of fire, use water spray, foam, dry chemicals or CO,.

4. **SPILL**: Soak up with sand or earth.

E. When mixing the stabilizer additive with the fuel, the following procedures should be observed:

1. The additive system will not remove existing sludge, microbiological growth, and debris from a storage tank or fuel tank, but it will help prevent further sludge from forming and will kill all organisms that may be present. Fuel tanks containing large amounts of sludge and microbiological debris should be cleaned and inspected before they are filled with additive treated fuel.

2. The additive should never be added to an empty fuel tank that contains water bottoms. If the biocide component is poured directly into water, it may react to form insoluble crystals that are ineffective as a biocide and may possibly lead to plugged filters.

3. Whenever possible, add the FSP-55/JF to partially (approximately 1/2 full) filled tanks to expedite mixing. The addition of the remaining fuel needed to fill the tank serves to mix the additive thoroughly and give quick proper dilution.

4. If possible, add the additive to a flowing stream of fuel. This will ensure proper mixing and avoid possible areas of high concentration.

5. When using the additive, check the filters frequently at first. Dying microorganisms will release specks of dirt and rust that have been caught in the fungal mats. Also, the slime itself may come off walls and structures as it is killed. Once dead, the slimy nature of the fungus will disappear, and it should become more filterable.

CAUTION

6. Do not overtreat. This is most important and should be noted by all potential users. The treatment levels specified have been developed after considerable research and are adequate to protect the fuel. Use of excessive additive will unnecessarily increase the treatment cost and provide no additional benefits.

7. If you need to treat fuel being added to a partially-filled treated tank, calculate the treatment based only on the amount of added fuel.

Example: A 10,000-gallon storage tank contains 5000 gallons of treated fuel. To fill the tank, 5000 gallons of fuel must be added. The correct treatment is one gallon of each FSP-55/JF component for the 5000 gallons of added fuel.

8. After the stabilizer additive has been thoroughly mixed with the fuel, it is not necessary to use any special handling precautions with the fuel.

CAUTION

However, water bottoms drained from treated fuel tanks after a long period may contain significant amounts of biocide and should not be disposed overboard, in lakes or streams because of possibility of toxicity to fish.

B. In some instances of fuel stability/cleanliness problems, it will be necessary to analyze fuel samples to determine the cause of the problem. As laboratory results are no better than the sample, obtaining truly representative samples is of paramount importance and cannot be overstressed. No amount of laboratory work will give reliable data on a product if the sample is not representative or is contaminated with other materials.

C. Samples should be 1 gallon in size, and sample containers should be clean, dry, 1-gallon cans.

D. Do not take samples through storage tank cleanout lines, manifolds, water draw-offs, bleeder valves, hose nozzles, etc. , as such samples may not be representative of the product in the tank. When it is necessary to sample fuel tanks, and access to such tanks cannot be gained through a manhole or sampling hatch, the tanks may be sampled through the supply line after first discharging from the line a volume of the product estimated at two times the capacity of the piping system.

E. Close all sample containers tightly immediately after taking the sample. Do not use sealing wax, paraffin, rubber gaskets, pressure-sensitive tapes, or similar materials to seal containers.

F. Identify each sample container immediately after sampling by securely attaching a sample tag. Information on the tag should include the location of the activity at which the sample is taken, name of person taking the sample, grade of material, quantity represented, specification of material when known, fuel storage tank number and location, watercraft hull number and name if applicable, date sample was taken, type of sample, and reason for sample.

G. In cases where fuel filter plugging is occurring, the plugged fuel filter should be retained in a clean container. The filter may be analyzed to determine what is actually plugging the filter. Fuel samples will be required along with the filter in the event that the filter plugging is caused by fuel degradation products. All samples should be labeled thoroughly.

V. ORDERING INFORMATION

A. Ordering information for the two components of MIL-S-53021 is listed below by nomenclature, unit of issue, and NSN. (NOTE: In this manual, the biocide component is referred to as simply "JF" however, it is listed in the Federal Supply Catalog as "BIOBOR JF".)

1. BIOBOR JF, Biocide, 55 gallon drum, NSN 6840-01-041-0098

2. FSP-55, Stabilizer, Diesel Fuel, 55 gallon drum, NSN 6850-01-167-4788

3. BIOBOR JF, Biocide, 5 gallon can, NSN 6840-01-173-6940

4. FSP-55, Stabilizer, 5 gallon can, NSN 6850-1-167-4789

Items 1 and 2 together will treat 275,000 gallons of fuel and cost approximately $2100. Items 3 and 4 together will treat 25,000 gallons of fuel and cost approximately $250. Prices are subject to change based on the depot acquisition costs.

Manufacturer- US Borax

Source- Amalgamated Coat and Petroleum Specialists
P.O. Box 9798
Ft. Wayne, Indiana 46898

Telephone- AC-219-489-2549

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

WILLIAM J. MEEHAN, II
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-25A:

(qty rqr block nos. 247, 248 and 249) Operator, Unit, Direct Support and General Support Maintenance requirements for Barge Deck, Non-propelled, Steel, 578-T or 4160 BBL, 120 Ft, Model 231B (TM 55-1930-202 Series).

(qty rqr block nos. 259, 260 and 261) Operator, Unit, Direct Support and General Support Maintenance requirements for Boat, Bridge Erection, Inboard Diesel Engine, 27 Ft, (HPI-27A, 27B, 27C, 27D) (TM 5-1940-221 Series).

(qty rqr block nos. 262, 263 and 264) Operator, Unit, Direct Support and General Support Maintenance requirements for Boat, Bridge Erection, Twin Jet, Aluminum USCSBMK-1 (TM 5-1940-277 Series).

(qty rqr block nos. 271, 272 and 273) Operator, Unit, Direct Support and General Support Maintenance requirements for Boat, Passenger and Cargo, Diesel, Steel, 65 Ft (Design 2001) (TM 55-1940-203 Series).

(qty rqr block nos. 274, 275 and 276) Operator, Unit, Direct Support and General Support Maintenance requirements for Boat, Passenger and Cargo, Diesel, Steel, 65 Ft (Design 2001) (TM 55-1940-204 Series).

(qty rqr block nos. 277, 278 and 279) Operator, Unit, Direct Support and General Support Maintenance requirements for Boat, Picket, Diesel, Steel, 46 Ft, 4-1/2 in Long (Design 4003) (TM 55-1940-201 Series).

(qty rqr block nos. 280, 281 and 282) Operator, Unit, Direct Support and General Support Maintenance requirements for Boat, Picket, Diesel, Wood, 64 Ft, 11 in Long (MOD 4002) (TM 55-1940-205 Series).

(qty rqr block nos. 1045, 1046 and 1047) Operator, Unit, Direct Support and General Support Maintenance requirements for Landing Craft, Mechanized, Diesel Power, Design LCM-6, Model 1, 56 Ft (TM 55-1905-201-35P).

(qty rqr block nos. 1048, 1049 and 1050) Operator, Unit, Direct Support and General Support Maintenance requirements for Landing Craft, Mechanized, Diesel, Design LCM-8, Model 0, Mark VIII, 69 Ft (TM 55-1905-202 Series).

DISTRIBUTION Contd:

(qty rqr block nos. 1051, 1052 and 1053) Operator, Unit, Direct Support and General Support Maintenance requirements for Landing Craft, Mechanized Steel Design LCM-8, Model 1, Mark VII, 74 Ft (TM 55-1905-217 Series).

(qty rqr block nos. 1054, 1055 and 1056) Operator, Unit, Direct Support and General Support Maintenance requirements for Landing Craft, Utility, LUC-1466, Type III (TM 55-1905-203 Series).

(qty rqr block nos. 1057, 1058 and 1059) Operator, Unit, Direct Support and General Support Maintenance requirements for Landing Craft, Utility, LUC-1667-1670 (TM 55-1905-219 Series).

(qty rqr block nos. 1060, 1061 and 1062) Operator, Unit, Direct Support and General Support Maintenance requirements for Landing Craft, Utility, LUC-1670-1679 (TM 55-1905-220 Series).

(qty rqr block nos. 1108, 1109 and 1110) Operator, Unit, Direct Support and General Support Maintenance requirements for Lighter Air Cushion Vehicle (LACV-30), 30 Ton (TM 55-2305-001 Series).

(qty rqr block nos. 1111, 1112 and 1113) Operator, Unit, Direct Support and General Support Maintenance requirements for Lighter, Amphibious (LARC-LX), Diesel, Self Propelled, Steel, 60-T, 61 Ft (Design 2303) (TM 55-1930-203 Series).

(qty rqr block nos. 1114, 1115 and 1116) Operator, Unit, Direct Support and General Support Maintenance requirements for Lighter, Amphibious (LARC-LX), Diesel, Self Propelled, Aluminum, 5-T (Design 8005) (TM 55-1930-205 Series).

(qty rqr block nos. 1117, 1118 and 1119) Operator, Unit, Direct Support and General Support Maintenance requirements for Lighter, Amphibious, (LARC XV), Resupply/Cargo, Diesel, Self Propelled, Aluminum, 15-T (Design 8004) (TM 55-1930206 Series).

(qty rqr block nos. 1981, 1982 and 1983) Operator, Unit, Direct Support and General Support Maintenance requirements for Tug, Harbor, Diesel, Steel, Flight 1, 1200 HP, 100 FT (Design 3006) (TM 55-1925-204 Series).

(qty rqr block nos. 1984, 1985 and 1986) Operator, Unit, Direct Support and General Support Maintenance requirements for Tug, Harbor, Diesel, Steel, Flight 2, 1200 HP, 100 FT (Design 3006) (TM 55-1925-205 Series).

(qty rqr block nos. 1987, 1988 and 1989) Operator, Unit, Direct Support and General Support Maintenance requirements for Tug, Harbor, Diesel, Steel, 200 HP, 45 FT (Design 320) (TM 55-1925-201 Series).

(qty rqr block nos. 1990, 1991 and 1992) Operator, Unit, Direct Support and General Support Maintenance requirements for Tug, Harbor, Diesel, Steel, 600 HP, 65 FT (Design 3004) (Hull No ST1978-ST2015) (TM 55-1925-202 Series).

(qty rqr block nos. 1993, 1994 and 1995) Operator, Unit, Direct Support and General Support Maintenance requirements for Tug, Harbor, Diesel, Steel, 600 HP, 65 FT (Design 3004) (Hull No ST2097-ST2136, 2198, 2200, 2201) (TM 55-1925-203 Series).

*U.S. GOVERNMENT PRINTING OFFICE: 1989 654-030/00277

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton meters	1.356	metric tons	short tons	1.102
pound-inches	newton meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

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