

## CHAPTER 5 HULL, SPECIFICATIONS AND REPAIR

### Section I HULL DESCRIPTION

#### 5-1. GENERAL.

This section contains a physical description of hull construction, hull fittings, draft marks, painting and cathodic protection.

#### 5-2. HULL CONSTRUCTION.

**5-2.1. BULKHEADS, FRAMES AND PLATING.** The hull is of welded steel construction with steel plates welded over transverse and longitudinal bulkheads and transverse frames. The main deck is of steel plates welded over transverse and longitudinal steel beams and girders and supported by stanchions where extra strength is required. There are five watertight bulkheads at frames 2, 6, 12, 16 and 23. Bulkheads are designed to provide adequate strength for the ship as a whole. Doors and other openings are located so that as few stiffeners as possible are cut and so that the efficiency of the bulkhead as a frame is not impaired. Transverse web frames are numbered consecutively from the forward perpendicular to the after perpendicular and stand square to the baseline and to the longitudinal vertical plane on the centerline. Additional framing is fitted for local stiffness to resist shock and vibration. Longitudinals and stringers are laid off in conjunction with shell framing to give structural strength and support to the shell. Shell plating has a minimum thickness of 3/16-inch and interference of butts and seams with longitudinals, bulkheads, decks and structural members and fastenings is avoided. Sea chests and other openings with transverse dimensions larger than 24 inches are reinforced with insert plates and special framing.

**5-2.2. TANKS AND FOUNDATIONS.** The fuel, ballast and lube oil tanks are constructed of welded steel plate and are an integral part of the hull and framing. All tanks are fitted with oiltight or watertight manhole covers for inspection and cleaning. Foundations throughout the craft are constructed to withstand the loads imparted by the equipment they support while the craft is operating at full speed under all conditions. To minimize weight, structural members of the hull, reinforced as necessary, are used as parts of the foundations. All foundations are constructed of steel and contain no pockets that can retain liquid.

**5-2.3. HULL PENETRATIONS.** Hull penetrations are well separated and are not aligned in a transverse plane.

Penetrations in the hull are generally circular; however, when rectangular openings are necessary, the openings have corner radii. Webs of deck beams and girders, longitudinal and transverse framing and bulkhead stiffeners which are six inches or more in depth may have lightening holes if strength requirement will permit. In nontight structures, drain holes are provided to prevent accumulation and retention of liquids. Refer to Table 5-2 for the list of onboard NAVSEA drawings which show complete details of hull construction.

#### 5-3. DOORS, SCUTTLES AND MANHOLES.

The C.O., C.P.O and the observer's staterooms are fitted with metal joiner nontight doors with locks. The crew berthing space is fitted with metal joiner nontight doors without locks. A raised, watertight 24 x 24-inch hatch is provided on the main deck for access to the bosun's stores area. A raised watertight hatch, 24 x 30 inch is provided on the main deck for access to the lazarette. Two 18-inch scuttles are provided on the main deck, one forward of frame 12, port side, for access to the crew washroom and one starboard side, between frame 18 and 19 for access to the engine room. The hatches and scuttles are equipped with devices to hold them in the open position. Oiltight or watertight manholes are provided for all tanks and void spaces for cleaning and inspection.

#### 5-4. DECK COVERINGS.

Deck covering in the mess lounge, galley, living spaces, and operating areas consists of a monolithic epoxy resin composition. Deck covering in sanitary spaces is decorative polyurethane. Traffic areas on interior or exterior decks are painted and slip resistant coatings are applied.

#### 5-5. HULL FITTINGS.

Rubber fenders are installed on port and starboard sides of the hull and on the transom to protect the hull when along side a dock or another craft. Vertical fenders are installed on the transom to straddle the torpedo recovery end of the ramp deck track to prevent damage to the hull during torpedo in-haul. A fender is also installed across the bottom of the ramp cut-out. Chocks, bits and cleats are provided to allow safe line handling during mooring procedures. Towing pads are provided at centerline, forward and aft, to allow for towing another craft or for

towing of the Torpedo Weapons Retriever. Padeyes are installed for convenient and rapid handling of stores to and from storerooms and over auxiliary machinery for lifting parts of the machines during overhaul and repair. Padeyes are also installed at the ends of the torpedo rollers for fairleaders, to haul torpedoes up the recovery ramp and forward and aft into stowage positions. Cleats and fairleaders are installed for the proper leads and belaying of signal halyards and rigging are the same on the mast, bow mast and stern mast.

5-6. CATHODIC PROTECTION.

The underwater areas of the craft are protected from corrosion by zinc anodes, type 2HC-23. Twenty anodes

are attached to the hull to provide a corrosion protection system. Refer to Figure 1-3 for location of anodes. The anodes are secured to fully threaded studs, welded to the hull with washers and self-locking nuts.

5-7. DRAFT MARKS. (Figure 5-1.)

Limiting draft marks are located port and starboard at the most stringent load line, forward and aft. Limiting draft marks are 7 feet, 8-7/8 inches above underside of keel. Appendage draft marks are located at frame 14 to indicate operating draft including sonar transducer and guard below the keel of the craft. Calculative draft marks are located at frame 2 port and starboard and 6 inches aft of frame 27 port and starboard.

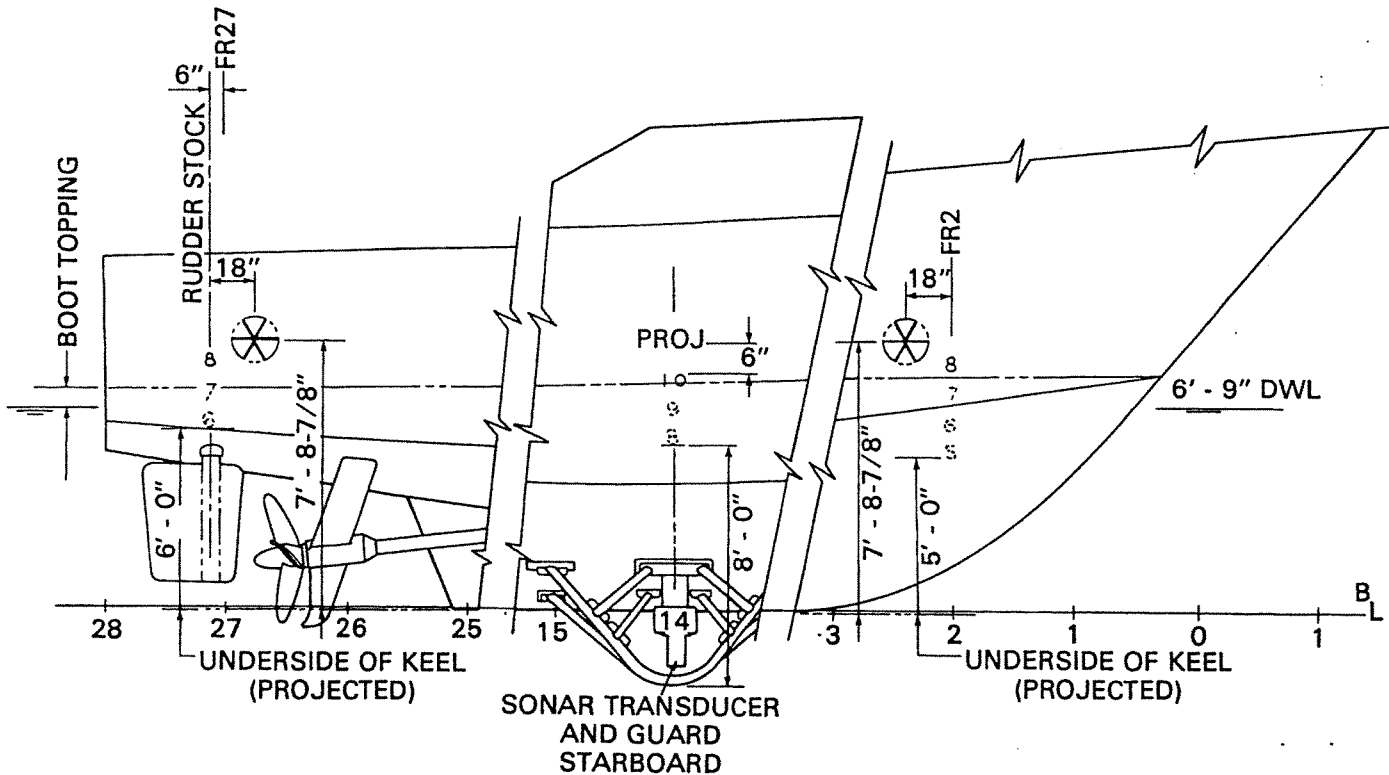


Figure 5-1. Draft Marks

Section II  
REPAIR

5-8. PAINTING GUIDELINES.

Painting of the ship's surfaces, interior and exterior shall be performed when necessary to prevent corrosion or deterioration of the surfaces. Repainting of surfaces shall be accomplished with the compatible coating specified in the ship's painting schedule or the information provided

in this chapter. Solid surfaces should be cleaned rather than painted.

5-8.1. INTERIOR SURFACES. In repainting interior surfaces, apply the minimum number of coats required to satisfactorily cover the surface. One coat is usually sufficient.

5-8.2. **EXTERIOR SURFACES.** In exterior painting, touch-up rather than complete repaint should be considered. If small areas requiring touch-up are cleaned to bare metal, edges of the adhering paint should be mechanically cleaned to a tapering edge. When repainted, the junction of old and new paint should have as natural an appearance as possible. When light blasting has been performed, at least two coats of anti-corrosive paint shall be applied before applying top coats of antifouling paint.

## 5-9. PAINT APPLICATION PROCEDURES.

5-9.1. **EPOXY-POLYAMIDE COATINGS.** Epoxy-polyamide coatings consist of a two-component system that includes a pigmented polyamide resin (A component) and an epoxy resin (B component). When they are mixed together and applied as a paint film, the coating cures to a hard film by chemical conversion. During curing, the solvents used to maintain the composition in liquid form are released by evaporation.

5-9.2. **EPOXY-POLYAMIDE FORMULATIONS.** Epoxy polyamide coating (MIL-P-24441) consists of seven individual formulations; Formulas 150 through 156. These coatings are suitable for use in tanks, bilges, wet spaces and on exterior surfaces.

### CAUTION

Since solvent fumes from epoxy paint systems are potentially hazardous, suitable precautions shall be taken to prevent fires and to protect personnel from fumes and fume inhalation.

### CAUTION

Epoxy coatings can cause allergic reactions when allowed to come in contact with the skin. Prompt skin cleanup is required using soap and water, not solvent.

## 5-10. SURFACE PREPARATION.

5-10.1. **CLEANING.** Surfaces to be coated must be completely free from rust, loose paint, dirt, scale, oil, grease, salt deposits, moisture and other contaminants.

5-10.2. **BARE SURFACES.** When painted surfaces show evidence of corrosion, peeling, blistering, checking or general disintegration, the old paint must be removed down to bare metal prior to repainting. Surfaces to be painted with epoxy-polyamide system should be abrasive-blasted to near-white metal. In areas where abrasive blasting is not permitted, the surfaces must be cleaned by mechanical means (disk sanding, chipping tools or pneumatic discaler), to remove all loose paint

film and foreign matter. Since abrasive blasting will not adequately clean surfaces contaminated with oil or grease, such areas should be cleaned with solvent.

5-10.3. **GALVANIZED STEEL.** Galvanized steel must be roughened by a light abrasive blast or by mechanical means to provide a suitable painting surface.

5-10.4. **TOUCHUP PAINTING.** When only localized areas or spots require painting, removal of the old paint must be carried back to an area of completely intact and adhering paint film. Edges of tightly adhering paint around the area to be repainted must be sanded to a smooth shape (feathered) from the intact paint to the bare metal area. Areas of intact paint to be overcoated shall first be roughened.

## 5-11. MIXING EPOXY-POLYAMIDE COATINGS.

5-11.1. **MIXING RATIOS.** Epoxy-polyamide coatings are in measured amounts that must be mixed together in exact proportions to ensure the correct chemical reaction. The mixing ratios of the MIL-P-24441 coatings are all 1:1 by volume.

### NOTE

The individual components of the various formulas are not interchangeable.

5-11.2. **MIXING PROCEDURE.** Each component shall be thoroughly stirred prior to mixing the components together. After mixing equal amounts of the two components, the mixture must again be thoroughly stirred until well blended. The induction or stand-in times given in Table 5-1 must be adhered to. Induction time is defined as that time immediately following the mixing of components A and B during which the critical chemical reaction period of these components is initiated. This reaction period is essential to ensure the complete curing of the coating.

5-11.3. **MIL-P-24441 INDUCTION TIMES.** The approximate temperature of the paint components should be estimated to judge the amount of induction time and the pot life that might be expected. Jobsite application temperature affects the paint curing time and must be considered in estimating induction time, cure time and the effect of batch size on these functions. The induction times listed in Table 5-1 are based on a 10-gallon batch. A smaller batch will require a longer induction time. When paints are to be applied at a jobsite having temperatures in the range of 1.6 to 10 degrees Centigrade (35°F to 50°F), induction must occur in a warm area 21.1 degrees Centigrade (70°F). When the coating is fully cured (induction period complete) the paint is carried to the worksite for application. To ensure the reaction proceeds uniformly, the paint must be stirred

periodically during the induction period. This stirring prevents localized overheating or hot spots within the paint mixture.

Table 5-1. MIL-P-24441 Job Site Ambient Temperature and Induction Time

Ambient Temperature °C (° F)	Induction Time (in hours)
1.6 to 10 (35 to 50)	2 at 21.1°C (70°F)
10.0 to 15.6 (50 to 60)	2
15.6 to 21.1 (60 to 70)	1 to 1-1/2
21.1 and above (70 and above)	1/2 to 1

## 5-12. EPOXY POLYAMIDE COATING APPLICATION.

Epoxy-Polyamide coating (MIL-P-24441) may be applied by brushing, spraying and rolling or dip coating. Refer to the following paragraphs for proper application.

5-12.1. THINNING. Up to one pint of ethylene glycol monoethyl (EGM) ether for each gallon of mixed paint may be added if paint has thickened during cold temperature, or when necessary to improve application characteristics. When applied at the proper thickness, without thinning, this type of paint will have no tendency to sag.

5-12.2. APPLICATION THICKNESS. Unless otherwise stated in this manual, apply each coat of paint to produce approximately 3 mils dry film thickness (DFT). Application which yields in excess of 4.0 mils DFT should be avoided.

5-12.3. BRUSH APPLICATION. During maintenance painting, brush application is recommended for the first coat of paint over mechanically cleaned surfaces and hand cleaned bilges.

5-12.4. SPRAY APPLICATION. Epoxy-polyamide paint should be sprayed with a normal spray gun at normal spray pot pressure. The spray gun should be equipped with a middle-side (D) needle and nozzle setup. Both conventional and airless spray equipment can be used.

5-12.5. TIME LAPSE BETWEEN COATS. If more than seven (7) days elapse between coats of epoxy, the surface must be cleaned with water and detergent and rinsed clean with fresh water. Use solvents if grease or oil are present. Apply a tack coat, 1 to 2 mils, wet film

thickness (WFT) of the last coat applied or Formula 150 to the hard epoxy coat. Allow to dry for approximately four (4) hours before applying the next full coat of the system. This same procedure applies to aged epoxy paint surfaces after service. Formula 150 should be used as a tack coat when applying MIL-P-24441 paints over proprietary epoxy coatings.

5-12.6. EQUIPMENT CLEANUP. Since epoxy paints cure with time, the paint should not be allowed to remain in spray equipment for an extended period, especially in the sun or a warm area. When Components A and B are mixed together, the pot life of the mixture (including the induction time) is 6 hours at 21.1 degrees Centigrade (70°F). Pot life is longer at lower temperatures. After use, spray equipment should be cleaned by flushing with EGM ether solvent. General cleanup is also done using EGM ether solvent. Brushes and roller should be given a final cleaning in warm soapy water, rinsed clean with warm fresh water, and hung to dry.

## 5-13. TWR PAINT SPECIFICATIONS.

5-13.1. EXTERIOR SURFACES. The exterior surfaces below the waterline are coated with anti-corrosion paint, Military Specification MIL-P-24441, one coat of formula 150, 156 and 151. Total dry film thickness to be 9 mils minimum. Two coats of International Interspeed BJA 600, anti-fouling paint to be applied before third coat of anti-corrosion paint becomes dry and hard. Film thickness to be a minimum of 4 mils.

5-13.1.1. Vertical and near vertical surfaces above the waterline are coated with anti-corrosion paint, Military Specification MIL-P-24441, one coat of formula 150, 156 and 151. Total dry film thickness to be 9 mils minimum.

5-13.1.2. The bridge deck and pilothouse top are coated with one coat of MIL-P-24441 formula 150, 3 mils thick and one coat of MIL-D-24483, non-skid, Type 1.

5-13.2. INTERIOR SURFACES. The pilothouse overhead and bulkheads are coated with MIL-P-24441 formula 150, 151 and 152. One coat of each is required to a thickness of 9 mils minimum. The deck requires one coat, 3 mils thick of formula 150. Deck is then covered with Type 2 Dex-O-Tex Colorflake M. A matting 48 x 48 inches and 1/4-inch thick is installed in front of the helm station. Safety treads are installed in both doorways and at the head of the passageway ladder.

5-13.2.1. Weather decks, interior decks and bulkheads in deckhouse are coated with one coat of MIL-P-24441 formula 150, 3 mils thick. All interior bulkheads and decks are then coated with one coat of formula 151, 3 mils thick. Due to color coordination in living spaces the third coat can be formula 152 #24585, 152 #22563, 152 #25526 or 152, white.

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thickness (WFT) of the last coat applied or Formula 150 to the hard epoxy coat. Allow to dry for approximately four (4) hours before applying the next full coat of the system. This same procedure applies to aged epoxy paint surfaces after service. Formula 150 should be used as a tack coat when applying MIL-P-24441 paints over proprietary epoxy coatings.

5-12.6. EQUIPMENT CLEANUP. Since epoxy paints cure with time, the paint should not be allowed to remain in spray equipment for an extended period, especially in the sun or a warm area. When Components A and B are mixed together, the pot life of the mixture (including the induction time) is 6 hours at 21.1 degrees Centigrade (70°F). Pot life is longer at lower temperatures. After use, spray equipment should be cleaned by flushing with EGM ether solvent. General cleanup is also done using EGM ether solvent. Brushes and roller should be given a final cleaning in warm soapy water, rinsed clean with warm fresh water, and hung to dry.

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5-13.1. EXTERIOR SURFACES. The exterior surfaces below the waterline are coated with anti-corrosion paint, Military Specification MIL-P-24441, one coat of formula 150, 156 and 151. Total dry film thickness to be 9 mils minimum. Two coats of International Interspeed BJA 600, anti-fouling paint to be applied before third coat of anti-corrosion paint becomes dry and hard. Film thickness to be a minimum of 4 mils.

5-13.1.1. Vertical and near vertical surfaces above the waterline are coated with anti-corrosion paint, Military Specification MIL-P-24441, one coat of formula 150, 156 and 151. Total dry film thickness to be 9 mils minimum.

5-13.1.2. The bridge deck and pilothouse top are coated with one coat of MIL-P-24441 formula 150, 3 mils thick and one coat of MIL-D-24483, non-skid, Type 1.

5-13.2. INTERIOR SURFACES. The pilothouse overhead and bulkheads are coated with MIL-P-24441 formula 150, 151 and 152. One coat of each is required to a thickness of 9 mils minimum. The deck requires one coat, 3 mils thick of formula 150. Deck is then covered with Type 2 Dex-O-Tex Colorflake M. A matting 48 x 48 inches and 1/4-inch thick is installed in front of the helm station. Safety treads are installed in both doorways and at the head of the passageway ladder.

5-13.2.1. Weather decks, interior decks and bulkheads in deckhouse are coated with one coat of MIL-P-24441 formula 150, 3 mils thick. All interior bulkheads and decks are then coated with one coat of formula 151, 3 mils thick. Due to color coordination in living spaces the third coat can be formula 152 #24585, 152 #22563, 152 #25526 or 152, white.

5-13.2.2. All interior decks will be second coated with formula 151 and 154, 3 mils thickness of each type. Weather decks will have 1 coat of non-skid, Type 1.

5-13.2.3. The lube oil tank and the fuel oil tanks are sandblasted to a near white finish and coated with a medium weight lubricating oil preservative, MIL-L-3150, medium.

5-13.2.4. The exterior of the chain lockers and the ballast tanks are coated with one coat of formula #150, one coat of formula #151 and one coat of formula #152 to MIL-P-24441 and each coat will be 3 mils thick.

5-13.2.5. The lazarette engine room, pump room and the bow thruster space will be painted as follows:

1. MIL-P-24441, one coat each of formula #150, #151 and #152, 3 mils thick. This includes all removable deck plates, gratings and supports.
2. Bilges within these spaces are painted as follows:
  - a. In spaces with removable deck plates or grating, the bilge is painted red to 3 inches above the highest plate or grating level.
  - b. In spaces where insulation is present the bilge is painted red to the lowest level of insulation.
  - c. In spaces where no deck plate or grating level is present the bilge is painted red to the chine.

5-13.2.6. The interior and the exterior of the potable water tanks are coated the same as the pump room.

5-13.2.7. The interior of the waste oil tank is sandblasted to a near white and coated with a medium weight lubricating oil preservative. The exterior is painted the same as the potable water tanks.

5-13.2.8. The interior of the sewage tank is painted with MIL-P-24441, one coat for formula #150, one coat of formula #156, one coat of formula #151 and a final coat of formula #152. Each coat is 3 mils thick. The exterior of the tanks is painted the same as the pump room.

5-13.2.9. The provisions storeroom, washroom and bosun's stores areas are painted the same as the interior of the potable water tanks. All paint thicknesses are 3 mils.

5-13.2.10. The crew berthing and the observer's stateroom are painted to MIL-P-24441 using one coat of

formula #150, one coat of formula #151 and one coat of formula #152 (25526, pastel blue), 3 mils thick.

5-13.2.11. The passageway and the linen locker spaces are painted using one coat of formula #150, one coat of formula #151 and one coat of formula #152 (22563, beach sand), 3 mils thick. All treads on inclined ladders are painted using non-skid Type I.

5-13.2.12. Interior decks in the air handling room, the electronic equipment space and the passageways on the main deck are painted with a three coat epoxy anti-corrosion coating system with a final coat of "haze gray," MIL-P-24441, formula 151.

5-13.2.13. Anchors are coated with asphalt varnish black, Fed. Std. TT-V-51.

5-13.2.14. Insulation not covered by sheathing is coated with two coats of MIL-Spec DOD-E-24607 chlorinated alkyd 3 to 4 mils dry film thickness colored to match compartment topcoat. Overhead color is white. Refer to onboard NAVSEA drawing 631-6003460 for painting specifications and colors.

#### 5-14. WELDING.

All welding procedures and inspection shall be as specified in Fabrication, Welding and Inspection of Metal Boat and Craft Hulls, NAVSHIPS 0900-060-4010. Nondestructive test personnel shall be certified in accordance with Qualifications-Certifications Requirements for Nondestructive Test Personnel NAVSHIPS 0900-006-8010.

#### 5-15. REPAIR.

There are no special hull repair or maintenance procedures for the Torpedo Weapons Retriever. Maintenance and repair procedures shall be in accordance with NAVSHIPS Technical Manual, Chapter 9820, Boats and Livesaving Craft, NAVSHIPS 0901-820-0002. Refer to the onboard drawings (Table 5-2) for hull construction information.

#### NOTE

Disturbed or damaged paint or bare steel installed in the repair process shall be painted in accordance with paragraph 5-8 through 5-13 of this chapter.

Table 5-2. Hull Construction Drawings

NAVSEA Drawing No.	Title
111-6003300	Shell Expansion
113-6003301	Inner Bottom and 1st Platform
114-6003302	Skeg
116-6003303	Longitudinal Framing and Girders
117-6003304	Trans Bulkheads Below Main Deck
117-6003305	Transverse Ordinary Frames
121-6003306	Long Bulkheads Below Main Deck
130-6003307	Main Deck Structure
150-6003308	Superstructure - Decks
150-6003309	Superstructure - Trans. Frames and Bulkheads
150-6003310	Superstructure - Long Frames and Bulkheads
161-6003311	Shaft Struts and Barrels
163-6003312	Sea Chest
167-6003313	Water Tight Closures