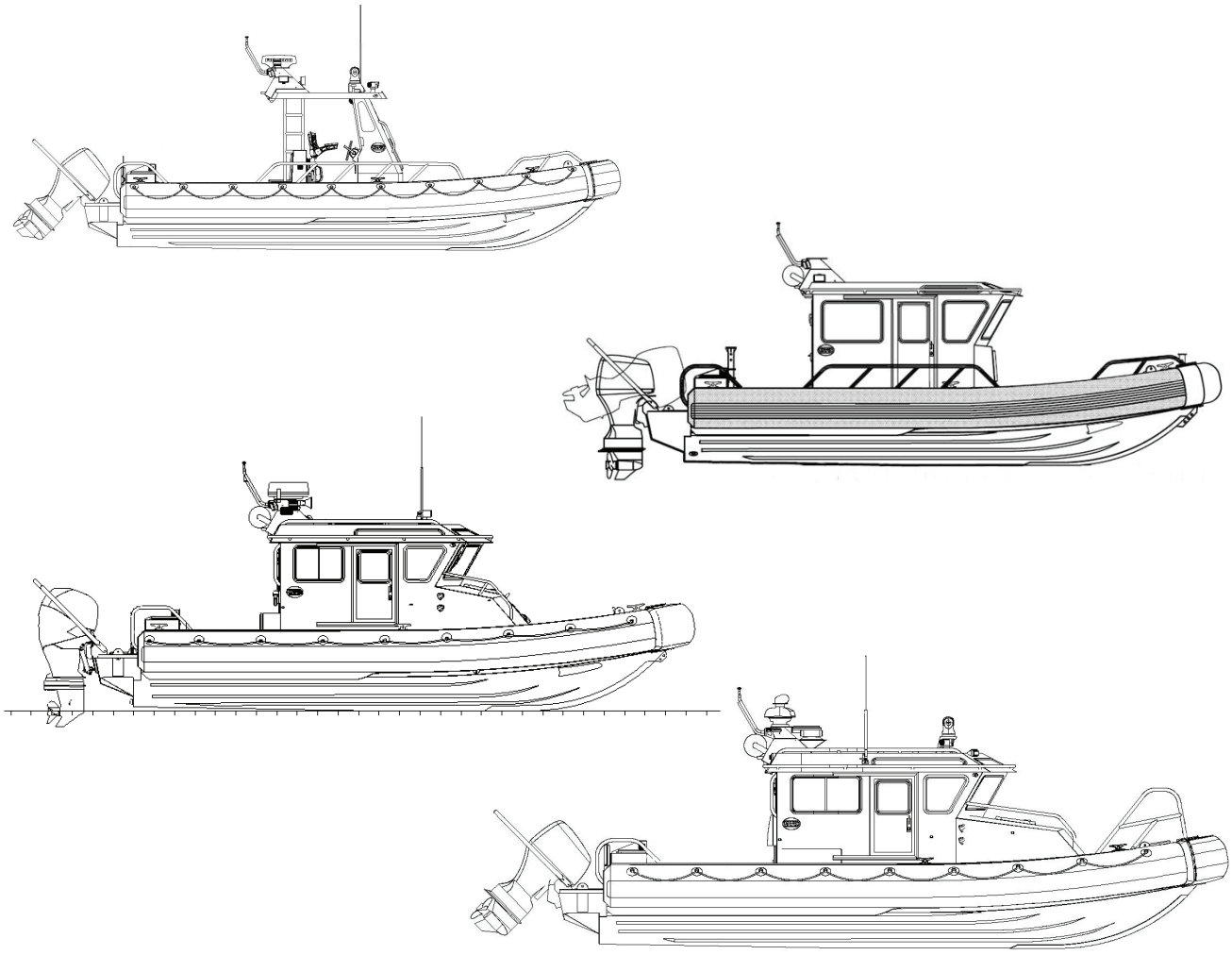
SAFE BOATS INTERNATIONAL, LLC
8800 SW Barney White Road
Bremerton, WA 98312
360.674.7161 | FAX 360.674.7149

God, Country and Fast Boats

BOAT OPERATOR'S HANDBOOK



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RECORD OF CHANGES

CHANGE NUMBER	DATE OF CHANGE	DATE ENTERED	ENTERED BY	PAGES	REASON

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042	General Administration

042 General

The Boat Operator's Handbook contains information necessary for the safe and efficient operation of the boat. It defines operational capabilities, maintenance procedures, manufacturer provided outfit list, and physical characteristics of the boat.

The manual is laid out numerically according to standard Expanded Ship Work Breakdown Structure (ESWBS) coding numbers and is in accordance with NAVSEA Publication S9040-AA-IDX-020. ESWBS numbers provide for a uniform and consistent numbering system for all onboard systems and structures regardless of class, size, or propulsion system.

Not every section or picture outlined in this handbook may be applicable to every SAFE Boat.

SECTION 044 BOAT OPERATION

Mission Performance

Introduction

The actions and techniques described in this chapter are products of field experience. They are intended to give boat crewmembers information on how SAFE Boats perform and react in various mission scenarios. The information is not intended to provide the only way to perform an action or complete a mission. Boat crews should use effective communications and teamwork skills along with this general information to adapt their actions to each unique mission scenario.

Information in this section alone does not qualify a crewmember. Observe these procedures and apply skills developed through practice.

044-1 Trailering

This section contains the following procedures and section:

Table 044-1.1 Trailering Inspection
Table 044-1.2 Launching
Table 044-1.3 Recovering

Section 044-1.4 Lifting Points

Table 044-1.1. Trailering Inspection

Step	Action
	<u>WARNING</u> **Do not exceed the maximum weight rating of trailer. Exceeding the maximum rating voids the manufacturer's warranty and may lead to premature failure of the trailer, causing damage to the boat and creating an unsafe towing condition.**
	<u>CAUTION</u> **Grease all buddy bearings or applicable grease fittings monthly in accordance with the preventive maintenance schedule. Failure to comply may result in damage to trailer.**
1.	Lower all antennas.
2.	Ensure all boat/trailer straps are secured to the connecting points.
3.	Ensure trailer coupler securely engages the hitch. The coupler and hitch ball must be rated for the same size. The size should be imprinted on both the ball and the hitch. The factory trailer coupler is a 2 5/16-inch coupler.
4.	Ensure jack is fully cranked up.
5.	Ensure brake chain is attached.
6.	Ensure safety chains are secured to trailer and tow vehicle in a crisscross fashion under the trailer tongue.
7.	Ensure the brake back-up solenoid valve is connected to the tow vehicle's back-up light circuit.

Table 044-1.1. Trailering Inspection (cont.)

Step	Action
8.	Ensure all fasteners and bolts are properly tightened. Pay particular attention to the wheel lug nuts (tightened to 85 ft-lbs).
9.	Ensure engines are tilted up and locked in position.
10.	Set engine locks. Engine locks are located on the side of each engine above mounting bracket.
11.	Turn off all battery switches.
12.	Ensure boat is securely tied down with tie-down straps at the bow and transom. The winch strap is not a tie-down strap. The winch secures the boat to the trailer in a fore and aft direction. Tie-down straps secure the boat in the vertical and side to side direction. Bow-eye and transom tie down straps must be securely attached when the boat is on the trailer.
13.	Ensure tires are properly inflated. Read the tire sidewall to determine the correct tire pressure required. Trailer tire rating may be different than the tow vehicle tire rating. Inspect tires for tire wear, cracks, bubbles or foreign objects imbedded in the tire.
14.	Ensure brake lights and other trailer lights are working.
15.	Ensure brakes are functioning by lightly testing brakes before getting on a major road.

Table 044-1.2. Launching Procedure

Step	Action
	CAUTION **Do not exceed the maximum weight rating on your trailer. Exceeding the maximum rating voids the manufacturer's warranty and may lead to premature failure of the trailer causing damage to the boat and creating an unsafe towing condition.**
1.	Remove aft tie-down straps securing boat to trailer prior to backing the boat and trailer into the water.
2.	The trailer and boat are backed into the water until the aft end of the boat is afloat. Backing the trailer until the trailer forward axle is just submerged is a good guideline.
3.	Remove forward tie-down straps.
4.	Release engine locks and lower engines to the full down position.
5.	Before the coxswain starts an engine, complete the pre-launch check list.
6.	Start engines one at a time, ensuring there is water flowing through the raw water filters and through the overboard discharge tubes. The engines are allowed three to five minutes to warm up and functioning properly prior to attempting to back off the trailer.
7.	The coxswain makes sure the helm is centered, signals the driver to unhook the winch cable and safety chain. If the boat is being pulled backwards by the current, wind, or the angle of the ramp, the coxswain may have to accelerate slowly forward to hold the boat on the trailer, allowing the tow vehicle driver enough slack to unhook the winch cable.
8.	If the boat does not easily back off the trailer, the coxswain increases reverse throttle slowly in the attempt to free the boat from the trailer. The problem with throttling up when trying to back off the trailer is the amount of mud and sand that will collect in the engine intake filters.

Table 044-1.2. Launching Procedure (cont.)

Step	Action
9.	If the boat cannot back off the trailer under its own power, the tow vehicle driver (providing the ramp is long enough), inches the trailer into the water slowly until the boat is free from the trailer.
10.	If the current runs parallel to the ramp, launching is no problem. Verify engines have been warmed up and are functioning properly prior to launching.
11.	If the current runs perpendicular to the ramp, the coxswain should back into the current, allowing the current to help swing the bow away from the trailer. More throttle will be required to complete this maneuver safely. If the ramp is wide enough, the trailer should be backed in so that the aft end of the boat is parallel to the current.

Table 044-1.3. Recovering Procedure

Step	Action
	CAUTION **Do not exceed the trailer maximum weight rating. Exceeding the maximum rating voids the manufacturer's warranty and may lead to premature failure of the trailer, causing damage to the boat and creating an unsafe towing condition.**
1.	Back the trailer down the ramp until approximately 4-feet of the outer bunks are out of the water. Ensure that the trailer winch and ratcheting safety straps are securely fastened before pulling boat out of the water.
2.	Set tow vehicle emergency brake. Place blocks under tow vehicle wheels.
3.	Pull 12 to 18-inches of winch cable out.
4.	Set winch control in Lock position.
5.	Maneuver the boat between the trailer uprights and forward onto the trailer until the bow touches the trailer bow stop.
6.	Raise engines to the full up position.
7.	Attach winch strap to boat tow eye and wind in strap until the strap indicator sleeve is aligned with the top of the winch base plate. Verify boat is tight against bow stop. This will ensure proper loading and weight distribution.
8.	Pull boat and trailer forward. Verify boat is centered on trailer.
9.	Pull boat and trailer out of water onto level ground.
10.	Attach tie down straps (two aft and two forward) at trailer tie down points.
11.	Verify brake lights and other trailer lights are working.
12.	Verify operation of trailer brakes.

044-1.4 Lifting Two lift fittings are located on the bow, outboard of the anchor locker and two are located outboard of the engines on the transom void compartment.

WARNING

Lift by designated lift fittings only. Do not use trailer tie -down fittings as lifting points. Failure to comply may result in damage to equipment or serious injury to personnel.

044-2 Starting Procedures

This section contains the following procedures:

Table 044-2.1. Pre-Launch Procedure

Step	Action
1.	Turn on all battery switches. If there is not enough power to start the engine, turn on the interconnect switch.
2.	Ensure engine safety shut-off lanyard is secured to the switch and coxswain.
3.	Verify propellers are free of obstructions, such as fishing line.
4.	Lower engines to operating position.
5.	Test operation of all lighting systems.
6.	Test operation of horn and loudhailer.
7.	Energize radar and test all display functions.
8.	Verify displayed GPS position information is correct.
9.	Test operation and accuracy of depth sounder if water depth permits.
10.	Rotate helm to the left (port) and right (stbd) steering limits. Verify engines follow smoothly.
11.	Perform radio check on all radios on local working frequencies.
12.	Verify quantity of personnel flotation devices (PFD) onboard are sufficient and easily accessible.

Table 044-2.1. Pre-Launch Procedure (cont.)

Step	Action
13.	Verify all items on deck and in the cabin are stowed and/or secured.
14.	Verify hatches and doors are secured in the closed position to prevent water intrusion.
15.	Verify number of fenders and mooring / towing lines onboard are sufficient and secured.
16.	Verify fuel level is adequate.

Table 044-2.2. Engine Starting Procedure

Step	Action
1.	Set throttle levers to NEUTRAL position at all operating stations.
2.	Leave the fast idle lever in OFF position (fully lowered).
3.	Turn engine ignition key to START position until engine starts. Log start time.
4.	Check outboards for nominal or adequate cooling water output at telltale discharge on each engine.
	CAUTION **If cooling water output is not evident, immediately secure engine and investigate.**
5.	Check hydraulic steering system for leaks at helm and at steering cylinders by outboards.
6.	Verify engine safety shut-off lanyard functions properly. Log stop time.
7.	Restart engines, log start time.

Table 044-2.3. Energizing Equipment Procedure

Step	Action
1.	Close (turn ON) all of the remaining breakers on the 12-VDC power panels.
2.	Energize and test all installed electronic components.
3.	Test throttle operation in forward and reverse.
4.	Ensure gear is properly stowed and watertight integrity is set.
5.	Perform pre-op check of all required navigation equipment; navigation lights, deck lights, instrument lights, horn, etc.
6.	Inform coxswain on the status of all engineering and electronic systems and that the boat is ready to get underway.

Table 044-2.4. Connecting Shore Power

Step	Action
1.	Ensure pier power is secured. Main breaker should be open (OFF).
2.	Connect shore power cable to pier then boat.
3.	Energize pier side power.
4.	On AC panel verify that selector switch is set to shore power. Verify that AC voltage is within appropriate range on voltage readout and that reverse polarity light is off. If voltage is outside of approved range or reverse polarity light is on, secure power and confirm correct settings and wiring at pier side hookup.
5.	Turn on Main AC breaker

Table 044-2.5 Securing Shore Power

Step	Action
1.	Secure all AC components.
2.	Secure Main AC breaker.
3.	Set AC meter to OFF position.
4.	Secure pier power.
5.	Disconnect and stow shore power cord. Verify that boat shore power outlet cover is in locked position.

044-3 Underway	It is the responsibility of the coxswain and crewmembers to ensure that once the vessel is underway the boat and its systems are operated in a safe and efficient manner. The safety of the crew and any embarked personnel is also incumbent on all crewmembers. After getting underway, observe all appropriate machinery gauges. If an abnormal condition develops, take corrective action to prevent further damage. Report any abnormal conditions to the coxswain.
044-3.1 Personal Protective Gear	Always observe requirements of this manual, local regulations and ordinances and any organizational guidelines for wearing protective clothing, personal flotation devices, and boat crew signal kits.
044-3.2 Communica-tions	Crew communications and coordination is the key to safe operations. Crewmembers should inform the coxswain of their location when moving about the deck. Engine noise can make crew communications difficult on boats. Speak loudly and clearly repeat as necessary until acknowledged.

Note 1: When operating the boat with minimal crew, effective crew communications are critical. Speak loud enough to be heard over the background noise. Ensure the receiver hears and understands the message being passed. A common strategy is to have the receiver repeat back the message that was sent.

Note 2: The enclosed steering station can create a sense of isolation from the elements and other marine traffic. Crewmembers should use all available means to maintain awareness of wave action, winds, currents, and traffic.

044-4 Going Alongside Boats and Vessels of Interest

This section contains the following procedures:

Table 044-4.1. Going Alongside

Step	Action
1.	Ensure that communications between the boat and the operational commander are established and reliable.
2.	Attempt to make and establish contact with the vessel of interest on designated marine band frequencies.
3.	Make approach preparations and inform the crew. The coxswain should determine where to make contact with the vessel.
	WARNING **Pick a contact point well clear of a larger vessel's propeller (including in the area of suction screw current), rudder, and quarter wave. Forces from these could cause loss of control.**
4.	Conditions permitting, match boat speed to the other vessel, and then start closing in from the side.
5.	Close at a 15 to 30 degree angle to the other vessel's heading. This should provide a safe rate of lateral closure at no more than one-half the forward speed.
	Note 1: If initial heading was parallel to the other vessel, increase speed slightly when boat starts to close at an angle.
6.	If contact has been made with the vessel of interest, determine if a sea painter has been provided for going alongside. Also, determine if a boarding ladder (if necessary) is available and rigged.

Table 044-4.1. Going Alongside (cont.)

Step	Action
	Note 2: In some instances, a sea painter may be used in going alongside a larger vessel underway. The sea painter is a line used to sheer a boat clear of a ship's side, when underway or at anchor, to hold a boat in position under shipboard hoisting davits, and occasionally to hold the boat alongside a ship in order to embark or disembark personnel. It leads from the larger vessel's deck, well forward of where the boat will come alongside.
	WARNING **Do not secure the sea painter to the boat's stem or to the side of the boat away from the vessel of interest. If secured to the outboard side of the boat, capsizing could result.**
	Note 3: As both the boat and vessel of interest have headway, the pressure of the water on the boat's bow will cause it to sheer away from the vessel of interest. Use this force by touching on the helm to control sheer, in or out, by catching the current on one side of the bow or the other side. Riding the sea painter will help maintain the position and control of boat while alongside.
	Note 4: When sheering in or out, apply steering commands slowly and be prepared to counteract the tendency of the boat to close or open quickly.
7.	Come alongside of the vessel, matching its course and speed. When close to the larger vessel, and forward of the desired contact point, ask the vessel to pass the sea painter.
8.	Receive the sea painter and secure it inboard just aft of the bow.
9.	The sea painter is usually passed by use of a heaving line. Quickly haul in the heaving line and adjust the boat's heading and speed to control slack in the sea painter so that these lines do not get into the boat's propeller or mast.
10.	Reduce speed slowly and drift back on the painter (ride the painter).

Table 044-4.1. Going Alongside (cont.)

Step	Action
11.	Use helm to hold the boat at the desired position alongside or at some distance off the vessel.
12.	If set toward the vessel, apply steering commands to sheer the bow out. If too far away, apply steering commands to sheer the bow in. The forward strain on the painter will pull the boat and provide steering way.
	Note 5: If approaching a vessel anchored in a strong current, the sea painter provides a means to lay alongside. Procedures are the same as if the vessel is making way. Approach from leeward, against the current.
	CAUTION **Use care when going alongside a vessel of interest so as not to damage the collar.**
13.	Make contact with the forward sections of boat (about halfway between the bow and amidships). Use helm and power (if not on a sea painter) to hold the bow into the other vessel at the same forward speed. Do not use so much helm or power that you cause the other vessel to change course.
14.	Ensure that communication with the operational commander is established to update the status of the assigned mission. If personnel are to be embarked/disembarked on the vessel of interest, utilize a boarding ladder as provided. Minimize the time alongside. If necessary make-up to the other vessel rather than relying on helm and power to maintain contact.
15.	When the mission is complete, embark all personnel. Sheer the stern in with the helm to get the bow out. Avoid getting set toward the side or stern of the vessel.
	Note 6: If on a sea painter, its strain sheers the boat clear.
16.	If on a sea painter, use enough speed to get slack in the line, then cast off when clear. Ensure the sea painter is hauled back aboard the larger vessel immediately to keep it from getting caught in the outdrive or mast.

Table 044-4.1. Going Alongside (cont.)

Step	Action
	CAUTION **Do not back down when clearing alongside, parallel to another vessel that is making way. Outboard powered vessels with a large portion of weight aft are susceptible for shipping water while backing, particularly in a chop.**
17.	Apply gradual power to gain slight relative speed. Maneuver the boat away from the vessel of interest. Continue to update position and status of the mission with the operational commander.

044-4.2 Fore and Aft Tow

A fore and aft tow (figure 044-4.2a), is best suited for an open water situation where the craft have unrestricted maneuverability or where winds and wave actions could endanger an alongside tow. When towing in a fore or aft tow, arrange the tow line in a straight tow (figure 044-4.2a). The maximum length of the tow lines should not exceed three times the length of the vessel under tow. When entering a protected anchorage, the tow lines should be shortened to increase maneuverability.

The craft being towed should be kept under close observation during the entire towing operation so that the towing lines do not slack into the water and get drawn into propellers of the tow craft. When towing, day shapes are to be displayed or tow lights are to be lit indicating a fore and aft or alongside tow.

Figure 044-4.2a. Fore and Aft Tow

044-4.3 Alongside Tow

An alongside tow (figure 044-4.3a), is more suited for protected waters, or where maneuverability is restricted. Prior to going alongside the disabled craft, both craft should put fenders over the side fore, aft, and midship. The towing craft should come alongside the disabled craft from the quarter to position itself in an aft bearing tow position. The working lines (A, B, D, figure 044-4.3a), are connected before the spring line (C, figure 044-4.3a), is connected.

If there is a vertical displacement between the tow and towing craft's mooring cleats, chaffing gear should be attached between the tow lines and the chaffing points.

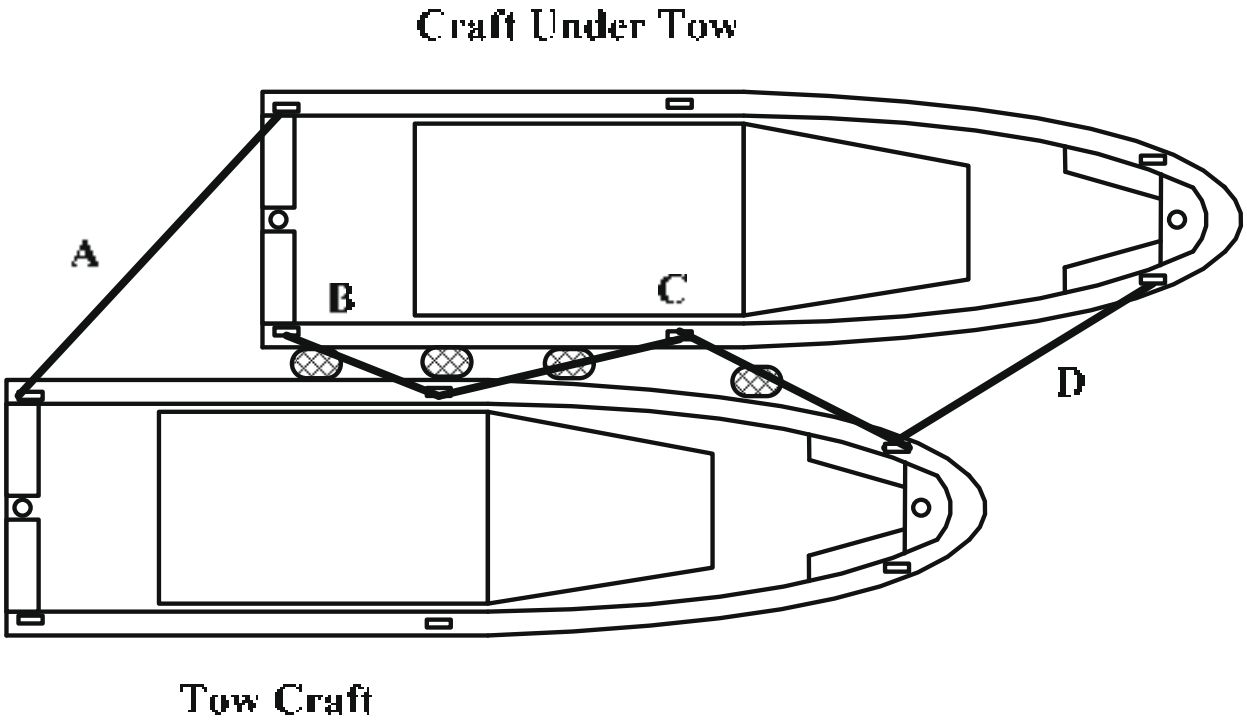


Figure 044-4.3a. Alongside Tow

044-5 Handling Characteristics

Boat handling is a complex skill that requires knowledge and practical underway experience to build confidence and skill level. Use forethought and finesse when handling the boat. Know the boat's handling features, monitor weather conditions, and be aware of the operating limitations of the boat.

This section contains the following information.

044-5.1 Turning and Pivoting

Each boat turns or pivots, for steering purposes, on its vertical axis, at approximately the aft cabin bulkhead when fully trimmed in. Due to this characteristic (which provides other benefits such as straight-line tracking and planing), coxswains must be aware of the boat's turning capabilities.

WARNING

High-speed turns while improperly trimmed may result in injury to crew or damage to the boat.

044-5.1.1 Turning on Plane

Avoid making sharp, high-speed turns while improperly trimmed. Due to the reduced amount of wetted surface (hull in water), sharp, high-speed turns may result in hooking a chine. This can be hazardous and may result in injury to the crew or damage to the boat. If a sharp turn is required, trim the engines in (down), before turning.

044-5.2 Buoyancy	The primary consideration when advancing in head seas is to maintain forward momentum and keep the bow into the swell. The buoyant construction of the boat allows it to ride up over oncoming seas.
044-5.3 Over-Acceleration	When heading into the wind and up the face of large waves, care must be taken to avoid over-accelerating, which can result in the bow being caught and creating a pitch-pole situation where the boat is inverted end-over-end.
044-5.4 Beam Seas	Whenever possible, the coxswain should avoid steering a course parallel (broadside) to heavy swells. Tack across the swells at a 30 to 40 degree angle. If necessary, steer a zigzag course, making each leg as long as possible, and adjust the boat speed for a safe and comfortable ride. Seas directly off the beam of the boat can cause adverse rolling conditions. When transiting parallel to the seas, the boat will tend to ride the contour of the wave surface. This means that the boat's vertical axis will remain perpendicular to the surface on which the boat is operated. A wave face of 20 degrees will cause a 20 degree heel.
044-5.5 Following Seas	Following open seas up to six feet can be negotiated at full speed as long as the boat remains stable as it travels down the front of the swell. In bad weather, boats are relatively safe running before the sea due to their speed. If caught in breaking seas, this advantage is used to ride the back of the waves while adjusting speed as required.
044-5.6 Quartering the Seas	Taking larger head seas slightly off of either bow can create a more comfortable ride, as the boat may proceed more gently off the back of the wave instead of slamming violently. The speed and angle of approach will have to be adjusted as needed for the optimum ride. This is referred to as quartering the seas, which is not to be confused with taking a following sea on the quarter.

044-5.7 Maneuverability	In calm or negligible wind and seas, the boat responds well using standard twin-screw operating practices. In stiff winds, several design features combine to make handling this boat challenging. With the majority of weight and the deepest draft aft, the bow is very susceptible to the effects of the wind. Moderate winds may have an effect on maneuverability and can often be the predominant environmental factor in maneuvering situations. It can be difficult to recover and turn the bow into the wind at slow speeds.
044-5.8 Stern-To	Station keeping requires concentration to maintain a constant heading and position. The boat tends to work well with its stern to the wind as the bow tends to weathervane downwind. If stern-to station keeping is not an option, the operator must use extra care to counteract environmental factors.

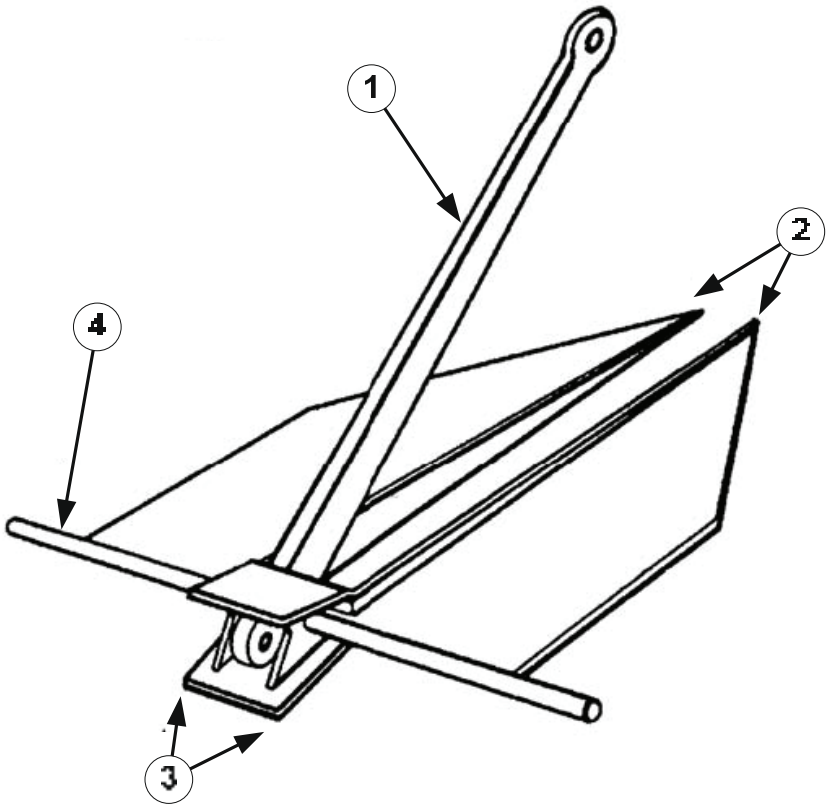
44-5.9 Anchor System

The marine anchor is stowed in the fwd deck anchor locker (figure 44-5.9a). The anchor is designed to hold a working load of 408 kg (900 lbs.) and a boat length of 8 to 10 meters (28 feet to 32 feet). The anchor weighs 3.2 kg (7 lbs.) with an anchor line of 150-foot of 5/8-inch double braided nylon (DBN). A 316 stainless steel thimble is spliced into one end of the anchor line, a 9-foot, 3/8-inch stainless steel anchor chain is attached to the anchor line thimble with the jaw -to-jaw swivel. The free end of the chain is attached to the anchor with a 316 stainless steel shackle with captive pin. The anchor locker is equipped with drains.

Figure 44-5.9a. Anchor Locker

44-5.9.1 Fluke Style Anchor

The fluke style anchor (figure 44-5.9.1a), is designed for holding strength. The shank (1, figure 44-5.9.1a), provides an attachment point for the anchor line and aids in setting and weighing the anchor. Flukes (2, figure 44-5.9.1a), dig into the bottom and bury the anchor, providing holding power. The crown (3, figure 44-5.9.1a), lifts the rear of the flukes, forcing them into the bottom, and the stock (4, figure 44-5.9.1a), prevents the anchor from rolling or rotating.



1. Shank **3. Crown**
2. Flukes **4. Stock**

Figure 44-5.9.1a. Fluke Style Anchor

44-5.10 Anchoring

The anchorage should always be approached heading into the wind and/or current, whichever is stronger. Allow a full 360-degree swing (figure 44-5.10a), that is clear of any obstacles. As anchorage is approached, the vessel should be stopped or even begin to drift back. The anchor should be lowered quickly, under control until it is on the bottom. The vessel should continue to drift back, and the cable should be veered out under control so it will be relatively straight. A minimum of 8:1 for setting the anchor, and 5:1 for holding is required. The vessel should be gently forced astern. A hand on the anchor line may telegraph a series of jerks and jolts, indicating the anchor is dragging, or a smooth tension indicative of digging in. As the anchor begins to dig in and resist backward force, the engine may be throttled up to get a thorough set. This enables the anchor to dig-in and provide good holding power. Adjust rode as conditions require.

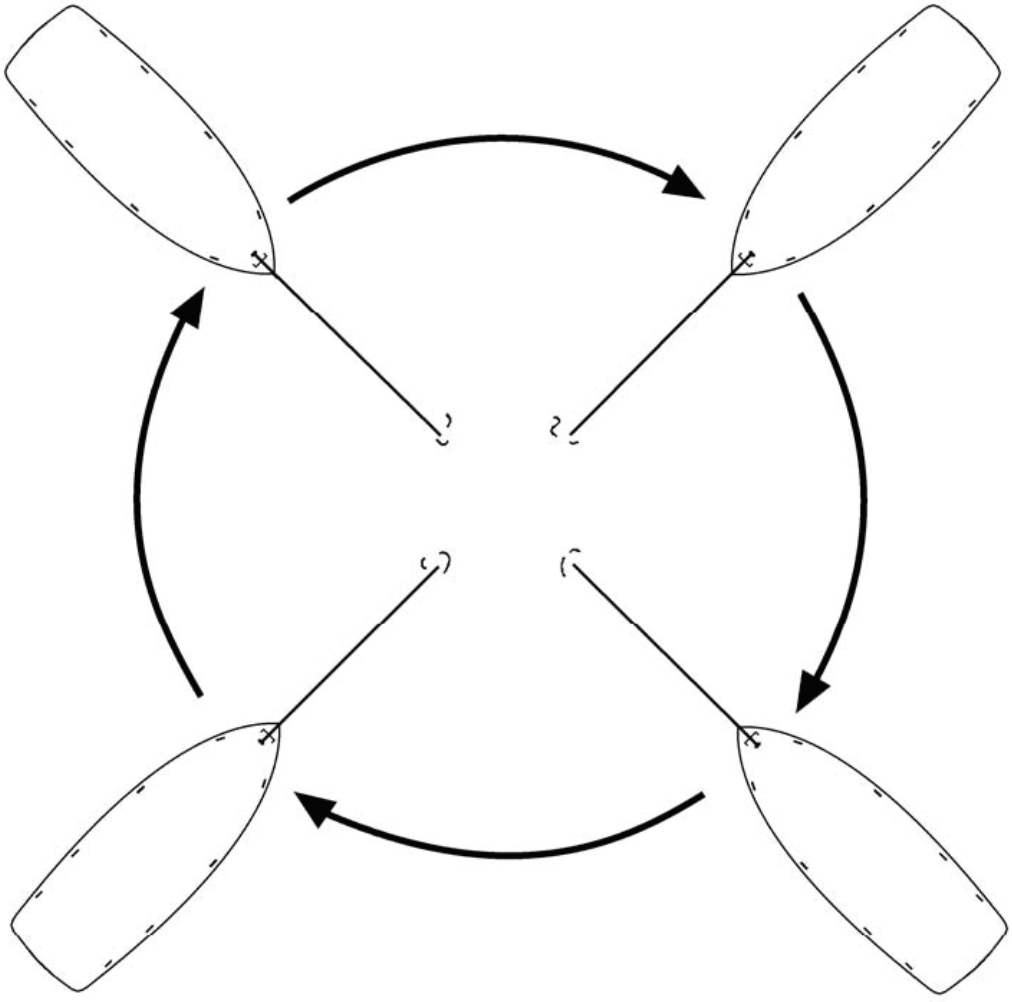


Figure 44-5.10a. Boat Swing at Anchor

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SECTION 100 HULL STRUCTURE, GENERAL

100	Hull Structure
100 General	The boat hull is 5086 marine aluminum. The hull design is a monohull, deep-vee planing hull form with a pointed bow and flat transom. The deadrise is 25° at the transom, and is defined as the angle between the baseline plane and the hull bottom when measured perpendicular to the boat centerline. The hull deepest draft is at the step. Performance fins (figure 100.1a), are located port and stbd below the aft portion of the collar. They provide lift upon acceleration and create a vacuum for stabilization during turning. Custom lifting strakes (figure 100.1b), are located on each side of the vee bottom hull to improve sea keeping, directional stability, and planing performance. A 1/4-inch 5086 beaching plate (figure 100.1c), is welded to the keel along the forefoot to provide additional protection to the hull.

Figure 100.1a. Performance Fin

Figure 100.1b. Lifting Strakes

Figure 100.1c. Beaching Plate

SECTION 100 HULL STRUCTURE, GENERAL

100-1 Hull Construction and Framing

The hull is 1/4-inch bottom plating. The deck is 5/32-inch 5086 marine grade aluminum. Side plating is 3/16-inch 5086 marine grade aluminum. Internal herringbone stiffeners direct impact energy along its natural course of flow to efficiently disperse it.

100-2 Rig Tubes and Wire Ways

All wiring and hydraulic lines run through rigging tubes (figure 100-2a), located directly below the cabin deck on the port and stbd sides where they interconnect with the transverse rigging tube. There are multiple access points to the rig tubes. Wiring within the cabin overhead or to the radar arch is routed through overhead wire ways that originate in the helm and run up through the windshield corner posts (figure 100-2b).

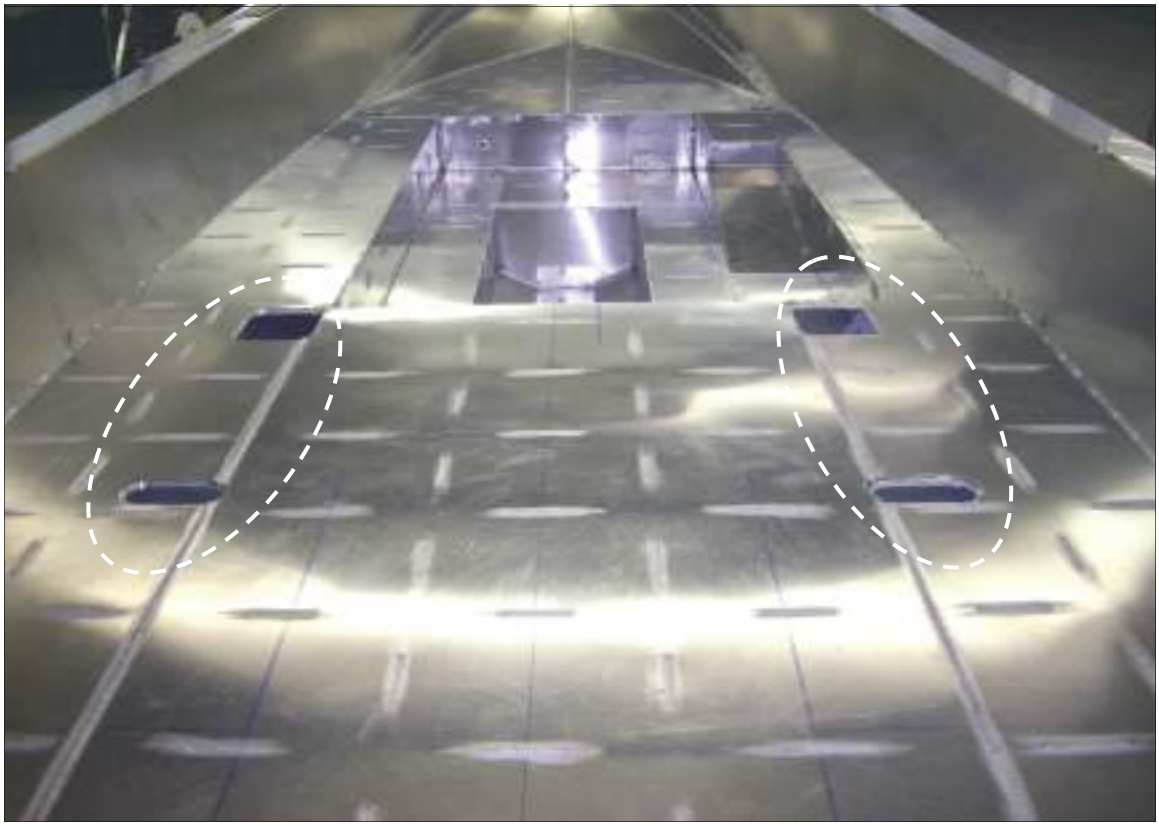


Figure 100-2a. Rigging Tubes

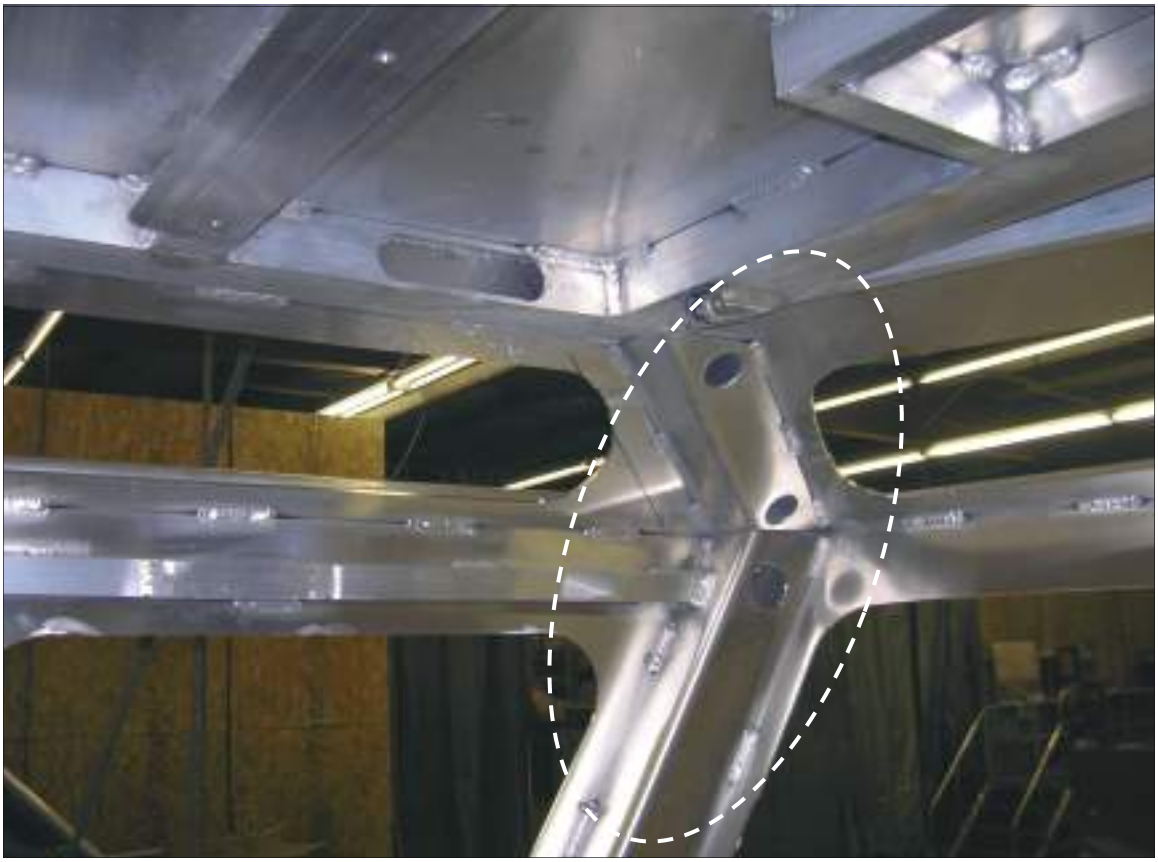


Figure 100-2b. Overhead Wire Ways

100-3 Hull

Figure 100-3a shows the 5086 herringbone framing tacked to the hull. The herringbone stiffeners are fit 90º to each other. The herringbone does not run into the side sheet, but is cut at a 45º angle with a wrap weld at the end. During the full weld out, the side sheet is welded to the bottom sheet 100% inside and outside. The herringbone is skip welded to the hull. The vertical joints in the herringbone are welded 100% to each other and to the girders and tank mounts.

Figure 100-3b shows the deck plate attached using plug welds. After the main deck is installed, all of the plug welds are tacked to the deck tubing. The seam between the main deck and the side deck is tack welded. The plug welds, the seam between the side deck and the main deck are fully welded.

Figure 100-3a. Boat Framing

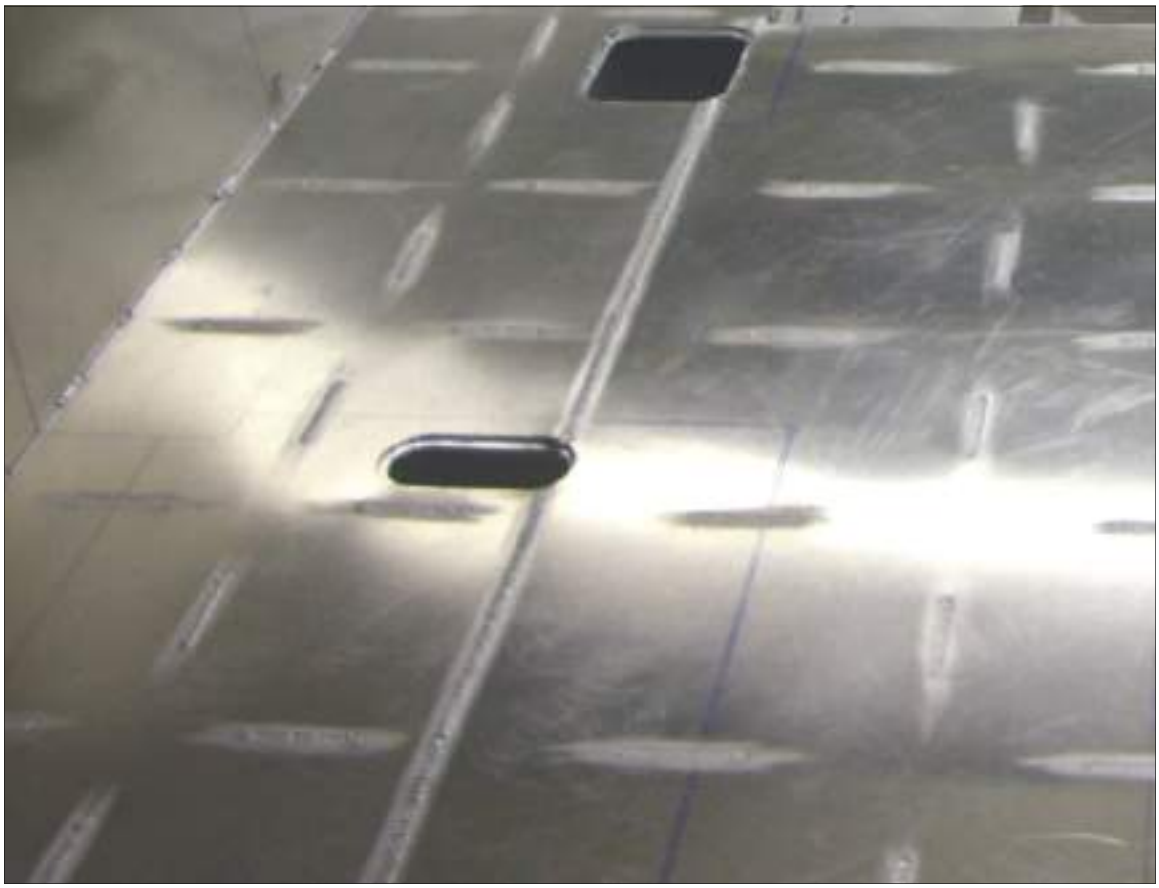


Figure 100-3b. Deck Welds

100-4 Inspection

There are access ports for inspection and pressure testing of the hull. An inspection plug is located forward of the transducer and is used for hull draining and bore scope access. A bore scope is required for internal inspection.

100-5 Windows

All the boat windows are bolt in safety glass. The two windshield sections (figure 100-5.1a), fwd quarter side windows, spotter and brow windows (along roof line), side door windows, aft windows, and aft door window are fixed windows. The cabin aft side windows are slide open windows. The spotter and brow windows are tinted to reduce glare. Refer to table 100-5.1 for window and gasket replacement procedure.

Figure 100-5.1a. Windshield and Spotter Windows

100-6 Spotter and Brow Windows	**Spotter windows** are located on the port and stbd sides of the main cabin overhead (up to 4). **Brow windows** are located above the port and stbd windshields (2 total) overhead in the brow of the cabin roof top. All windows and doors are weather tight. Butyl tape is not used during installation due to the nature of the tape to melt and run in hot weather climates, and is very difficult to remove if it becomes necessary to replace window or door. SAFE Boats International uses a "D" bulb gasket. This gasket bonds to the window frame using compression to provide a weather tight seal against the aluminum house. Condensation is a common occurrence in the marine environment and can cause water build up on the glass, frame or on the dash from dripping condensation.
100-7 Main Cabin Side Windows	Main cabin side windows are slide open windows and can be opened for ventilation. A latch on the aft end of the interior slider locks the window in the fully closed position.
100-8 Exterior Rails and Handholds	Rigid, fixed rails and handholds are fitted horizontally around the exterior sides and roofline of the main cabin and the cuddy cabin. Fixed rails and handholds are also mounted around the bow and aft decks and are coated with grip tape for crew and passenger safety. Refer to table 100-8.1 for grip tape removal and installation.
100-9 Interior Handholds	Interior handholds run the length of the main cabin port and stbd above the seats. A single handhold is mounted on the console above the cuddy access. Handholds in the cuddy cabin are behind the bench seats and port and stbd of the access door.

Table 100-5.1. Window and Gasket Replacement Procedure

Step	Action
	Note 1: Two persons are required to remove and install the windows. One person on the inside and one person on the outside.
1.	Secure window externally with tape or by hand.
2.	Remove securing bolts from interior window frame. Retain all hardware for reinstallation.
3.	Remove window and interior mounting frame from boat.
4.	Remove interior window mounting frame from replacement window (figure 100-5.1a). Retain all hardware for installation.
	 **Figure 100-5.1a. Replacement Mounting Frame and Window**

Table 100-5.1. Window and Gasket Replacement Procedure (cont.)

Step	Action
	Note 2: If re-installing the removed window, remove old gasket material and glue residue using a green pad (Scotchbrite) and a lacquer thinner or another solvent.
5.	Clean inboard side of replacement window frame with solvent.
	Note 3: Do not stretch trim-lok gasket during application. Bunch the gasket material in or around corners to ensure adequate material for seal. Stretching may produce leaks.
6.	Remove adhesive backing from trim-lok gasket and apply one end of gasket (figure 100-5.1b), to bottom inboard mounting edge of replacement window.
	 **Figure 100-5.1b. Trim-lok Gasket**

Table 100-5.1. Window and Gasket Replacement Procedure (cont.)

Step	Action
7.	Work gasket around window so ends meet at the base of the window and are tight to one another with no gaps.
8.	Coat finish end of gasket with 540 sealant (figure 100-5.1c), and press into place ensuring contact with opposite end.
	 **Figure 100-5.1c. Adhering Gasket Ends**

Table 100-5.1. Window and Gasket Replacement Procedure (cont.)

Step	Action
9.	Using a straight edge (figure 100-5.1d), ensure the window opening has been tuned to within 1/8-inch.
10.	Using a dead-blow hammer, carefully adjust the aluminum opening to within 1/8-inch range.
	 **Figure 100-5.1d. Out-of Tolerance Window Opening**

Table 100-5.1. Window and Gasket Replacement Procedure (cont.)

Step	Action
11.	Clean cabin window mounting surface with solvent.
12.	Place window in boat opening on outboard side of cabin with gasket against the hull of the boat.
	Note 4: Install securing screws by hand, do not use power tools.
13.	Place interior window frame (figure 100-5.1e), over window opening and secure window corners with mounting screws.
14.	Verify placement of window and mounting frame. Secure remaining bolts, working in an alternating fashion.
15.	Verify bolts are hand tight and window opens and closes without binding.
	 **Figure 100-5.1e. Interior Window Frame**

Table 100-5.1. Window and Gasket Replacement Procedure (cont.)

Step	Action
16.	Allow 48 hours for settling and snug all screws by hand again.
17.	Repeat step 16 after an additional 48 hours to ensure window settling and secure seal.

Table 100-8.1. Handrail Grip Tape Removal and Installation

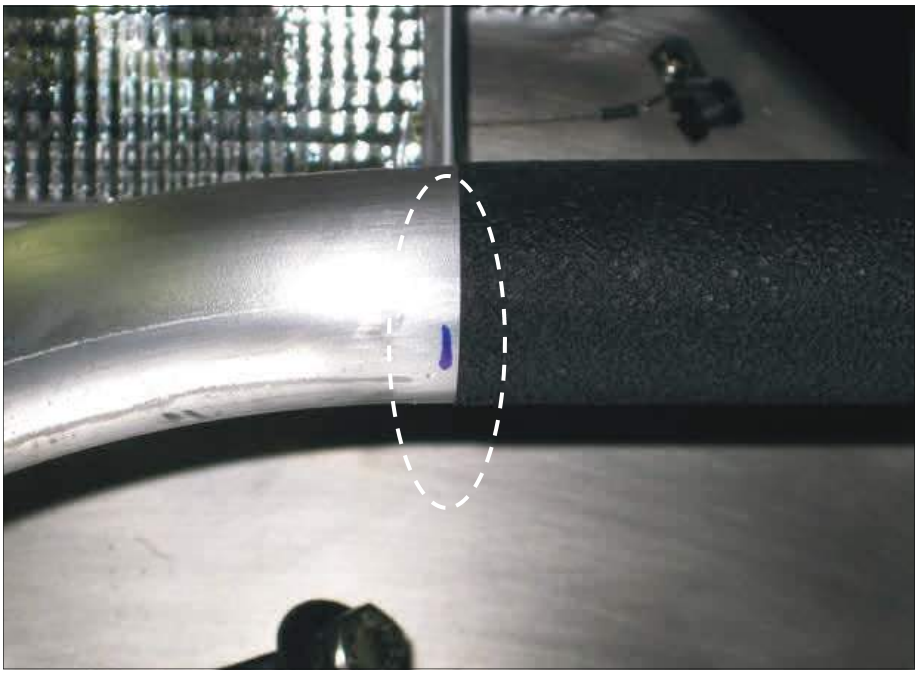
Step	Action
1.	Mark the location at both ends of the grip tape to be replaced with a permanent marker (figure 100-8.1a), prior to removal. This allows for ease of installation.
	 **Figure 100-8.1a. Grip Tape Location Mark**
2.	Remove damaged grip tape with the aid of a heat gun, being careful not to overheat and melt the tape.

Table 100-8.1. Handrail Grip Tape Removal and Installation (cont.)

Step	Action
3.	Clean dirt, debris and residue from rail using soap and water or lacquer thinner for tough residue.
	WARNING **When working with acetone, wear gloves, safety glasses and a face mask. Failure to comply may result in personnel injury.**
	WARNING **When working with acetone, ensure adequate ventilation. Failure to comply may result in personnel injury.**
4.	Scuff the aluminum rail with Scotchbrite pad and clean with lacquer thinner or acetone. Be careful not to remove location marks.
	Note 1: For straight rails, the measurement marks should be 1/8-inch from beginning of weld to 1/8-inch from next weld.
	Note 2: For rails with bends, the measurement marks should be where the rail tapers away from the straight edge.
5.	Measure length between placement marks. If necessary measure length of rail accordingly.
6.	Apply this measurement to a new roll of grip tape and cut at a 90 degree angle with a razor blade or scissors.

Table 100-8.1. Handrail Grip Tape Removal and Installation (cont.)

Step	Action
7.	Using applied marks, peel the protective backing from the grip tape and lay one side of the grip tape tight against the center of the rail (figure 100-8.1b).
	 **Figure 100-8.1b . Grip Tape Installation**
	Note 3: This will result in an overlap around the back of the rail.
8.	Peel back protective backing and work out air pockets and creases as you adhere grip tape to rail.
9.	Using a razor blade, cut through both flaps of grip tape where they overlap the length of the piece.

Table 100-8.1. Handrail Grip Tape Removal and Installation (cont.)

Step	Action
10.	Fold the flaps back and remove excess grip tape.
	Note 4: This will now join the two flaps, end to end without overlap or gaps.
11.	Re-affix the grip tape to the rail.
12.	Using the heat gun, seal the seam while being careful not overheat the tape.
13.	Trim any uneven area on either end.

SECTION 100 HULL STRUCTURE, GENERAL

100-10 Cabin Doors	The cuddy cabin fwd door, main cabin side doors, and aft cabin door are all lockable doors accessed by a single key. SAFE Boats International retains a spare key. Replacement keys are available from Diamond Sea Glaze.
100-11 Radar Arch	The radar arch is located on the aft roof top, above the aft cabin door. The radar arch typically houses the radar pod or array, flood lights, strobe lights, loudhailer speaker, horn, and all around light. The arch is hinged above the aft cabin door and secured with latches, located forward on the arch to the roof top. Connections are accessed by referring to table 100-11.1 for lowering the radar arch.
100-12 Engine Safety Shut-Off Switch and Lanyard	The engine safety shut-off switch and lanyard is located at the coxswain's station. One end of a safety lanyard is attached to the switch and the other end of the lanyard is clipped to the coxswain's personal flotation device (PFD). The lanyard is required to be in place to start the engines. If the coxswain is pulled away, or leaves the helm, the safety lanyard will be pulled out of the safety shut-off switch, shutting down the engines.
100-13 Engine Ignition Keys	The boat is equipped with an ignition key for each engine, located at the coxswain's console and requires ignition keys and engine safety shut-off lanyard to be in place to start engines. Keys are provided by the engine manufacturer and are keyed the same for all ignition panels on the vessel.

Table 100-11.1. Lowering Radar Arch Procedure

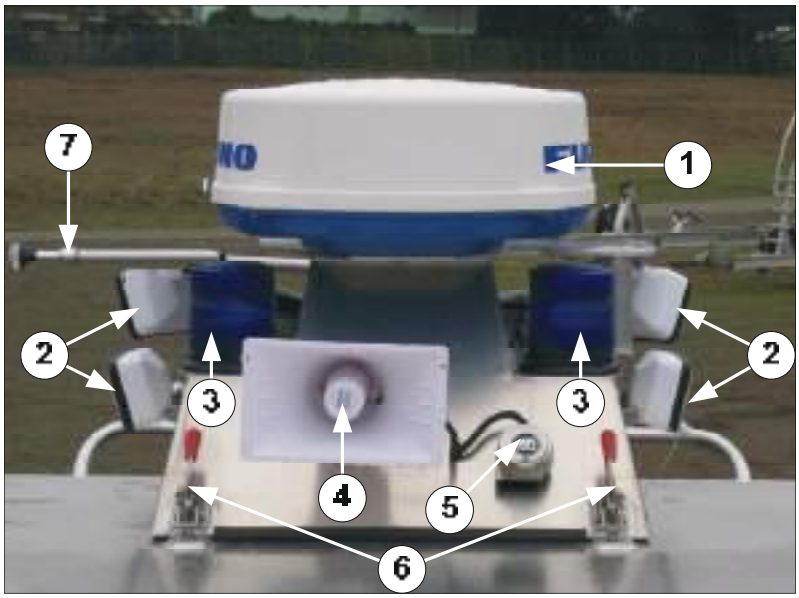
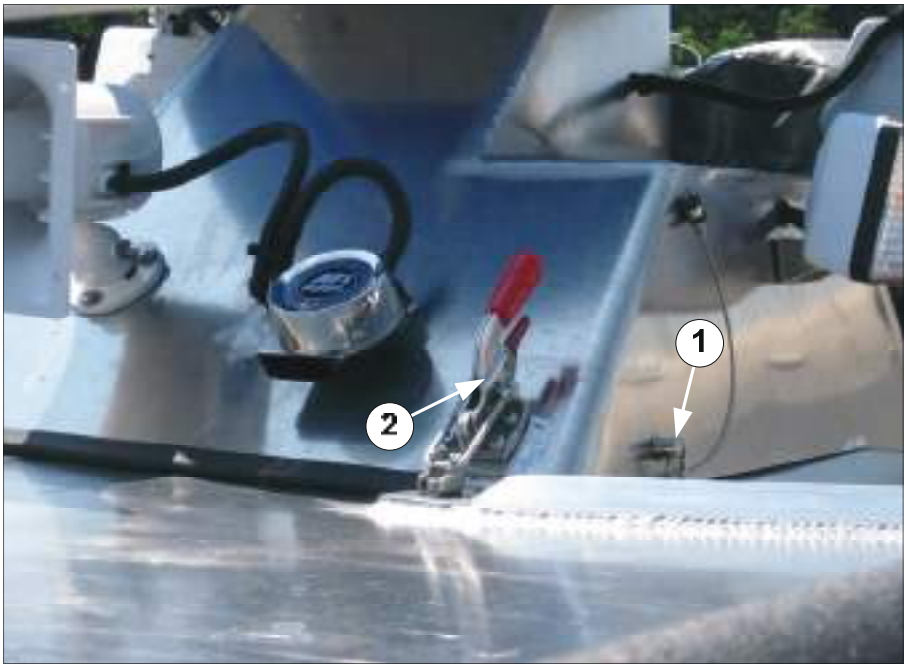
Step	Action
	WARNING **Radar arch is heavy and awkward. Two persons minimum recommended for lowering. Failure to comply may result in injury to personnel or equipment.**
1.	**Tag out in accordance with local command electrical safety instructions.**
	 **1. Radar** **2. Flood Lights** **3. Strobe Lights** **4. Loudhailer Speaker** **5. Horn** **6. Securing Latches** **7. All Around Light** **Figure 100-11.1a. Basic Radar Arch**
2.	Ensure tow light post is stowed.
3.	Release two securing latches (6, figure 100-11.1a), on fwd side of radar arch.

Table 100-11.1. Lowering Radar Arch Procedure (cont.)

Step	Action
4.	Remove locking pins (1, figure 100-11.1b), from port and stbd sides of radar arch.
	 **1. Radar Arch Locking Pin** **2. Securing Bracket** **Figure 100-11.1b. Radar Arch Locking Pins**
5.	Ensure aft cabin door is secured in the closed position.
6.	With one person on aft deck, rotate radar arch up and aft to the lowered position.
7.	Access to radar arch wiring is from cabin roof top.
8.	To raise radar arch, reverse procedure.

SECTION 114 FENDERING SYSTEM

114	Fendering System
114 General	The fendering system (collar) (figure 114-1a), is of a design covered by the U.S Patents developed and owned by SAFE Boats International regarding the use of foam for the stabilization of watercraft. The collar system also provides redundant buoyancy above and beyond the airtight hull of the boat, rendering it virtually unsinkable. The collar is 100% foam, no air is used. The closed cell polyethylene foam is shaped to the required geometry of the hull. The foam does not inherently absorb or retain water. The foam is inserted into a 1.1kg (40 oz.) per square yard blended polyurethane membrane collar that is reinforced with a woven polyester base cloth. The water-contacting surface of the collar is protected by an aluminum performance fin, which protects it from damage and enhances the handling characteristics of the boat.
114-1 Inspection	Inspections should be performed daily after each use to insure no damage has occurred. Both the upper and lower collar flanges (figure 114-1.1a), should be snug against the collars. If there are gaps, the flanges can be closed tight to the collars by using a five-pound dead-blow hammer. The exterior (figure 114-1.1b), should be checked for punctures or delamination. Small punctures in the collar are difficult to detect due to the excellent memory of the polyethylene foam. In the case of a blunt force impact, damage may not show as punctures or tears. **Contact SBI at 360-674-7161 with any questions or concerns before attempting collar repair.** Refer to table 114-1.1 for collar material and specifications and table 114-1.2 for collar test specifications.

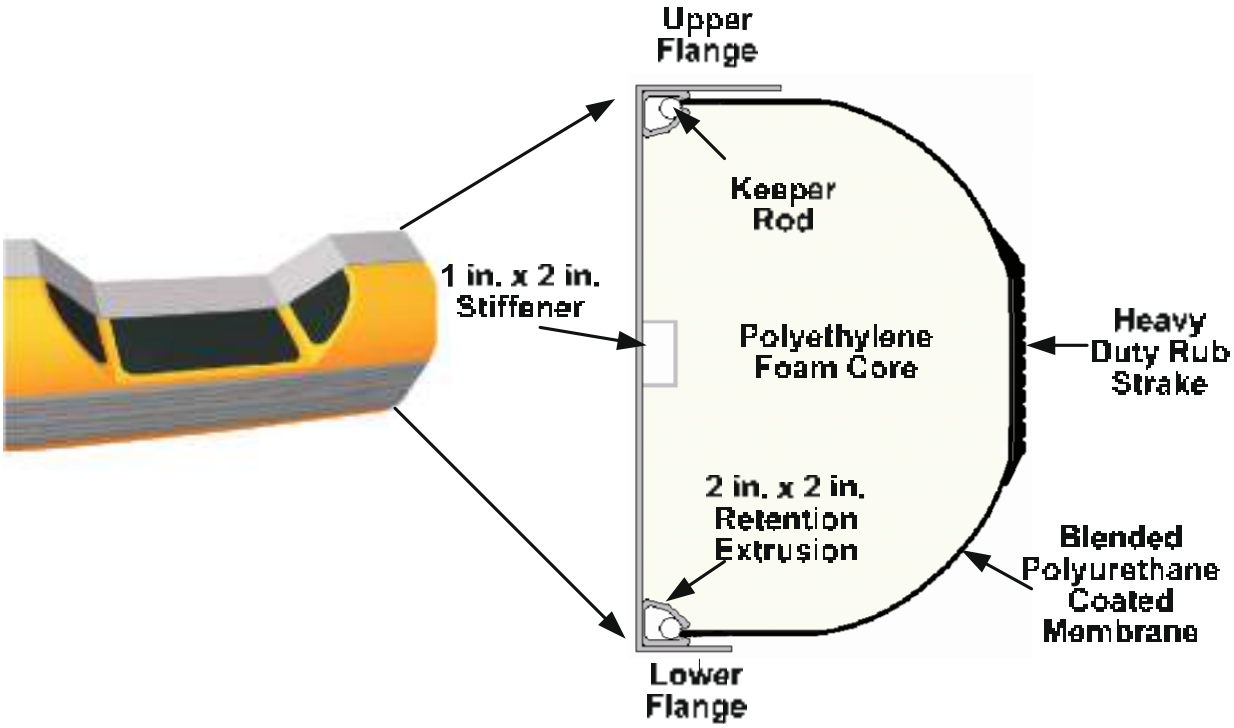
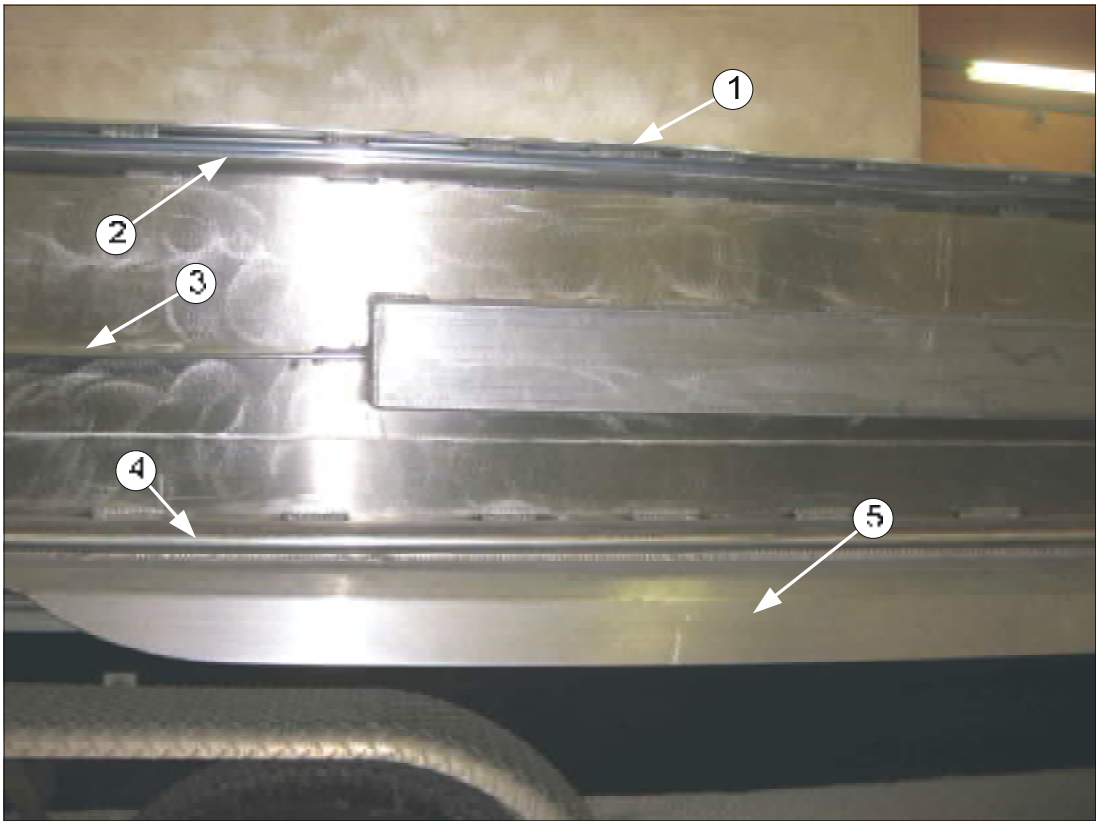
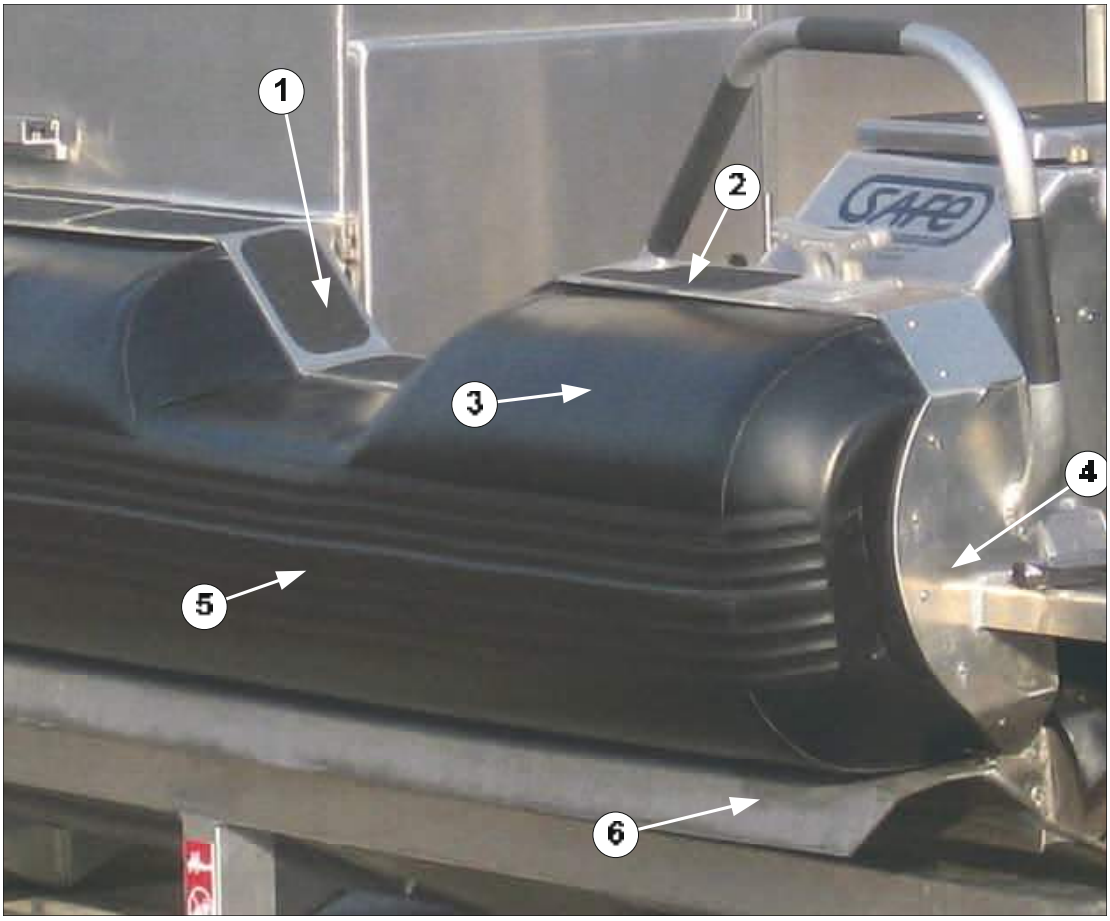


Figure 114-1a. SAFE XDR Collar System



1. Upper Flange
2. Upper Extrusion
3. Stiffener
4. Lower Extrusion
5. Lower Flange and Performance Fin

Figure 114-1.1a. SAFE XDR Collar Mounts



1. PRC Cutout
2. Upper Flange
3. Polyurethane Coated Membrane
4. Aft Capture Plate
5. Rub Strake
6. Lower Flange and Performance Fin

Figure 114–1.1b. SAFE XDR Collar

Table 114-1.1. Collar Material and Specifications

Fabric Material	Woven polyester
Collar Material	1.3 lbs. per cubic foot polyethylene foam
Fabric Weight	15 oz. per square yard
Finished Fabric Weight	40 oz. per square yard
Tongue Tear	448/495 lbs. per foot ASTM D751
Grab Tensile	1618/1683 lbs. per foot ASTM D751
Strip Tensile	1333/990 lbs. per inch ASTM 751 Procedure B
Adhesion	43 lbs. per inch dielectric weld
Hydrostatic Resistance	1000 lbs. per Inch
Low Temperature	Pass at -30º F
Abrasion Resistance	10,000 cycles ASTM 3389
H-22 Wheel Abradement	1000 gram load

Table 114-1.2. Collar Test Specifications

Property	Test Method	Unit	Characteris-tics
Average Density	ASTM D 3575	pcf	1.3
Compressive Strength	ASTM D 3575		
@ 25%		psi	13
@ 50%		psi	21
@ 75%		psi	51
Tensile Strength	ASTM D 3575	psi	34
Tensile Elongation	ASTM D 3575	%	16
Tear Strength	ASTM D 3575	lbs/in	11
Compressive Set @ 25%	ASTM D 3575	%	8
Compressive Set @ 50%	ASTM D 3575	%	25
Cell Size Maximum	ASTM D 3575	m/m	0.3
Buoyancy	ASTM D 3575	pcf	61
Thermal Conductivity	ASTM D 3575	BTU/ft-hr	0.024
Surface Resistivity	ASTM D 3575	ohms/sq	N/A
Service Temperature	ASTM D 3575	°F	176°
R Value	ASTM D 3575	@ 68 °F	3.63 per in.

114-2 Foam Repair

If collar foam is lost, follow these instructions for the addition of polyethylene foam for repair. Call SAFE Boats International (SBI) to insure correct method of any repairs. Use only polyethylene foam provided by SBI. Refer to table 114-2.1 for foam repair procedures.

Tools needed:

- Patch Foam
- Razor Knife
- Heat Gun

Table 114-2.1. Foam Repair

Step	Action
1.	Verify that all loose and damaged foam has been removed.
2.	Remove any foreign material, such as oil or grease (figure 114-2.1a).
	 **Figure 114-2.1a. Foam Damage**

Table 114-2.1. Foam Repair (cont.)

Step	Action
	CAUTION **A high heat setting will melt the polyethylene foam and further damage area.**
3.	Apply heat gun from safe distance (figure 114-2.1b), and at lowest setting to dry out foam around repair area.
	 **Figure 114-2.1b. Heat Application**

Table 114-2.1. Foam Repair (cont.)

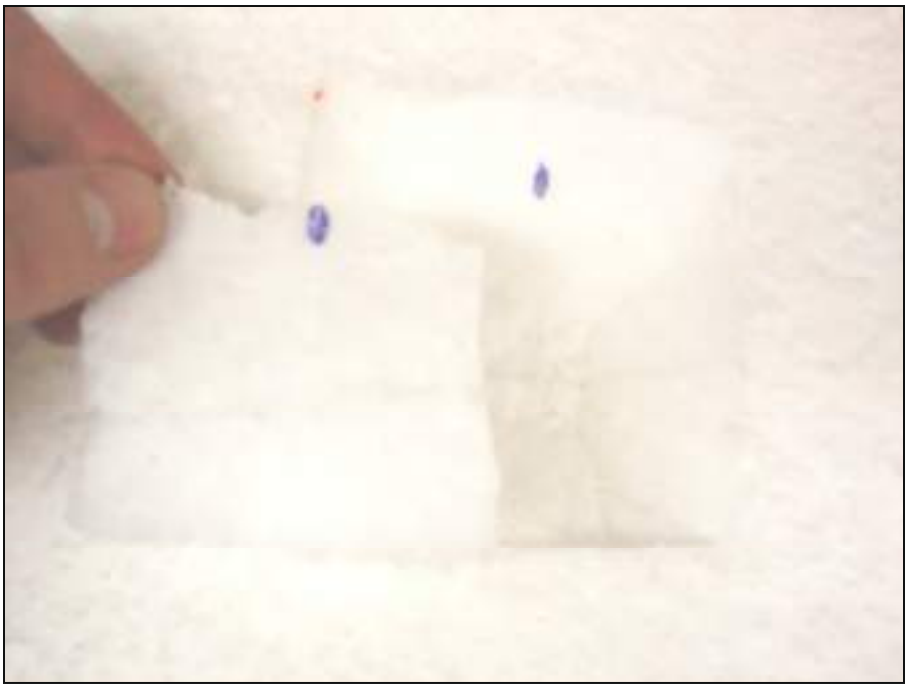
Step	Action
4.	Prepare the patch layer(s) of foam by cutting to the general size and shape of the area to be repaired (figure 114-2.1c).
	Note 1: For ease of repair, work with thin layers of foam, even when repairing deep gouges.
	 **Figure 114-2.1c. Patch Fitting**

Table 114-2.1. Foam Repair (cont.)

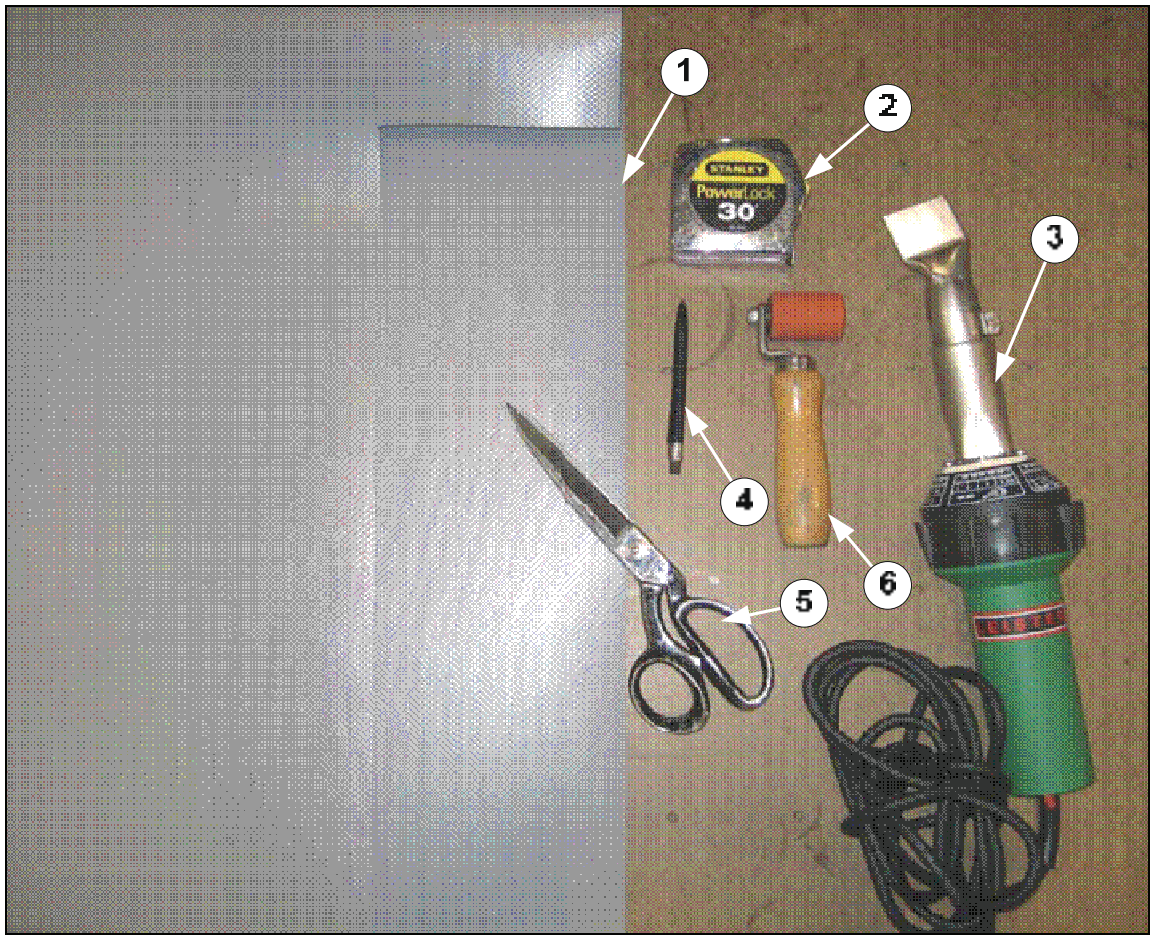
Step	Action
5.	Warm heat gun for five seconds on the highest setting.
	Note 2: If first experience heat welding, test on piece of foam prior to attempting repair.
6.	Hold repair section of foam in contact with the deepest area to be repaired (figure 114-2.1d).
	Note 3: The bond will be immediate once heat is applied.
7.	Maintain a distance of three inches between the heat gun and the material to be patched.
	 **Figure 114-2.1d. Heat Welding**

Table 114-2.1. Foam Repair (cont.)

Step	Action
8.	Once material begins to bond, work the heat gun out with a continuous side to side motion.
9.	Repeat bonding sections until void is filled.
10.	Trim excess foam from the patched area until flush with surrounding foam (figure 114-2.1e).
11.	Verify the damaged section has been completely replaced and is flush with the surrounding foam.
	 **Figure 114-2.1e. Foam Preparation**
12.	Reinstall the outer fabric membrane.

114-3 Fabric Repair

If the fabric of the collar becomes torn or punctured, repair using table 114-3.1 for fabric repair using tools shown in figure 114-3a or table 114-3.2 for fabric repair with Clifton adhesive. Practice with spare fabric before attempting to repair collar.



1. **Patch**
2. **Tape Measure**
3. **Heat Gun**
4. **China Marker**
5. **Scissors**
6. **Roller**

Figure 114-3a. Repair Tools

Table 114-3.1. Fabric Repair

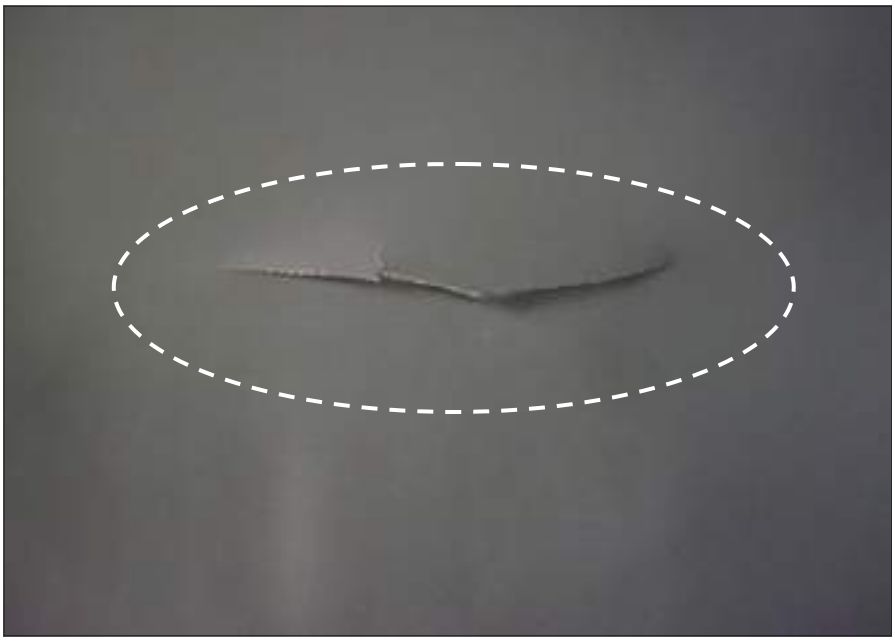
Step	Action
1.	Verify area behind the tear (figure 114-3.1a), is dry and free of any foreign material.
	Note 1: Refer to table 114-2.1 for foam repair.
2.	Ensure area to be patched is clean.
	Note 2: Practice with spare fabric before attempting to repair collar.
	 **Figure 114-3.1a. Tear Example**

Table 114-3.1. Fabric Repair (cont.)

Step	Action
3.	Warm up heat gun for five seconds.
	Note 3: The heat gun has an adjustable temperature range. The most used heat range is between 75-100% of its available power. The higher the heat the more rapid the adhesion, increasing the necessity to move when applying the patch.
4.	Roll while applying heat between layers (figure 114-3.1b).
	Note 4: Patch should overlap the tear or puncture by at least two inches.
	 **Figure 114-3.1b. Seam Repair**

Table 114-3.1. Fabric Repair (cont.)

Step	Action
5.	Being careful not to burn or overheat the surrounding fabric, work the roller back and forth (figure 114-3.1c), until the entire patch has adhered to the collar.
	

Figure 114-3.1c. Patch Repair

Table 114-3.1. Fabric Repair (cont.)

Step	Action
6.	Allow the patch (figure 114-3.1d), to cool completely prior to running the boat.
	 **Figure 114-3.1d. Repair Patch**

Table 114-3.2. Fabric Repair with Clifton Adhesive

Step	Action
	Recommended Safety Precautions: • Work in a well ventilated area • Chemical resistant gloves • Organic Fume respirator • Eye protection
	Environmental conditions: • Ideal ambient temperature for gluing: 75ºF and below 50% humidity • Maximum humidity: Do not try to mix and apply glue if the humidity exceeds 70%
1.	Area must be cleaned and all rough edges of material trimmed off to ensure patch will adhere securely.
2.	Measure and cut repair patch to size, ensuring a 1-inch overlap around entire repair and round the edges (figure 114-3.2a).
	 **Figure 114-3.2a. Repair Patch**

Table 114-3.2. Fabric Repair with Clifton Adhesive (cont.)

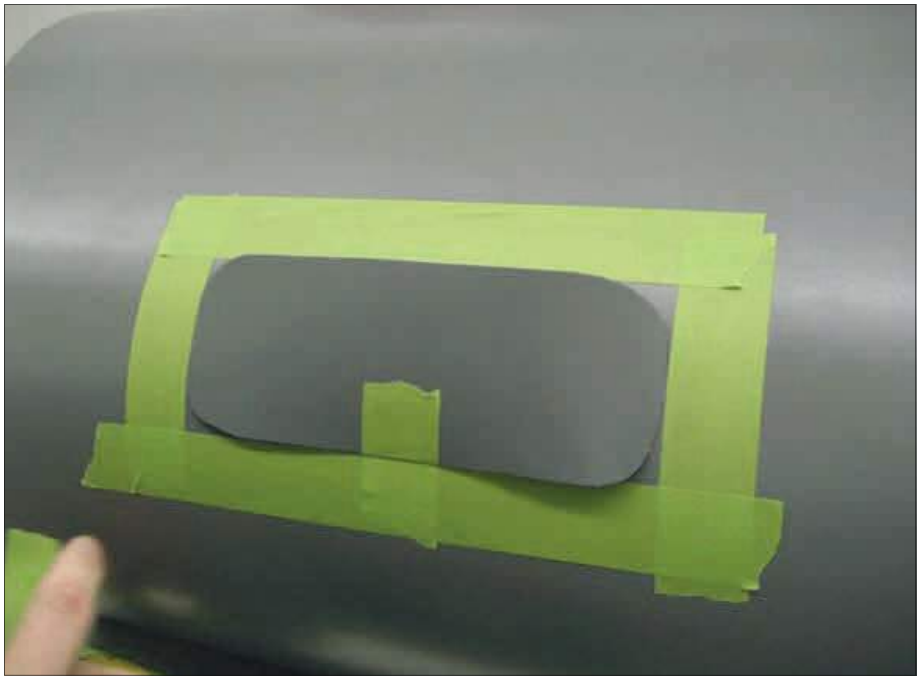
Step	Action
3.	Verify patch covers entire damaged area.
4.	Center patch over damaged area and tape in place with 2-inch masking tape.
5.	With patch held in place, use 2-inch masking tape to mask off the area surrounding the patch (figure 114-3.2b). Ensure complete coverage surrounding patch.
	 **Figure 114-3.2b. Masking Around Patch**

Table 114-3.2. Fabric Repair with Clifton Adhesive (cont.)

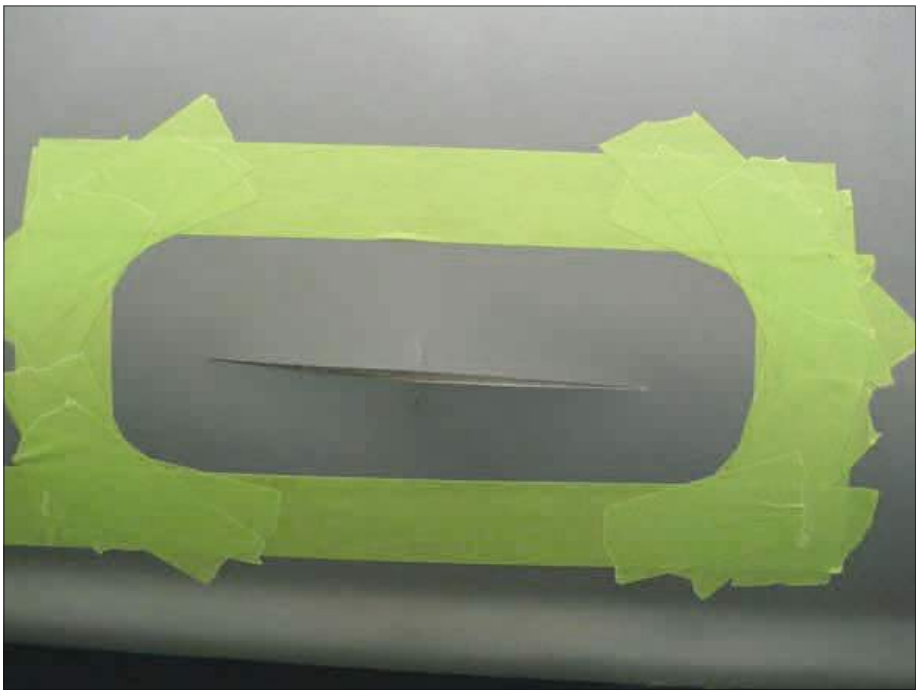
Step	Action
6.	When masking is complete, remove patch (figure 114-3.2b).
	 **Figure 114-3.2b. Masking Complete**

Table 114-3.2. Fabric Repair with Clifton Adhesive (cont.)

Step	Action
	Note 1: Do not buff the fabric down to the threads.
7.	Thoroughly buff all contact / gluing surfaces using a sanding wheel, 150 or 180 grit sandpaper (figure 114-3.2c), buff off the fabric shine.
	 **Figure 114-3.2c. Buffing Area**
8.	Repeat buffing on adjoining surface of repair patch.
9.	Clean the buffed surfaces with PVC cleaner, using a lint free towel. Allow to dry.

Table 114-3.2 Fabric Repair with Clifton Adhesive (cont.)

Step	Action
10.	Mix 0.75 fluid ounce of UR5208 catalyst (small jar) with 1 pint of UR5208 adhesive (large can).
	 **Figure 114-3.2d. Adhesive Mixing**
11.	Mix well.
	Note 2: The surfaces to be joined must be dry prior to applying adhesive.
12.	Coat both adjoining surfaces with a thin, even coat of adhesive mixture.
13.	Allow first coat of adhesive to dry – approximately 20 to 30 minutes. Conditions may vary drying time.

Table 114-3.2 Fabric Repair with Clifton Adhesive (cont.)

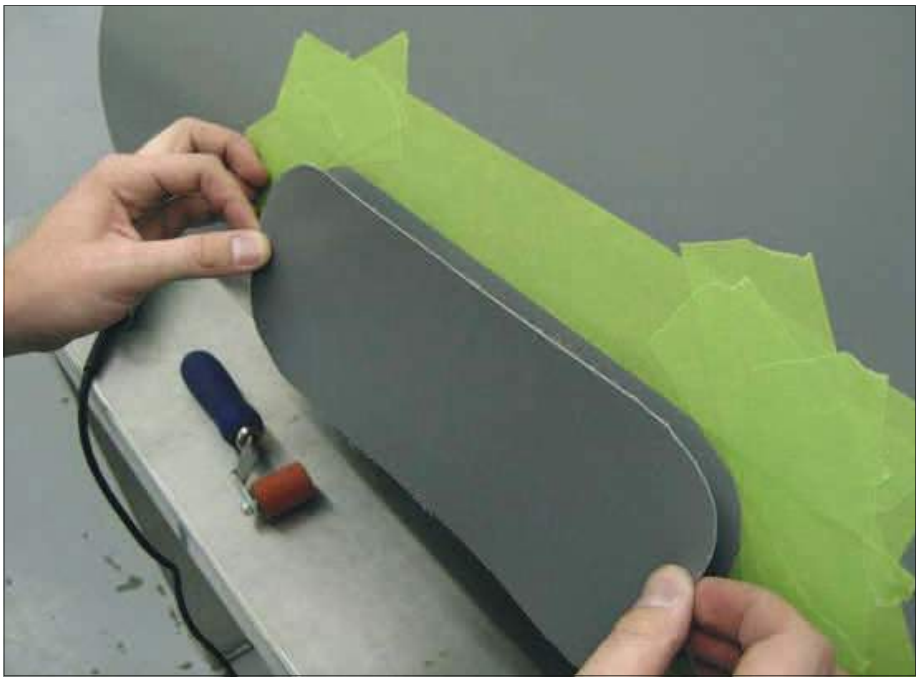
Step	Action
14.	Coat both adjoining surfaces with a second thin, even coat.
15.	Remove masking.
16.	When second coat is tacky, starting in the center, press both coated fabric pieces together (figure 114-3.2e).
	 **Figure 114-3.2e. Setting Patch to Collar**

Table 114-3.2 Fabric Repair with Clifton Adhesive (cont.)

Step	Action
17.	Using a heat gun with a temperature between 200ºF to 300ºF, wave heat between adjoining glued surfaces as they are rolled together. This forces any air bubbles out and meshes the two fabrics together.
18.	Roll from center out to ensure adhesion and smooth application (figure 114-3.2f).
	 **Figure 114-3.2f. Adhering Patch to Collar**
19.	Remove all masking.
20.	Ensure all of the patch edges are adhered securely.
21.	Allow to dry completely before placing back in service.
22.	Complete drying time takes approximately 24 hours.

114-4 Collar Removal

Follow the procedural steps in table 114-4.1 for collar removal. Read through the instructions completely prior to beginning the removal of the collar.

Table 114-4.1. Collar Removal

Step	Action
	Note 1: Save all hardware and capture plates for collar installation. Worn or damaged bolts and threaded inserts should be replaced as required.
1.	Remove the capture plates (figure 114-4.1a), located in the personnel recovery cutout and on the aft end of the collars. Retain all hardware for re-installation.
	Note 2: It will be necessary to remove the non-skid (if installed) from the personnel recovery cutout in order to access the bolts.
	 **Figure 114-4.1a. Capture Plate**

Table 114-4.1. Collar Removal (cont.)

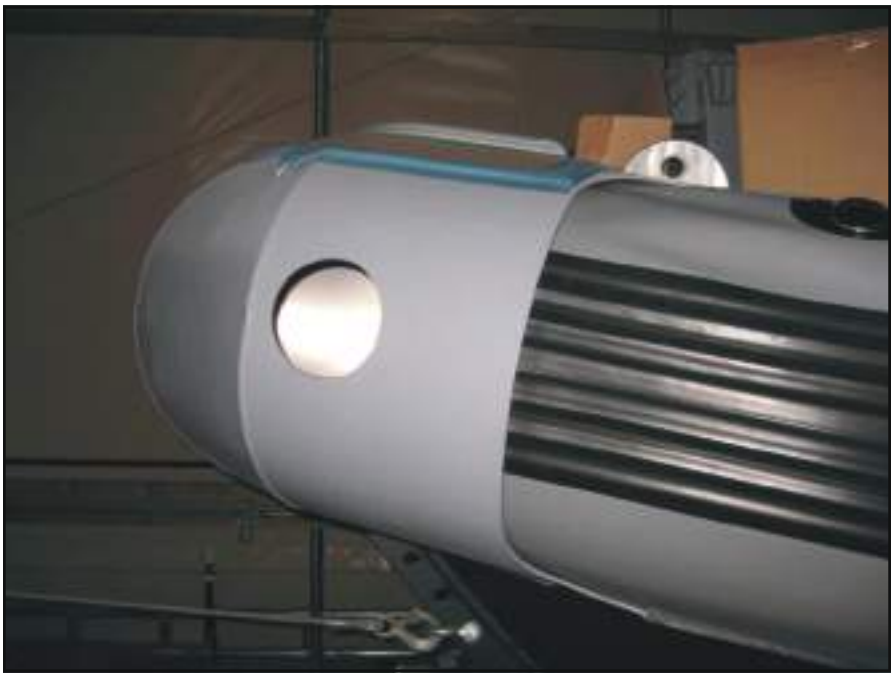
Step	Action
2.	Unlace the bow cover so that the five inch access holes in the bow (figure 114-4.1b), are exposed. It is not necessary to completely remove it from the boat.
3.	Remove the 12.7 cm (5 in.) diameter cover plates from the access holes.
4.	Remove the nuts from the four bolts inside the bow using a 14mm (9/16 inch) open end wrench or socket. This will release the bow tension ring from the interior flange.
	 **Figure 114-4.1b. Collar Access Holes**

Table 114-4.1. Collar Removal (cont.)

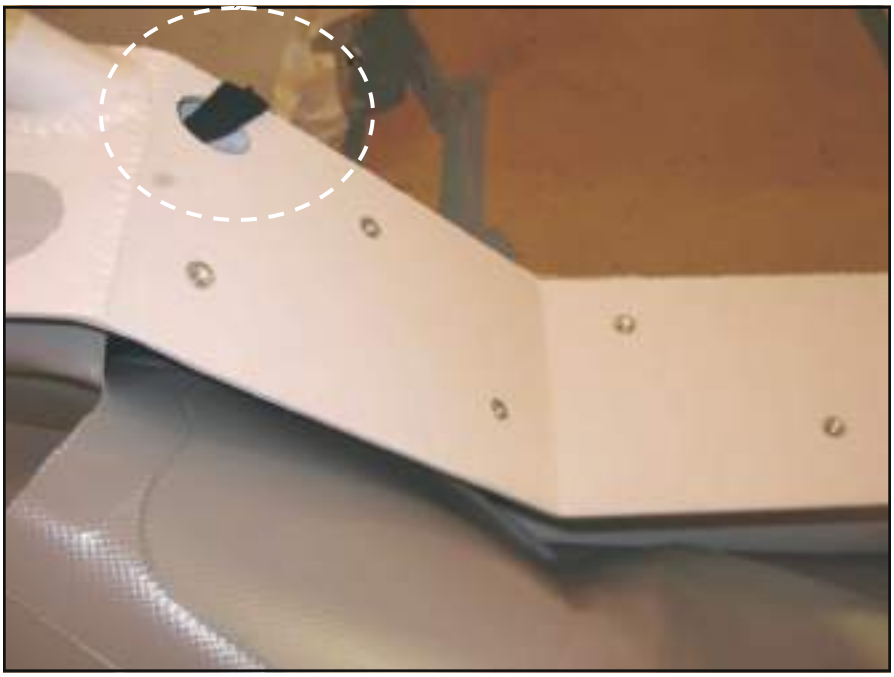
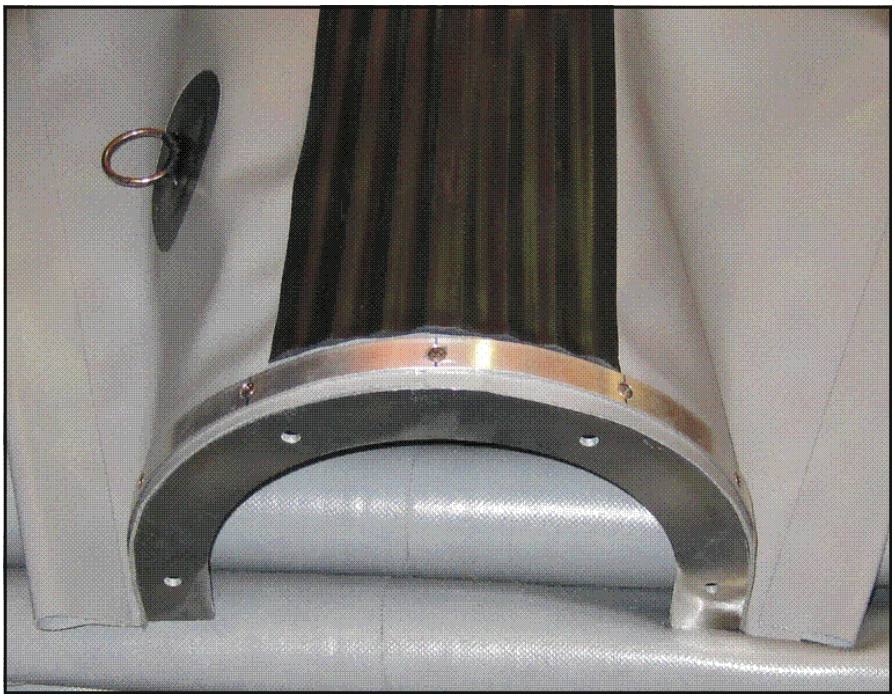
Step	Action
5.	Install the provided screw eye into the end of the aft upper extrusion rod located aft of the personnel recovery cutout (figure 114-4.1c). Remove the rod by pulling toward the bow. Removal may require using the provided 1 inch strap to aid in removing the rod.
	 **Figure 114-4.1c. Extrusion Access Hole**
6.	Repeat step 5. for rod removal of forward upper extrusion rod, located forward of the personnel recovery cutout.

Table 114-4.1. Collar Removal (cont.)

Step	Action
7.	With the upper rods removed, pull the upper portion of the collar out of the extrusion, letting the collar fall open to allow access to the foam.
8.	Remove all foam sections and set aside.
9.	Install the screw eye into the aft end of the lower extrusion rod. Remove the rod by pulling aft. Removal may require using the provided one inch strap to aid in removing the rod.
10.	Remove the bow ring (figure 114-4.1d), from the forward end of the collar using a 11mm (7/16 in.) wrench or socket.
	 **Figure 114-4.1d. Bow Ring**

114-5 Side Sheet Paint Reapplication

Once table 114-4.1 for collar removal is complete, verify side sheet paint adhesion. Read through the instructions completely prior to beginning reapplication of side sheet paint.

Table 114-5.1. XDR Side Sheet Paint Reapplication

Step	Action
	Tools, materials, and consumables required for side sheet paint reapplication: • 1 – 9-inch roller • 1 – 9-inch roller pad with 3/8" nap • 1 – Paint tray • 1 – 2-inch disposable paint brush • 1 – Roll of heavy duty shop towels • Acetone • Disposable gloves • Eye protection • 1 – Roll 2-inch masking tape • 1 – Random orbital sander • 2 – 80- grit sandpaper pads for Random orbital sander per side sheet • 1 – gallon Farwest, Alkyd Enamel Paint • 1 – Air line • 1 – Air nozzle
1.	Test the paint adhesion to the aluminum with a scraper or compressed air.
	Note 1: Ensure all loose paint is removed.
2.	Using random orbital sander with 80-grit sandpaper, abrade the aluminum and existing paint.
3.	Remove any dust using clean compressed air.
4.	Wipe all surfaces thoroughly with solvent, such as Acetone or denatured alcohol. Allow surface to dry.
5.	Using 2-inch masking tape, mask off areas not to receive paint.

Table 114-5.1. Side Sheet Paint Reapplication (cont.)

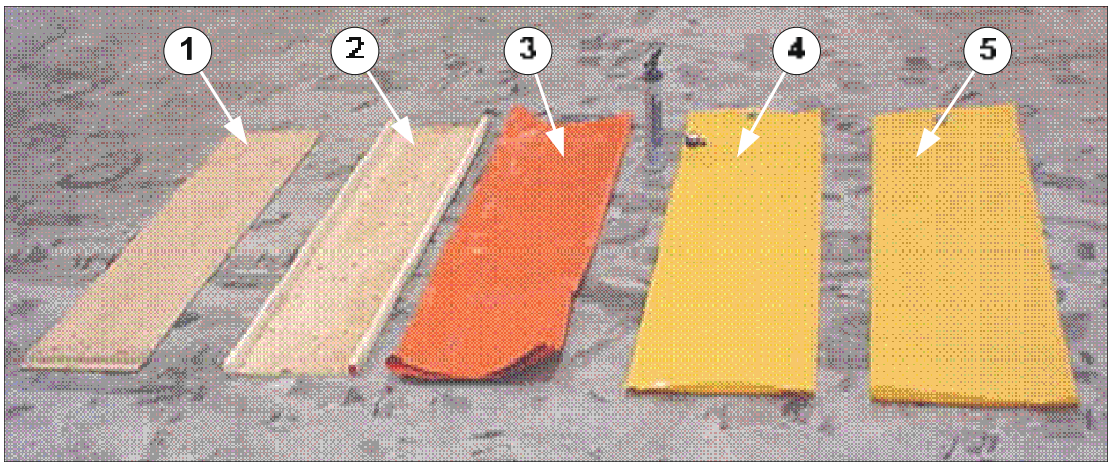
Step	Action
6.	Using disposable brushes and rollers, apply a thin coat of paint to side sheet.
7.	Allow to dry completely.
8.	Apply second heavier coat of paint .
9.	Remove all masking tape immediately after applying second coat, and clean any paint from unwanted areas.
10.	Allow second coat to dry completely.
11.	Proceed with installation of collar.

114-6 Collar Installation

Follow the procedural steps in table 114-6.1 for collar installation. Read through the instructions completely prior to beginning the installation of the collar.

Table 114-6.1. Collar Installation

Step	Action
1.	Place one of the compression bladders (4, 5, figure 114-6.1a), flat on the ground with the valve facing down.
2.	Place one compression panel (1, figure 114-6.1a), on top of the bladder.
3.	Place one foam section on top of the panel. Center the foam and panel on the bladder both length and width.
4.	Place a second compression panel on top of the foam.
5.	Lay a second compression bladder on top of the second compression panel, centering it with the valve up.
	Note 1: While sliding the assembly into the sleeve, take care to keep the air bladders centered.
6.	Slide the entire assembly into a compression sleeve (3, figure 114-6.1a), locating the air valves in the cut outs provided in the sleeve.
7.	Repeat above steps for the remaining sections of foam.
8.	Use the provided air pump to fill the bladders, being sure to alternate between the two sides to keep them roughly equal in size. Compression will be more effective if the bladders remain balanced in size and pressure.
9.	When the bladders have equalized in size, begin elevating the pressure to 5-7 psi. Check the pressure frequently as the bladder is inflated. Do not inflate over 7 psi.



1. Compression Panel
2. Compression Panel
3. Compression Sleeve
4. Compression Bladder
5. Compression Bladder

Figure 114-6.1a. Collar Compression Kit

Table 114-6.1. Collar Installation (cont.)

Step	Action
10.	When the pressure has reached 5-7 psi, note the time and set aside for a minimum of 24 hours for sufficient compression.
	Note 2: Check the air pressure of the bladders every 20 to 30 minutes. Fill as needed to maintain a minimum pressure of 3—3.5 psi during compression cycle of 24 hours minimum.
11.	Spray silicone into the lower extrusion.
12.	Center the end of the membrane on the bow tension ring and attach, using the provided bolts and Nyloc nuts. Work from the middle of the ring outward in both directions. This will keep the membrane centered on the ring. Keep the fabric tight as the capture band is installed in order to ensure a wrinkle free fit.

Table 114-6.1. Collar Installation (cont.)

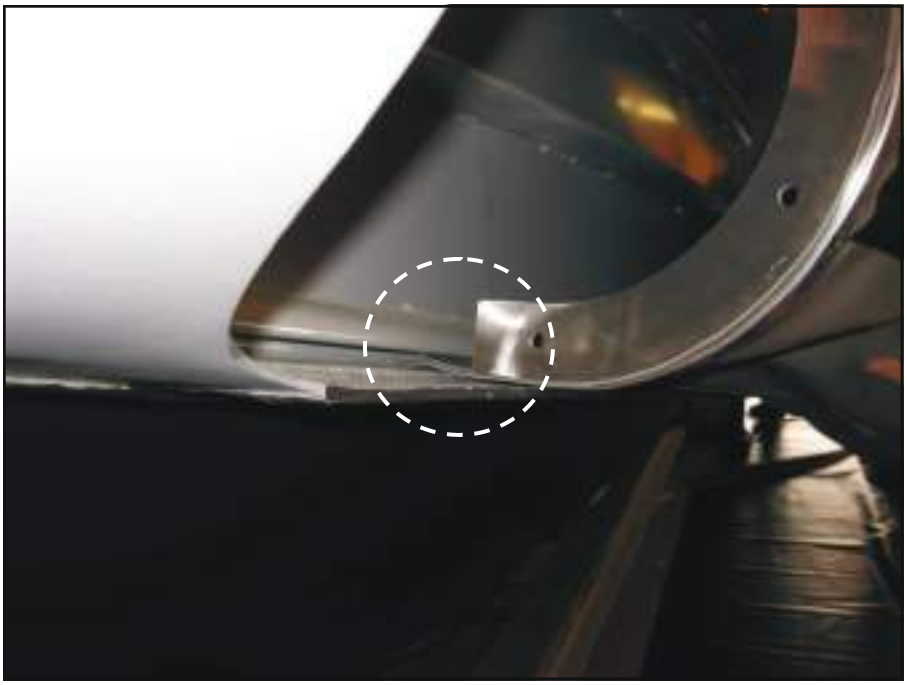
Step	Action
13.	Insert the lower pocket of the membrane into the lower extrusion (figure 114-6.1b), working from the bow to the stern. Keeping the weight of the collar and the bow attachment flange up will aid in inserting the lower pocket.
	 **Figure 114-6.1b. Collar Lower Extrusion**

Table 114-6.1. Collar Installation (cont.)

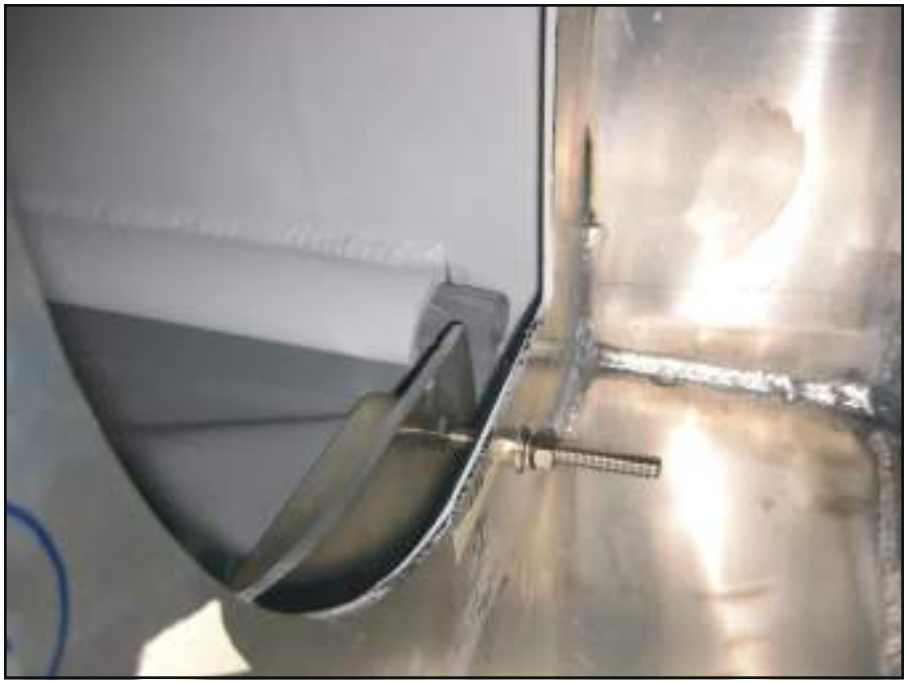
Step	Action
14.	Insert the bow attachment ring (figure 114-6.1c), into the bow as the collar is slid forward into position. Install bolts, washers and nuts. Do not tighten all the way, finger tight is sufficient.
	 **Figure 114-6.1c. Bow Attachment Ring**

Table 114-6.1. Collar Installation (cont.)

Step	Action
15.	With the bow attachment flange loosely secured, go to the aft of the collar. Using the attached pull strap, pull the collar back into position so the cone seam lines up with the end of the extrusion (figure 114-6.1d).
	 **Figure 114-6.1d. Aft Extrusion**

Table 114-6.1. Collar Installation (cont.)

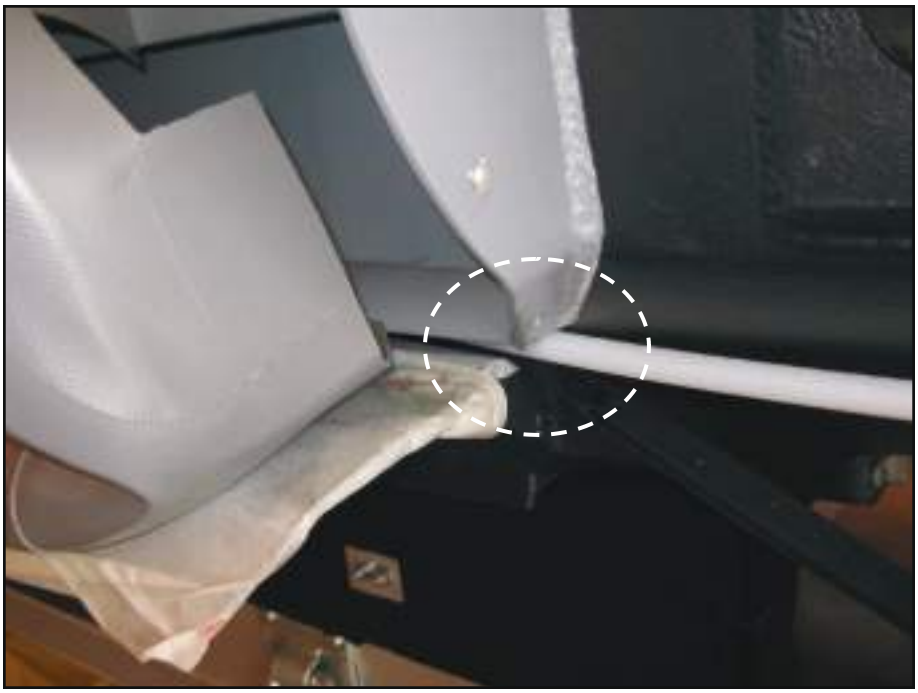
Step	Action
16.	With the pocket tucked into the lower extrusion, insert the lower keeper rod (figure 114-6.1e), into the pocket through the aft end of the lower extrusion. Spray silicone onto the rod and into the pocket as it is pushed into the pocket. A soft faced mallet or dead blow hammer can be used to tap the rod into the pocket as it becomes more difficult to push with increased friction.
	 **Figure 114-6.1e. Lower Keeper Rod**
17.	Using the attached pull strap, pull the collar back into position so the cone seam lines up with the end of the extrusion.

Table 114-6.1. Collar Installation (cont.)

Step	Action
18.	With the seam located and held into place, and lower keeper rod installed, install two 40mm (1-1/2 in.) long No. 12 screws through the lower extrusion (figure 114-6.1f), and into the lower keeper rod. Holes have been predrilled.
	 **Figure 114-6.1f. Lower Extrusion**
	Note 4: Do not tuck in the pocket, aft of the personnel recovery cutout, at this time.
19.	Starting at the bow, begin tucking the upper rod pocket of the collar into the extrusion. Work from the bow to the forward side of the personnel recovery cut out using the attached pull strap.

Table 114-6.1. Collar Installation (cont.)

Step	Action
20.	With the pocket tucked into the upper extrusion, insert the upper keeper rod into the pocket through the access hole (figure 114-6.1g), located on the forward side of the personnel recovery cutout. Spray silicone onto the rod and into the pocket as it is pushed into the pocket. A mallet or dead blow hammer can be used to tap the rod into the pocket. It becomes more difficult to push with increased friction.
	 **Figure 114-6.1g. PRC Access Hole**

Table 114-6.1. Collar Installation (cont.)

Step	Action
21.	Once in place, twist the aft end of upper keeper rod to remove the aft section of rod (figure 114-6.1h), from collar pocket. This allows for insertion of foam.
	 **Figure 114-6.1h. Upper Keeper Rod**
	Note 5: If re-installing the foam, it will be necessary to remove the 15cm x 15cm (6 in. x 6 in.) wide sections of foam off the back. A saw can be used to shave the foam off. If a short saw is used it may be necessary to slice the 4 in. thick foam down the middle lengthwise with the collar in order to remove it in two sections.
22.	Clean the back of the main foam sections with a broom or brush in order to remove any loose debris or foam.

Table 114-6.1. Collar Installation (cont.)

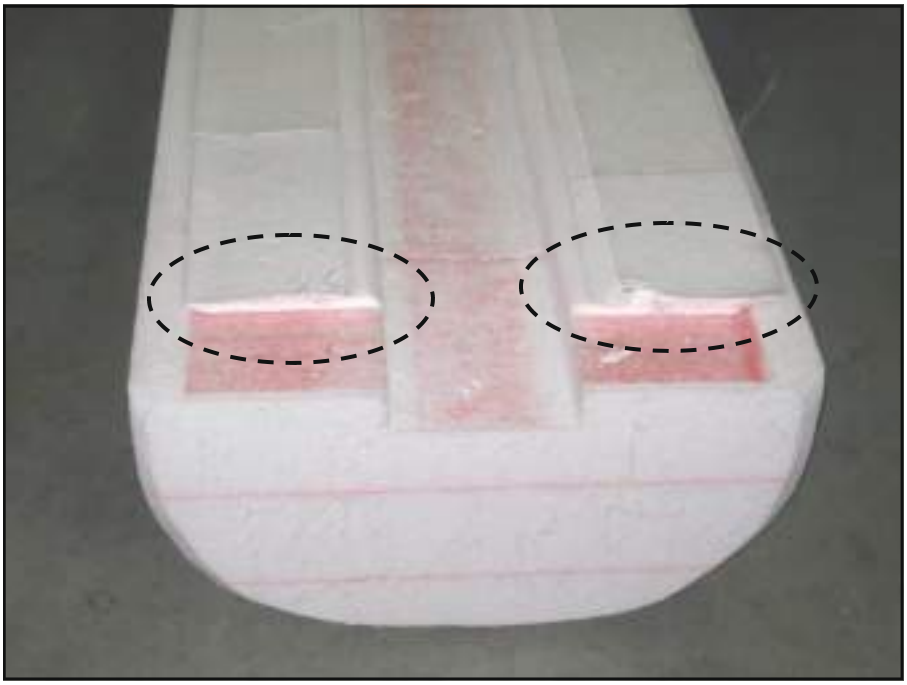
Step	Action
23.	Mask the upper and lower edges of the foam with two inch masking tape leaving an area 50cm (20 inches) wide exposed.
24.	Spray the exposed area with foam adhesive.
25.	Remove all sections of foam from the compression tubes and spray one side of the foam with the adhesive.
26.	Place the compressed foam (figure 114-6.1j), onto the main foam sections and press firmly into position. Ensure full contact over the glued area.
	 **Figure 114-6.1j. Compressed Foam**

Table 114-6.1. Collar Installation (cont.)

Step	Action
27.	Open the collar up as much as possible forward of the personnel recovery cutout (figure 114-6.1k). Spray silicone into the forward portion of the collar, coating the inside of the fabric and the side sheet of the hull.
	 **Figure 114-6.1k. Personnel Recovery Cutout**
28.	Place the long section of foam on the ground oriented with flat side vertical.

Table 114-6.1. Collar Installation (cont.)

Step	Action
29.	Spray the aft end of the forward section with adhesive.
30.	Spray the forward end of the short section of foam (contains personnel recovery cutout), with the adhesive.
31.	Butt the end of the short foam to the long foam and press the two together, aligning the ends to avoid a misalignment in the joint.
32.	Hold in place for three to five minutes until adhesive sets.
33.	When the adhesive has set, remove masking tape and place the forward end of the foam into the collar (figure 114-6.1m).
	Note 6: It may take three or four people to support and push the foam into position.
34.	Insert foam until the personnel recovery cut out of the hull aligns with the cut out of the foam. Periodically lift collar into place to assure a smooth installation.
	 **Figure 114-6.1m. Forward Foam Section**

Table 114-6.1. Collar Installation (cont.)

Step	Action
35.	Insert the forward end of aft keeper rod (figure 114-6.1n), threaded end first, into the upper pocket of the membrane.
	 **Figure 114-6.1n. Aft Keeper Rod Threaded End**
36.	Tap and turn the keeper rod enough to capture the forward keeper rod.
37.	Pull forward keeper rod out to the access hole in the personnel recovery cutout.
38.	Unscrew and remove aft keeper rod.
39.	Apply anti-seize to the securing end of the aft rod and screw into forward rod section.
40.	Insert keeper rod fully into the forward pocket of the membrane.

Table 114-6.1. Collar Installation (cont.)

Step	Action
41.	Pull collar tight around the aft end of the foam, assuring transom cut out is in place (figure 114-6.1o).
	 **Figure 114-6.1o. Collar Transom Cutout**
42.	Insert upper aft keeper rod into the membrane pocket using pocket strap (figure 114-6.1p), to keep membrane in position. Silicone or similar lubricant can be applied to the pocket and rod to aid with insertion.

Table 114-6.1. Collar Installation (cont.)

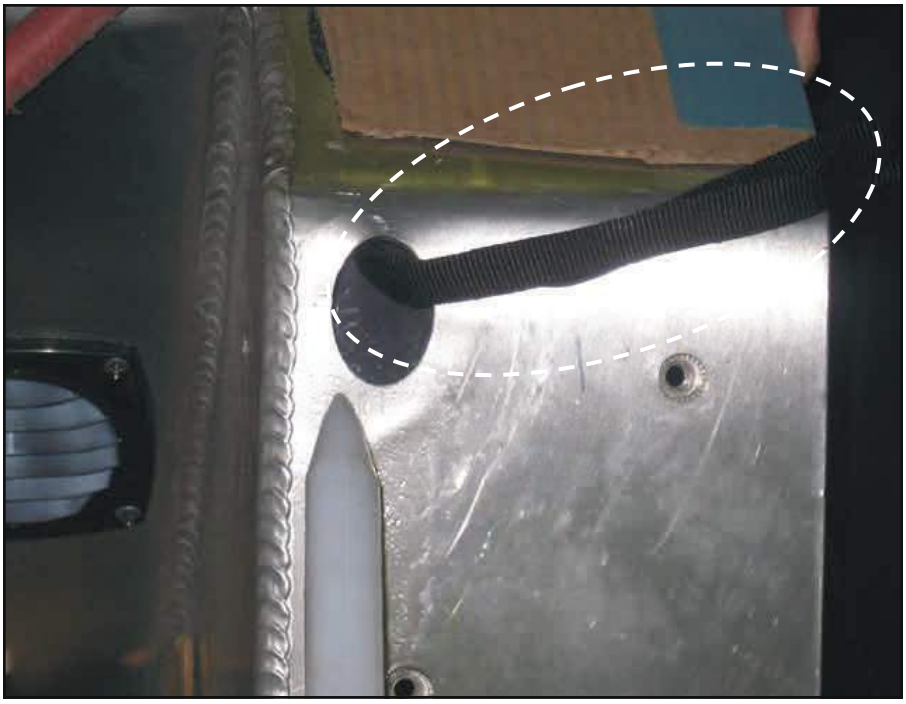
Step	Action
	

Figure 114-6.1p. Pocket Strap

Table 114-6.1. Collar Installation (cont.)

Step	Action
43.	Place PRC capture plate (figure 114-6.1q), in the personnel recovery cutout and mark holes on collar.
	 **Figure 114-6.1q. PRC Capture Plate**

Table 114-6.1. Collar Installation (cont.)

Step	Action
44.	Punch or cut holes in collar personnel recovery cutout and aft collar at the securing plate hull inserts (figure 114-6.1r).
	 **Figure 114-6.1r. Hull Inserts**
45.	Place personnel recovery cutout plate in position and align with collar and inserts.

Table 114-6.1. Collar Installation (cont.)

Step	Action
46.	Coat capture plate screws (figure 114-6.1s), with anti-seize. Install screws, inboard side first, to assure smooth lay of collar.
	Note 7: The collar fabric is cut to provide a one inch overhang in the personnel recovery cutout.
	Note 8: Foam will expand. Do not over tighten collar during plate attachment.
	 **Figure 114-6.1s. Capture Plate Screw**

Table 114-6.1. Collar Installation (cont.)

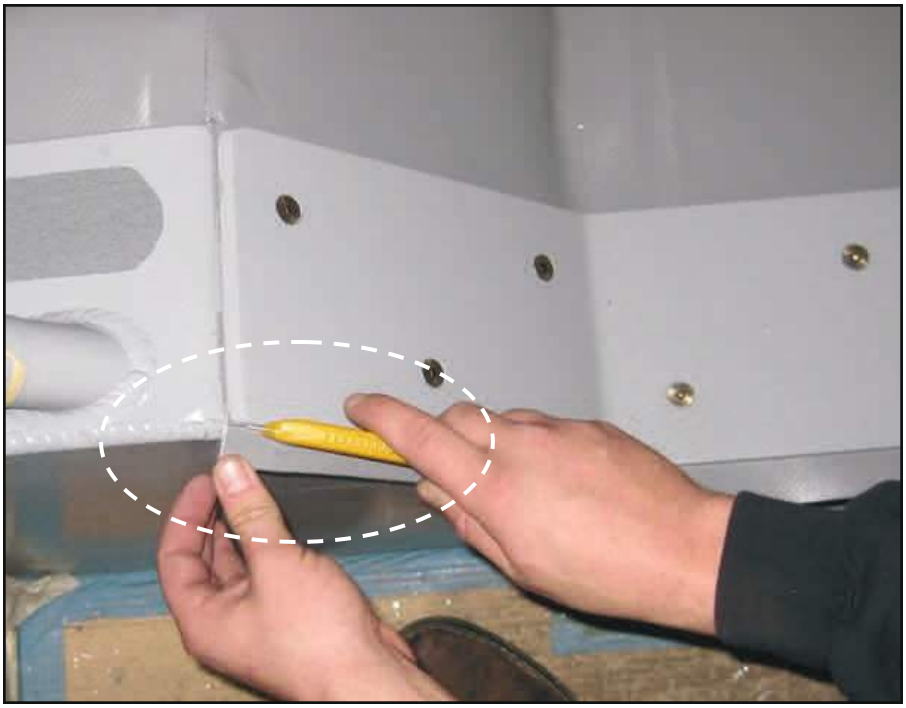
Step	Action
47.	Trim excess fabric (figure 114-6.1t), from inboard edge of capture plate.
	 **Figure 114-6.1t. PRC Excess Collar Fabric**
48.	Reinstall non-skid on personnel recovery cutout plate.

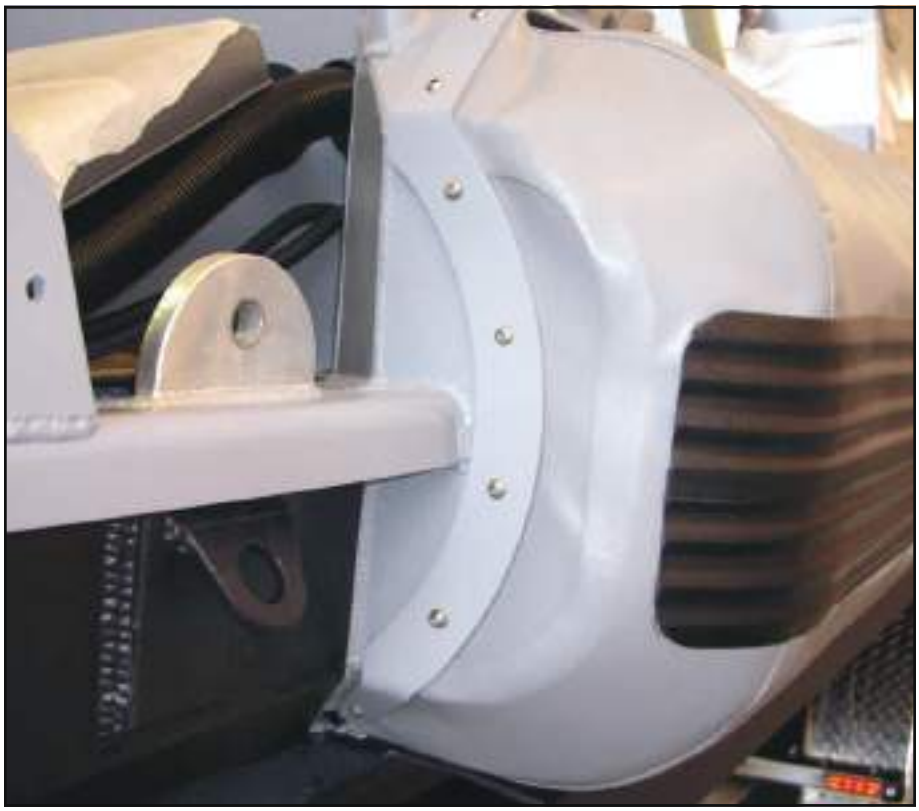
Table 114-6.1. Collar Installation (cont.)

Step	Action
49.	Coat aft securing plate (figure 114-6.1u), screws with anti-seize. Install screws, inboard side first, to assure smooth lay of collar and proper placement.
	 **Figure 114-6.1u. Aft Securing Plate**

Table 114-6.1. Collar Installation (cont.)

Step	Action
50.	Trim excess fabric from inboard edge of aft securing plate (figure 114-6.1v).
	 **Figure 114-6.1v. Aft Securing Plate Excess Collar Fabric**

Table 114-6.1. Collar Installation (cont.)

Step	Action
	 **Figure 114-6.1w. Final Collar Configuration**
	<u>CAUTION</u> **Do not put boat in water until foam has fully expanded.**
51.	Collar installation is complete (figure 114-6.1w). Foam will continue to expand over the next five days and tighten against the collar fabric.

114-7 XDR Bow Cover

The bow covering (bra) is not intended to act as a push point or fender, but is able to absorb minor frontal area impacts. The bow covering consists of a polyurethane membrane stretched over a 2-inch layer of closed cell polyethylene foam. The removal and installation instructions provide information needed to remove and install the bow covering correctly.

Table 114-7.1. Bow Cover Removal

Step	Action
	Tools needed for removal of bow cover: • Philips head screw driver • Needle nose pliers • Bow Cover Replacement Kit • Silicon Spray
1.	Locate end lacing strap tie-off on both port and stbd sides of bow cover (figure 114-7.1a).
	 **Figure 114-7.1a. Lacing Strap Tie-Off**
2.	Using needle nose pliers, untie lacing ends.

Table 114-7.1. Bow Cover Removal (cont.)

Step	Action
3.	Unlace port and stbd side panels (figure 114-7.1b).
	 **Figure 114-7.1b. Side Panel Unlaced**
4.	For side panel replacement only, proceed to step 9.

Table 114-7.1. Bow Cover Removal (cont.)

Step	Action
5.	Unlace upper bow cover lacing to release and lower bow cover (figure 114-7.1c), to replace foam and/or bow cover panel.
	 **Figure 114-7.1c. Lowering Bow Cover**
6.	To remove bow foam, cut tie wraps securing foam grommet retention panels. Remove foam.
	Note 1: Spray silicon on aft edge of extrusion to ease removal of upper or lower bow cover panels.
7.	To remove upper lacing panel, slide to one side and aft, out of upper extrusion.
8.	To remove lower bow cover panel, slide to one side and aft, out of lower extrusion.

Table 114-7.1. Bow Cover Removal (cont.)

Step	Action
9.	For removal of side panels, remove two securing screws (figure 114-7.1d). Retain for later installation.
	 **Figure 114-7.1d. Side Panel Securing Screw Removal**
10	Pull side panel out from behind the bow.
11.	For installation of bow cover, refer to table 114-7.2.

Table 114-7.2. Bow Covering Installation

Step	Action
	Tools required for installation: • Bow Cover Replacement Kit • Needle Nose Pliers • Silicon Spray • Tensioning Straps • Philips Head Screwdriver
	Note 1: Lubricating the extrusion with a silicon spray or like product will ease installation. Two persons are required for installation.
1.	Insert the bow cover grommet panel into the lower extrusion (figure 114-7.2a). The panel should be centered in the extrusion when complete.
	 **Figure 114-7.2a. Grommet Panel and Lower Extrusion**

Table 114-7.2. Bow Covering Installation (cont.)

Step	Action
2.	Pull the bow cover over the metal bow and flatten to eliminate any folds or wrinkles.
3.	Lay the cover open and spray the inside with silicon spray to reduce friction when lacing.
4.	Place the foam panel into the bow cover.
	Note 2: Do not overlap the edges of the foam grommet panels.
5.	Wrap the foam grommet panels over the foam and use the provided cable ties to attach the grommet strips together (figure 114-7.2b).

Table 114-7.2. Bow Covering Installation (cont.)

Step	Action
6.	Spray foam and grommet panels with silicon spray.
	Note 3: The notches cut into the foam should align with the welded seams of the metal bow.
	Note 4: The foam should be 2-inches below the upper edge of the bow cover when it is pulled into place.
	 **Figure 114-7.2b. Foam Grommet Retention Panels**

Table 114-7.2. Bow Covering Installation (cont.)

Step	Action
	Note 5: Lubricating the extrusion with a silicon spray or like product will ease installation.
6.	Insert the upper lacing panel into the upper extrusion located on the bow (figure 114-7.2c). The panel should be centered in the extrusion when complete.
	 **Figure 114-7.2c. Upper Lacing Panel**

Table 114-7.2. Bow Covering Installation (cont.)

Step	Action
7.	Begin pulling the bow cover assembly up at the center and onto the metal bow (figure 114-7.2d), pushing the foam down so that it is centered on the metal bow vertically and horizontally.
	Note 6: A length of rope or webbing through the center grommets to the fwd tow post will aid with leverage.
8.	Pull the center of the bow cover up as tightly as possible.
	 **Figure 114-7.2d. Raising Bow Cover**

Table 114-7.2. Bow Covering Installation (cont.)

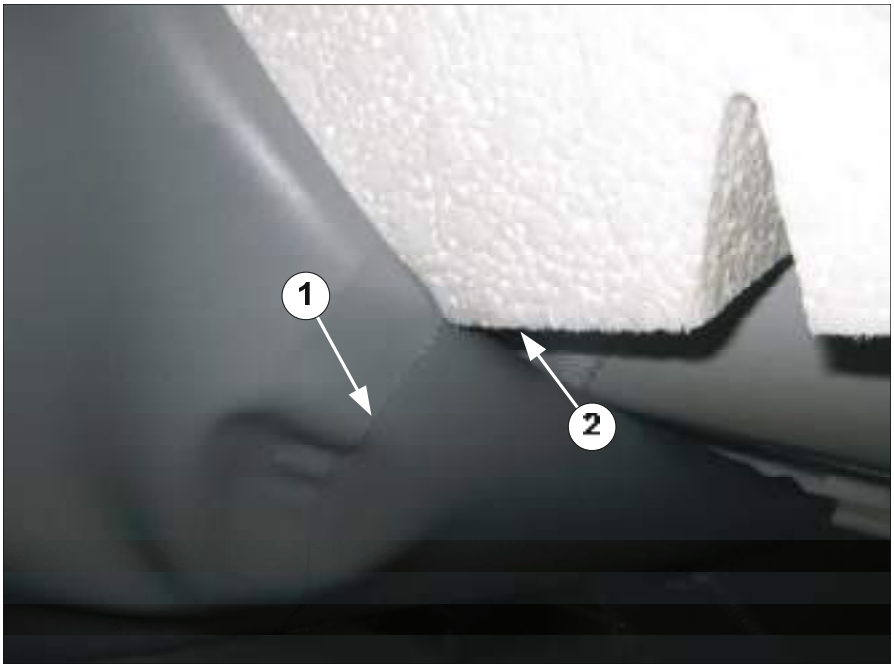
Step	Action
	Note 7: Foam should follow seam line in bow cover (1, figure 114 -7.2e).
	 **1. Bow Cover Seam Line** **2. Bow Foam Lower Edge** **Figure 114-7.2e. Foam Alignment**
9.	Roll bow cover to port and stbd sides over foam, ensuring proper alignment of foam is maintained.

Table 114-7.2. Bow Covering Installation (cont.)

Step	Action
10.	Insert becket straps through two center grommets and pass tensioning straps through becket straps to fwd tow post (figure 114-7.1f).
	 **Figure 114-7.2f. Bow Cover Tensioning Straps**

Table 114-7.2. Bow Covering Installation (cont.)

Step	Action
11.	Using needle nose pliers, insert becket straps on upper panel, under and through grommets in lower bow cover panel (figure 114-7.2g). Ensure proper alignment.
	 **Figure 114-7.2g. Becket Straps through Grommets**

Table 114-7.2. Bow Covering Installation (cont.)

Step	Action
12.	Starting in the middle of the bow cover, begin lacing from the center out in both directions by forming a chain with the becket straps (figure 114-7.2h).
13.	Pull the straps tight until the grommets are seated at the base of each becket strap or as close as possible.
	Note 8: A ratchet strap or other tensioning device can be used to pull the bow cover back and into position. Tensioning must be performed on both sides at the same time to ensure balanced tension and maintain proper placement.
	 **Figure 114-7.2h. Becket Strap Lacing**
14.	Lace the upper lacing panel as tight as possible.

Table 114-7.2. Bow Covering Installation (cont.)

Step	Action
15.	Attach a tensioning strap (figure 114-7.2j), to the last becket strap on each side to maintain tension on bow cover during side panel installation.
	 **Figure 114-7.2j. Bow Lacing Secured with Tension Strap**

Table 114-7.2. Bow Covering Installation (cont.)

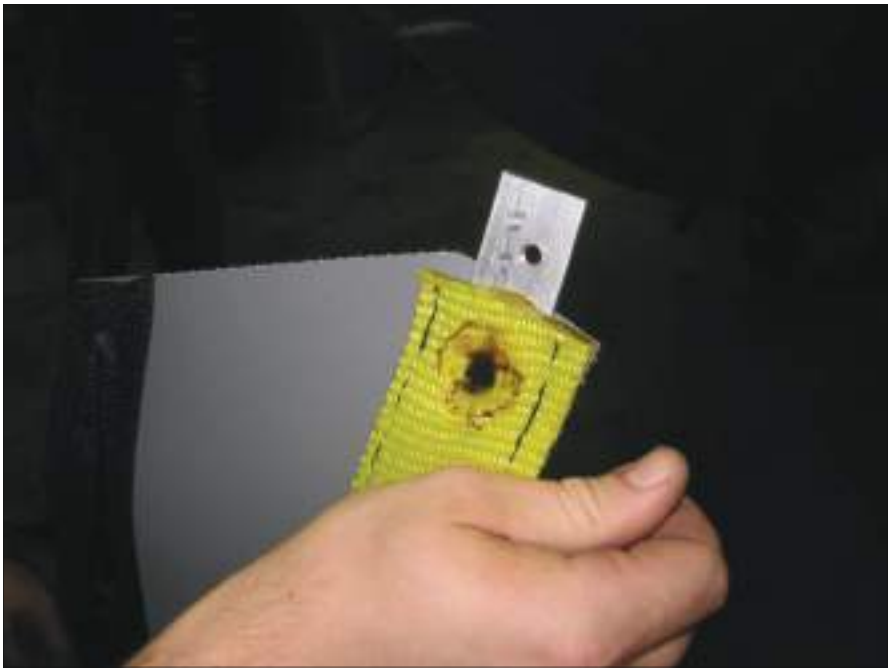
Step	Action
16.	Verify side panels are fitted with aluminum insert within the webbing, on upper and lower ends (figure 114-7.2k). Align holes for securing screws.
	 **Figure 114-7.2k. Aluminum Insert in Side Panel**

Table 114-7.2. Bow Covering Installation (cont.)

Step	Action
	Note 9: A large flat screw driver can be used to assist in inserting the side panels.
17.	Insert port and stbd side lacing panels between the collar and the edge of the aluminum bow (figure 114-7.2m).
	 **Figure 114-7.2m. Side Panel**
18.	Align securing screw holes and the top becket straps on the side panel with the end becket strap of the upper lacing panel.

Table 114-7.2. Bow Covering Installation (cont.)

Step	Action
19.	Secure side panels to bow with screws retained during removal procedure (figure 114-7.2n).
	 **Figure 114-7.2n. Side Panel Retaining Screws**
20.	Fold side panels forward over bow. Ensure proper alignment with bow cover grommets.

Table 114-7.2. Bow Covering Installation (cont.)

Step	Action
21.	Using needle nose pliers, insert the becket straps of the side panels under and through the corresponding grommets of the bow cover (figure 114-7.2p).
	 **Figure 114-7.2p. Side Panel Becket Straps**

Table 114-7.2. Bow Covering Installation (cont.)

Step	Action
22.	Begin at the bottom and work upward. Lace the becket straps of the side panels into a chain and pull until the grommets are seated at the base of each becket strap or as close as possible (figure 114-7.2q).
	Note 10: Repeat tensioning until bow cover is fit into correct position.
	 **Figure 114-7.2q. Side Panel Lacing**

Table 114-7.2. Bow Covering Installation (cont.)

Step	Action
23.	Finish the lacing on top of the bow using the open straps of webbing to tie the upper and side lacing panels into place (figure 114-7.2r).
	 **Figure 114-7.2r. Tying-Off Bow Cover Lacing**
24.	Remove tension straps used to pull the bow covering into position.

Table 114-7.2. Bow Covering Installation (cont.)

Step	Action
25.	Tie end lacing straps together securely (figure 114-7.2s).
	 **Figure 114-7.2s. Securing Bow Cover Lacing**

Table 114-7.2. Bow Covering Installation (cont.)

Step	Action
26.	Insert lacing strap ends under bow cover (figure 114-7.2t).
	 **Figure 114-7.2t. Securing Becket Straps**
27.	Installation is complete.

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311	Power Generation
311 General	This section is a general description of SAFE Boats typical electrical arrangement. All segments may not apply.
311-1 AC Power	Alternating Current (VAC) power originates at two sources. A shore power connection on the port side forward of the cabin, or from the dedicated generator. A circuit breaker lock-out in the power distribution panel prevents turning on both generator and shore power circuit breakers at the same time.
311-2 DC Power	Direct current is supplied by deep discharge marine batteries. Output from the house battery goes to the VDC power distribution panel to supply VDC power for all onboard VDC loads. The generator battery is a dedicated battery and only supplies power to the generator.
311-3 Shore Power	When the boat is at a pier, external shore power is connected to the shore power connection (figure 311-3a), on the port side of the main cabin. Inside the boat, the shore power runs from the shore power connector, through the port side rig tube, to the input side of an isolation transformer. The output side of the isolation transformer connects to the VAC power distribution panel. The VAC power from the distribution panel supplies power to the cabin VAC outlet, the battery chargers, and panel mounted volt meter.

311-4 Isolation Transformer

All three power wires from the shore power connector are connected to the input side of an isolation transformer (figure 311-4a), located in the cuddy cabin port side electronics space. The isolation transformer blocks low voltage DC currents from coming on board by way of the shore power ground wire while still passing the AC component of the shore power. The low level DC currents could cause corrosion to underwater metals, hull, and outboards. Boats in a marina plugged into shore power act as a giant battery. If the boats are in salt water, the salt water forms an electrolyte and the dissimilar metals connected together act as a battery, causing corrosion. Normally, no AC current is carried on the shore power ground wire, but it has to be able to carry the full load of the circuit in the event of a fault.

When the boat is out of the water for extended storage or shore side maintenance, a jumper is installed (figure 311-4.1c), in the isolation transformer to connect the isolation transformer input and output side ground connections. Connecting the two ground connections reduces the possibility of a dangerous or fatal personnel shock hazard or damage to equipment. Refer to table 311-4.1 for Out-of-Water/Shore Power Isolation Transformer Jumper Installation Procedure.

When the boat is returned to the water, the ground cable is disconnected, and the in-water isolation transformer jumper is re-installed (figure 311-4.1b).

WARNING

Do not connect out-of-water/shore power jumper if the boat is in the water.

DANGER

Do not connect external power to boat or energize boat electrical equipment when boat is out of the water without connecting an approved shore side ground connection or installing the out-of-water power jumper in the isolation transformer between J34 and the input side PE conductors. Failure to comply may result in serious or fatal shock to personnel and damage to equipment.

Figure 311-3a. Example Shore Power Connection

Figure 311-4a. Example Isolation Transformer

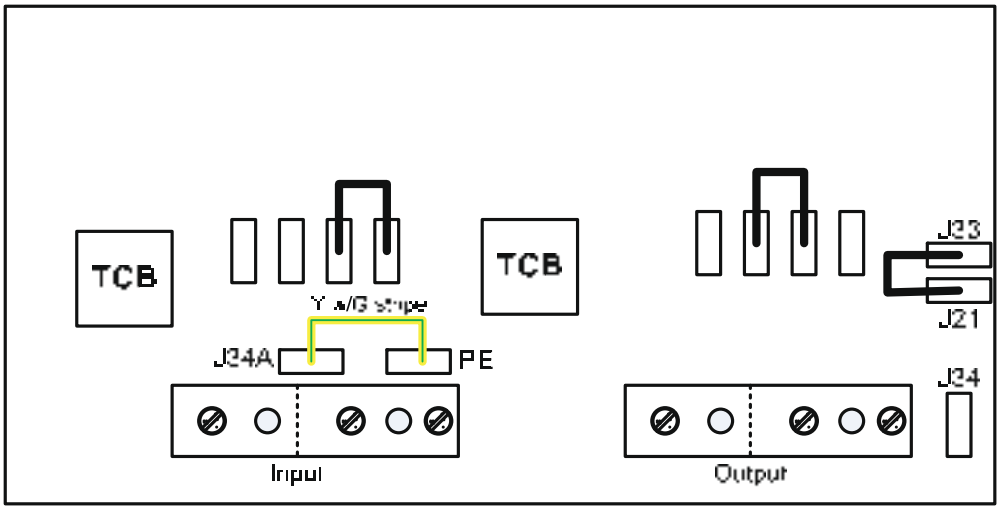


Figure 311-4b. In-Water/Vessel Power-Isolation Transformer Ground Jumper J34A to PE Connection

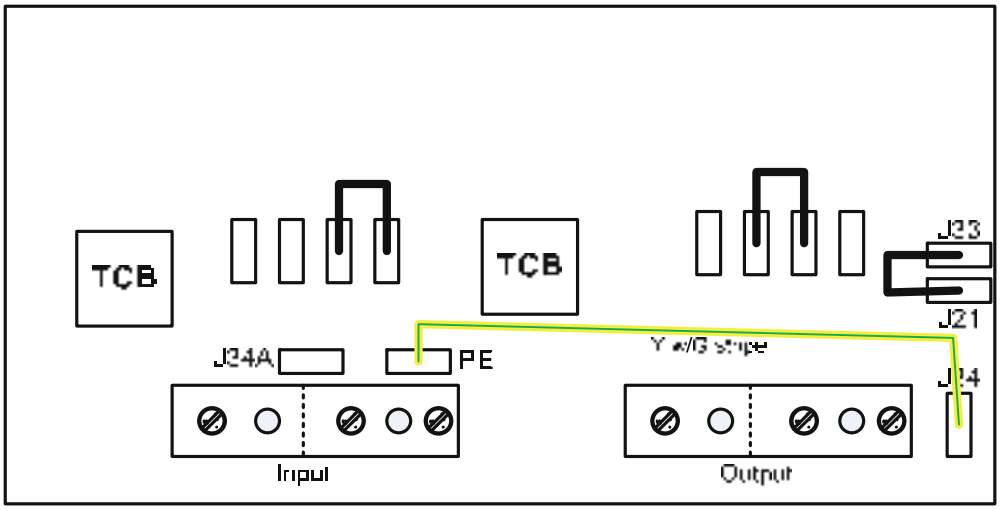


Figure 311-4c. Out-of-Water/Shore Power-Isolation Transformer Ground Jumper PE to J34 Connection

Table 311-4.1. Out-of-Water/Shore Power Isolation Transformer Jumper Installation Procedure

Step	Action
	DANGER **Do not connect external power to boat or energize boat electrical equipment when boat is out of the water without connecting an approved shore side ground connection or installing the out-of-water/shore power jumper cable between J34 and Input side PE conductors. Failure to comply may result in serious or fatal shock to personnel and damage to equipment.**
1.	Set AC MAIN circuit breaker to the OFF position.
2.	Set battery switch panel battery switches to the OFF position.
3.	Remove four screws securing isolation transformer cover plate to isolation transformer (figure 311-4.1a). Retain screws for later installation.
	 **Figure 311-4.1a. Isolation Transformer Cover Plate Screws**

Table 311-4.1. Out-of-Water/Shore Power Isolation Transformer Jumper Installation Procedure (cont.)

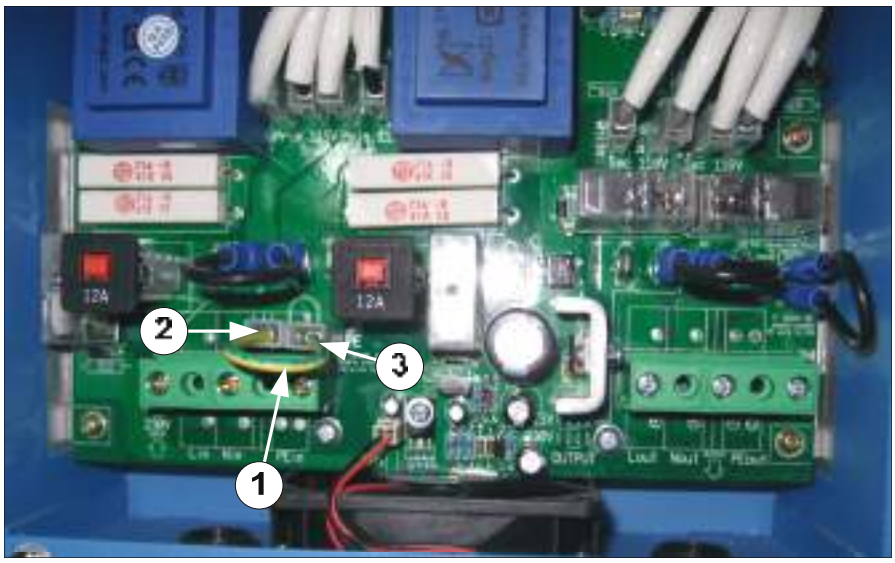
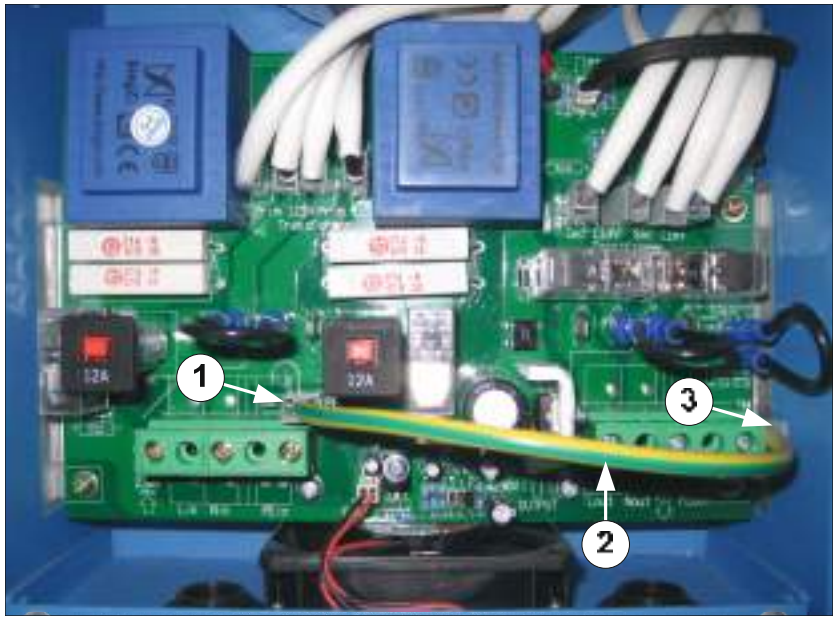
Step	Action
4.	Disconnect in-water ground jumper cable (1, figure 311-4.1b).
	 **1. In-Water Ground Jumper** **3. Input PE Conductor** **2. J34A Conductor** **Figure 311-4.1b. In-Water Isolation Transformer Ground Jumper**
5.	Retain in-water ground jumper cable for later installation when repairs are complete and boat returns to the water.

Table 311-4.1. Out-of-Water/Shore Power Isolation Transformer Jumper Installation Procedure (cont.)

Step	Action
6.	Connect out-of-water/shore power ground jumper cable (2, figure 311-4.1c), between input side PE conductor (1, figure 311-4.1c), and J34 conductor (3, figure 311-4.1c).
	

1. Input PE Conductor **3. J34 Conductor**

2. Shore Power Ground Jumper

Figure 311-4.1c. Out-of-Water/Shore Power Isolation Transformer Ground Jumper

Table 311-4.1. Out-of-Water/Shore Power Isolation Transformer Jumper Installation Procedure (cont.)

Step	Action
7.	Replace front cover on isolation transformer using hardware removed during cover removal.
8.	Attach safety tag to distribution panel to display "Warning: Vessel is attached to earth ground. Replace in-water jumper connection before returning boat to water."
9.	Set AC MAIN circuit breaker to the ON position.
10.	The boat is now properly grounded and the shore power may be connected.
	CAUTION **Remove isolation transformer shore power ground jumper between J34 and input side PE conductors when boat is returned to the water. Failure to comply may result in corrosion to underwater metals and hull.**
11.	When repairs are complete, reverse above procedure to re-install in-water jumper connection before returning boat to water.
12.	Remove safety tag and place back in service.

311-5 VAC Generator

When not connected to shore power, the boat's onboard generator supplies power for all alternating current requirements. The VAC goes to the distribution panel GENERATOR circuit breaker to supply VAC power to the cabin VAC outlet, battery chargers, and panel mounted volt meter.

311-6 Generator Cooling

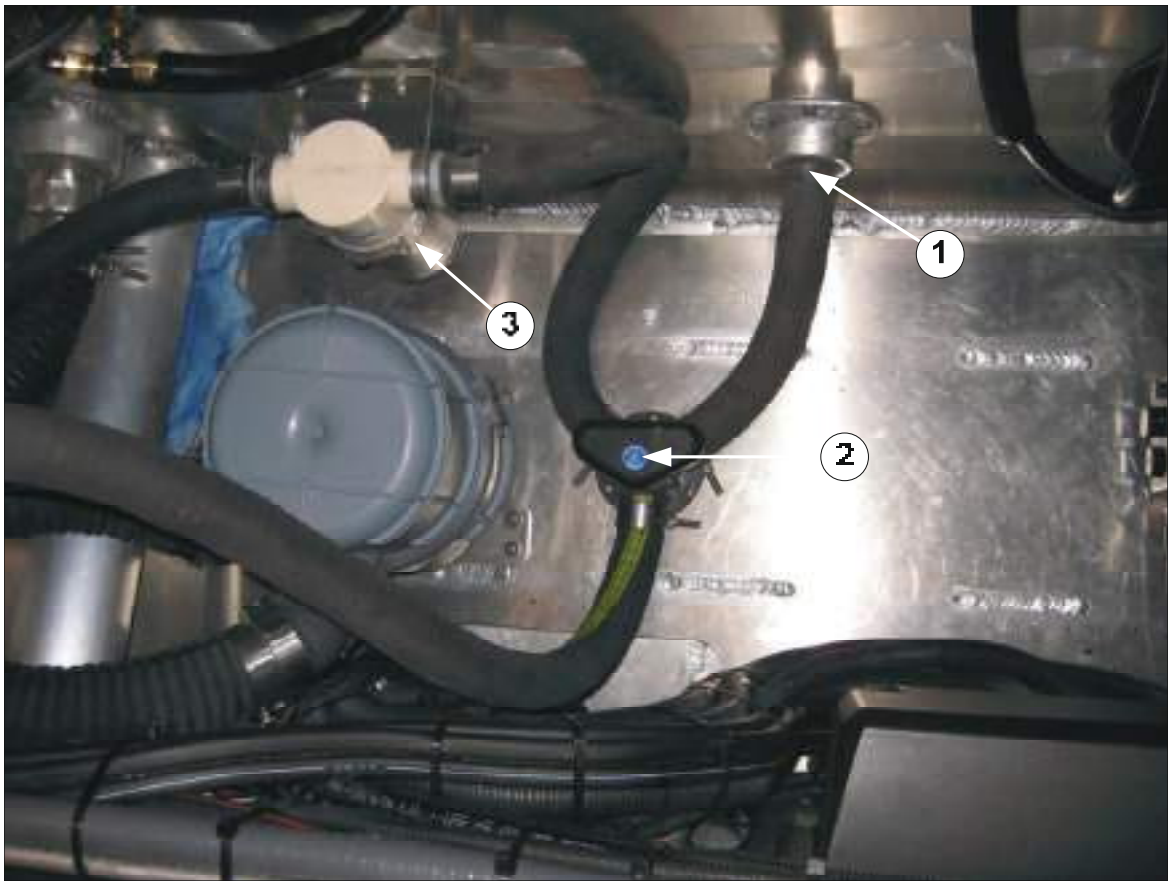
The generator is cooled by raw water from the generator raw water intake in the transom. Water circulation (figure 311-6a), is from the raw water intake, through a ball valve, to the generator priming valve in the aft stbd locker, raw water strainer, generator raw water pump, through the generator, and is discharged from the generator through the generator exhaust to an overboard discharge in the transom. Prior to starting the generator, verify that the raw water strainer has water in the bowl. If there is no water in the bowl, refer to table 311-6.1 for generator raw water priming procedure.

WARNING

Start and run the generator compartment blower for five minutes before starting the generator. Failure to comply may result in detonation of accumulated gases in the generator compartment resulting in damage to equipment and serious injury to personnel.

311-7 Generator Compartment Exhaust Fan

An exhaust fan is mounted in the generator compartment to expel accumulated and potentially explosive gases from the generator compartment prior to starting the generator set. The exhaust fan is mounted on the outboard side of the compartment and is ducted to an exhaust vent on the cabin aft bulkhead. Power to the fan is from the VDC power distribution panel, to the generator compartment blower switch located on the generator control panel.



1. **Bulkhead Fitting**
2. **Generator Priming Valve**
3. **Raw Water Strainer**

Figure 311-6a. Generator Cooling

Table 311-6.1. Generator Raw Water Priming Procedure

Step	Action
	CAUTION **Do not fill generator priming system from a pressurized hose. Generator may be damaged. Gravity fill only.** **CAUTION** **To prevent damage to generator raw water impeller, do not allow generator raw water hose to draw from an empty bucket.**
1.	Open raw water intake valve in transom void compartment.
2.	Fill a five gallon (18.9 liter), bucket with water from an external water source (figure 311-6.1a).
3.	Attach priming hose to hose fitting on stbd locker.
4.	Set priming valve in stbd locker to the PRIME position.
5.	Start generator in accordance with generator starting procedures.
6.	Verify generator is drawing water from bucket, and water filter bowl is filled with water.
7.	Set priming valve to the RUN position.
8.	Verify generator raw water filter bowl is filled with water and water is being discharged through the overboard discharge.
9.	Disconnect priming hoses and stow hoses and bucket.

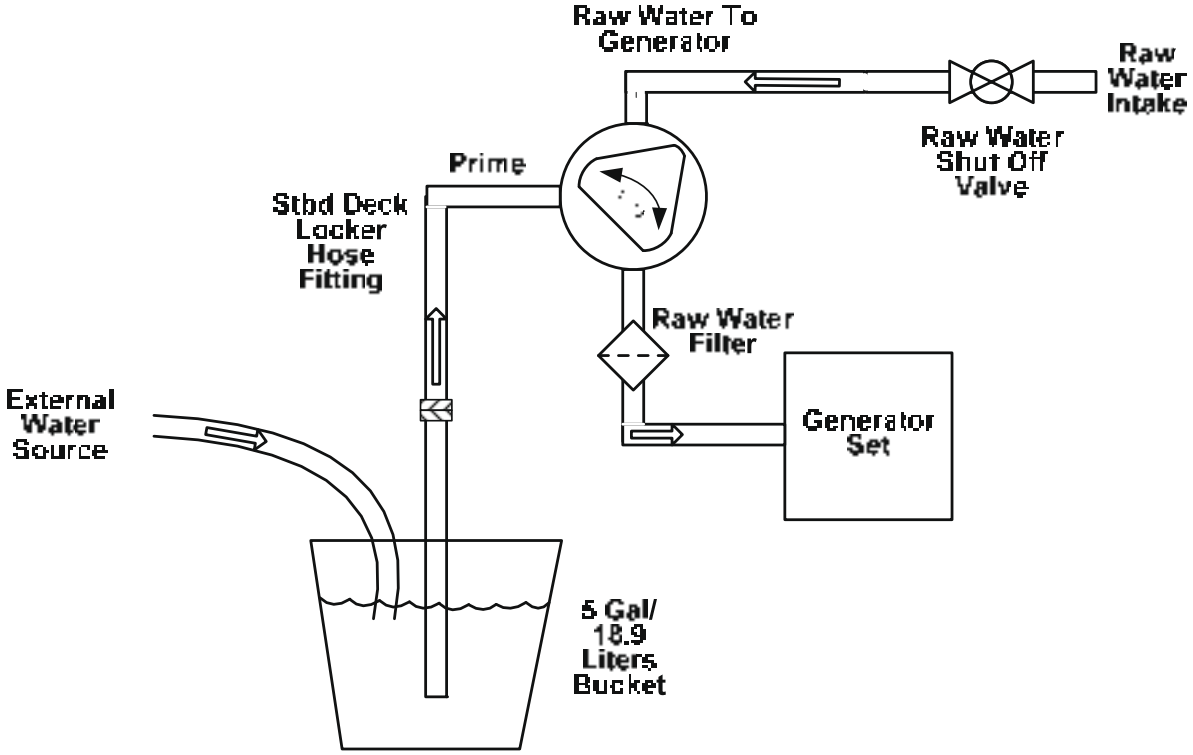


Figure 311-6.1a. Generator Raw Water Priming

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APPENDIX A-1 PLANNED MAINTENANCE

Planned Maintenance

General

Planned maintenance provides a standard means for planning, scheduling, controlling, and performing planned maintenance to mechanical, electrical, and electronic equipment. Scheduled maintenance actions are the minimum required to maintain equipment in a fully operable condition and within specifications. Planned maintenance provides regularly scheduled tests to detect degraded performance and to aid in preventing failures during tactical operations. A good planned maintenance program will prolong the life of the boat, the power plant, and all ancillary equipment. It will also increase unit readiness and reduce overall maintenance and repair costs. This maintenance program is only a suggested framework, and is the minimum maintenance requirements. Local directives, manufacturer's recommendations, operating conditions, and more specific engineering directives should be followed where applicable. Table A.1 lists the frequency at which individual maintenance actions should be performed.

Maintenance Scheduling

All boat maintenance is performed using the scheduling periodicities as shown in table A.1.

Table A.1. Maintenance Frequency

Section	Frequency
D	Daily Checks
W	Weekly Maintenance
M	Monthly Maintenance
Q	Quarterly Maintenance
S	Semi-Annual Maintenance
A	Annual Maintenance
R	As Required Maintenance

APPENDIX A-1 PLANNED MAINTENANCE

D-1	**Daily Maintenance**				
System	Boat	**Sub-System**	All		
Description	Daily System Operability Checks		**Frequency**		Daily
Safety Precautions	Observe standard safety precautions Perform in accordance with manufacturer's specifications				
Tools, Parts, Materials, Test Equipment					

Step	Action
	Note: These tests are performed with the boat in the water.
1.	Inspect lower units and propellers for marine growth.
2.	Verify engine cooling ports are free of all obstructions.
3.	Turn on all battery switches. If there is not enough power, turn on the interconnect switch.
4.	Lower engines to operating position.
5.	Check all fluid levels.
6.	Ensure outboard engines are trimmed up at a slight up angle. Start and run engines for 5+ minutes and log start time.
7.	When starting engines, ensure that self-test alarm system is functioning. Immediately check telltale for operation of engine water pump.

APPENDIX A-1 PLANNED MAINTENANCE

Step	Action
7.	Test operation of all lighting systems: • Side lights • Anchor light • Compass and instrument lights • Strobe lights • Flood lights • Interior deck lights • Exterior deck lights • Interior overhead lights • Searchlights
8.	Test operation of horn.
9.	Test all loudhailer functions.
10.	Energize radar and test all display functions on all displays.
11.	Verify displayed GPS position information is correct.
12.	If water depth permits, test operation and accuracy of fathometer.
13.	Rotate helm to the left (port) and right (stbd) steering limits. Verify engines follow smoothly.
14.	Shut down radar.
15.	Perform radio check on local working frequencies.
16.	Shut down engines and log stop time.
17.	Check fuel level.
18.	Tilt engines to full up position.
19.	Set all battery switches to the OFF position.
20.	Inspect hydraulic steering fluid reservoir level.
21.	Inspect steering linkage for signs of binding or damage.
22.	Verify all fittings and bolts are tight and nylock threads are engaged.

APPENDIX A-1 PLANNED MAINTENANCE

Step	Action
23.	Inspect fuel hoses and hose clamps, including the hose clamps located on the top of the fuel tank.
24.	Inspect drain tubes/flaps for integrity and blockage.
25.	Inspect collars for damage.

APPENDIX A-1 PLANNED MAINTENANCE

Weekly Maintenance

This section contains the following maintenance actions:

Topic	Frequency Code
Check Lower Unit Oil	W-1
Inspect Propellers	W-2
Test Safety Switch	W-3
Clean Fuel Filter Sediment Bowl	W-4
Test Run Generator	W-5

APPENDIX A-1 PLANNED MAINTENANCE

W-1	**Check Lower Unit Oil**				
System	Engines	**Sub-System**	Lower Unit		
Description	Lower Unit Oil Level		**Frequency**		Weekly
Safety Precautions	Observe standard safety precautions Perform in accordance with manufacturer's specifications				
Tools, Parts, Materials, Test Equipment	Rags Flat blade screwdriver				

Step	Action
	Note: Perform this maintenance action with boat on trailer.
1.	Ensure that boat is on a level surface.
2.	Lower engines to the down position one hour prior to performing this maintenance. Engine trim plates should be parallel with ground.
3.	Turn off all battery switches and tag out of service.
4.	Remove fill screw on lower unit and check the oil for water or signs of water intrusion. Oil should weep from vent hole.
5.	Replace fill screw.
6.	Oil change recommended after 100 hours of operation. Check appropriate manufacturer's technical publications.
7.	Remove all safety tags and place in service.

APPENDIX A-1 PLANNED MAINTENANCE

W-2	**Inspect Propellers**				
System	Engines	**Sub-System**	Propeller		
Description	Inspect Propellers		**Frequency**		Weekly
Safety Precautions	Observe standard safety precautions Perform in accordance with manufacturer's specifications Remove boat from water and perform test on land				
Tools, Parts, Materials, Test Equipment					

Step	Action
1.	Turn off all battery switches and tag out of service.
2.	Check for fishing line or other obstructions on propeller shaft.
3.	Inspect propeller blades for any nicks or deformities.
4.	Inspect hub nut, fold over tabs on keeper insert, and nylon spacer for damage, cracking, or excessive wear.
5.	Remove safety tags and return to service.

APPENDIX A-1 PLANNED MAINTENANCE

W-3	**Test Engine Safety Shut-off Switch**			
System	Engines	**Sub-System**	Ignition	
Description	Engine Safety Shut-off Switch Test	**Frequency**		Weekly
Safety Precautions	Ensure all personnel are clear of engines			
Tools, Parts, Materials, Test Equipment				

Step	Action
1.	Start engines.
2.	Remove safety switch lanyard.
3.	Verify engines shut down.
4.	Check for wear and cracking in lanyard attachment points.
5.	Check safety switch lanyard for wear, replace if worn.
6.	Re-attach safety switch lanyard.
7.	Inspect spare safety switch lanyard.

APPENDIX A-1 PLANNED MAINTENANCE

W-4	**Clean Fuel Filter Sediment Bowl**			
System	Engines	**Sub-System**	Fuel Strainer	
Description	Clean Fuel Filter Sediment Bowl	**Frequency**	Weekly or Every 50 hrs.	
Safety Precautions	No smoking in vicinity Observe standard safety precautions Perform in accordance with manufacturer's specifications			
Tools, Parts, Materials, Test Equipment	Waste container Rags			

Step	Action
1.	Check for presence of water and/or sediment in filter bowl.
2.	Secure drain hose to drain valve on bottom of sediment bowl and run out of the space to waste container.
3.	Open drain valve on bottom of sediment bowl to drain water.
4.	Unscrew sediment bowl from bottom of filter element to clean sediment bowl.
5.	Replace sediment bowl and close drain valve.
6.	Dispose of all waste material in accordance with local command hazardous waste disposal instructions.

APPENDIX A-1 PLANNED MAINTENANCE

W-5	**Test Run Generator**			
System	Auxiliary	**Sub-System**	Generator	
Description	Test Run	**Frequency**	Weekly or Every 50 hrs.	
Safety Precautions	No smoking in vicinity Observe standard safety precautions Perform in accordance with manufacturer's specifications			
Tools, Parts, Materials, Test Equipment				

Step	Action
	Note 1: Operate generator compartment blower for 4 minutes prior to starting generator. Maintain blower operation while generator is operating.
1.	Open the fuel shut-off valve located in the stbd side aft deck locker.
2.	Set the seacock to the open position.
3.	Place the generator set master switch to the RUN position.
	Note 2: The controller attempts to start the generator set three times. If the generator set does not start in three attempts, the system shuts down on an over crank fault.

APPENDIX A-1 PLANNED MAINTENANCE

Monthly Maintenance

This section contains the following maintenance actions:

Topic	Frequency
Inspect Sacrificial Anodes	M-1
Inspect Fuel Hoses	M-2
Inspect Electrical Ground Connections	M-3
Inspect Boat Trailer	M-4
Inspect Fire Extinguisher	M-5
Lubricate Hatch and Door Hinges	M-6
Lubricate Propeller Shaft	M-7
Lubricate Seat Mechanism	M-8
Test Window Gasket Seal	M-9
Test EPIRB	M-10
Test SM-2 Automatic Crew Overboard Light	M-11

APPENDIX A-1 PLANNED MAINTENANCE

M-1	**Inspect Sacrificial Anodes**		
System	Engines	**Sub-System**	Sacrificial Anodes
Description	Inspect Anodes	**Frequency**	Monthly
Safety Precautions	Observe standard safety precautions Perform in accordance with manufacturer's specifications		
Tools, Parts, Materials, Test Equipment			

Step	Action
1.	Inspect engine mounting bracket, lower unit, and hull anodes for deterioration.
2.	Replace the anodes if they have degraded to 50% of their original size.

APPENDIX A-1 PLANNED MAINTENANCE

M-2	**Inspect Fuel Hoses**				
System	Auxiliary	**Sub-System**	Fuel System		
Description	Inspect Fuel Hoses		**Frequency**		Monthly
Safety Precautions	No smoking in vicinity Observe standard safety precautions Perform in accordance with manufacturer's specifications				
Tools, Parts, Materials, Test Equipment					

Step	Action
1.	Inspect fuel hoses between fuel tank and engines for cracks, loose clamps and leaks.
2.	Remove cowling and inspect fuel lines on power head.

APPENDIX A-1 PLANNED MAINTENANCE

M-3	**Inspect Electrical Ground Connections**				
System	Electrical	**Sub-System**	Electrical Grounds		
Description	Inspect Electrical Ground Connections	**Frequency**	Monthly		
Safety Precautions	Observe standard safety precautions				
Tools, Parts, Materials, Test Equipment					

Step	Action
1.	Inspect all ground wire connections for corrosion or loose connections.
2.	Verify all connections are clean and tight.

APPENDIX A-1 PLANNED MAINTENANCE

M-4	**Inspect Boat Trailer**			
System	Auxiliary	**Sub-System**	Boat Trailer	
Description	Inspect Boat Trailer	**Frequency**	Monthly	
Safety Precautions	Observe standard safety precautions Perform in accordance with manufacturer's specifications			
Tools, Parts, Materials, Test Equipment	Lithium base waterproof wheel bearing grease Tire gauge			

Step	Action
1.	With boat on trailer, ensure bunks and rollers are supporting the hull.
2.	Test operation of all trailer lights.
3.	Launch boat.
4.	Inspect aluminum bunks for unusual wear or absence of covering.
5.	Ensure bunk supports are secured.
6.	Replace or repair any protective covering that is worn or torn.
7.	Inspect trailer hitch and tow ball for cracks and wear.
8.	Lubricate tongue jack screw and handle linkage.
9.	Check tires for correct inflation and signs of wear.
10.	Check wheel lug nut torque. Torque lug nuts / bolts to manufacturer's specifications.
11.	Inspect trailer light plug and cable for wear and corrosion.
12.	Check all bolted joints for cracks, corrosion, and tightness.
13.	Verify brake emergency break away cable is connected between tow vehicle and trailer brake actuator and is in good condition.

APPENDIX A-1 PLANNED MAINTENANCE

Step	Action
	Note: Bearing buddies must be warm before greasing to ensure air pockets are not formed.
14.	Grease all buddy bearings or applicable grease fittings.
15.	Check operation of all lights.
16.	Fully extend winch cable and inspect for cuts, separation, and hook condition.
17.	Check all tie down straps for cuts, abrasions, and excessive wear.
18.	Test winch operation in all modes of operation.
19.	Inspect brake fluid reservoir level and for presence of moisture.
20.	Inspect brake lines for chafing and leaks.
21.	Inspect brake calipers, rotors, and brake pads for signs of wear.
22.	Inspect master cylinder operation by manually activating it. Check for smoothness of operation and mounting.
23.	Inspect trailer for corrosion.
24.	Clean, prime, and paint as necessary.

APPENDIX A-1 PLANNED MAINTENANCE

M-5	**Inspect Fire Extinguishers**				
System	Auxiliary	**Sub-System**	Damage Control		
Description	Inspect Fire Extinguishers		**Frequency**		Monthly
Safety Precautions	Observe standard safety precautions Perform in accordance with manufacturer's specifications				
Tools, Parts, Materials, Test Equipment	Rubber faced mallet				

Step	Action
1.	Remove extinguisher from mounting bracket.
2.	Inspect valve for cracks and plugged discharge port.
3.	Inspect all parts for corrosion and visible damage.
4.	Ensure pressure gauge is reading in safe zone.
5.	Ensure safety pin and seal are in place.
6.	Invert the fire extinguisher and tap the bottom several times with a rubber faced mallet to loosen powder.
7.	Inspect mounting bracket and remount extinguisher.
8.	Record date of inspection and initial inspection tag.
9.	Repeat steps 1. through 8. for remaining fire extinguishers.

APPENDIX A-1 PLANNED MAINTENANCE

M-6	**Lubricate Hatch and Door Hinges**				
System	Auxiliary	**Sub-System**	Damage Control		
Description	Lubricate Hinges		**Frequency**		Monthly
Safety Precautions	No smoking in vicinity Observe standard safety precautions Perform in accordance with manufacturer's specifications				
Tools, Parts, Materials, Test Equipment	Silicone based grease or recommended lubricant Clean rags				

Step	Action
1.	Check operation of hinges, including doors, hatches, OHIP and radar arch hinges.
2.	Check operation of door and window slides.
3.	Lubricate as required.

APPENDIX A-1 PLANNED MAINTENANCE

M-7	**Lubricate Propeller Shaft**				
System	Engines	**Sub-System**	Propulsion		
Description	Lubricate Propeller Shaft		**Frequency**		Monthly
Safety Precautions	Observe standard safety precautions Perform in accordance with manufacturer's specifications				
Tools, Parts, Materials, Test Equipment	1 1/8-inch socket and ratchet Needle nose pliers New keeper insert Rags Water resistant red or white lithium grease or manufacturers specified grease				

Step	Action
1.	Turn off all battery switches and tag out of service.
2.	Remove keeper, retainer nut, and nylon spacer.
3.	Remove propeller from shaft.
4.	Remove old grease from shaft. Remove fishing line or other obstructions.
5.	Apply a thin coat of lithium grease to the shaft.
6.	Install propeller, nylon spacer, and retainer nut.
7.	Torque nut to manufacturer's specifications.
8.	Test run in forward and reverse.
9.	Check torque after initial run.
10.	Remove safety tags and return to service.

APPENDIX A-1 PLANNED MAINTENANCE

M-8	**Lubricate Seat Mechanism**			
System	Auxiliary	**Sub-System**	Auxiliary	
Description	Clean and Lubricate Seats	**Frequency**		Monthly
Safety Precautions	Observe standard safety precautions Perform in accordance with manufacturer's specifications			
Tools, Parts, Materials, Test Equipment	Lithium Grease Heavy Weight Oil Silicone Spray Vinyl Finish 303 Vinyl Protectant			

Steps	Action
1.	Grease fore/aft track and weight control thread with lithium based grease.
2.	Use heavy weight oil on all pivoting bolts.
3.	Apply light coat of lithium-based grease to any scratches in powder coating.
4.	Spray shocks with silicone spray to prevent sticking.
5.	Clean vinyl seats with Vinyl Finish and protect with 303 Vinyl protectant.

APPENDIX A-1 PLANNED MAINTENANCE

M-9	**Test Weather Tight Gasket Seal**				
System	Auxiliary	**Sub-System**	Window and Hatch Gasket Seal		
Description	Weather Tight Gasket Seal Test	**Frequency**	Monthly		
Safety Precautions					
Tools, Parts, Materials, Test Equipment	Hose less than 80 psi (must simulate a heavy rain)				

Steps	Action
	Note 1: Condensation is a common occurrence in the marine environment. This can cause water to build up on the glass, frame or on the dash from dripping water.
	Note 2: Do not used pressurized water (i.e. pressure washer) for testing.
1.	Dry all windows with condensation.
2.	Aim the water spray everywhere in an area located within 3.9 inches (0.1 m) each side of the periphery of the structure.
3.	Spray continuously for a minimum of three minutes.
4.	If the window fails and allows water intrusion proceed with table 100-5.1 for window and gasket replacement procedure.

APPENDIX A-1 PLANNED MAINTENANCE

M-10	**EPIRB Test Procedure**				
System	Auxiliary	**Sub-System**	Auxiliary		
Description	EPIRB Test Procedure		**Frequency**		Monthly
Safety Precautions					
Tools, Parts, Materials, Test Equipment					

Steps	Action
	Note: If all of the following tests pass, the unit has been tested successfully.
1.	Check data integrity: Unit beeps and PASS or FAIL indicator lights come on.
2.	Check 406 MHz Synthesizer: Same as above.
3.	Check RF Power/Battery: Same as above.
4.	Turn on green LED to indicate a successful test.
5.	Flash strobe light to test strobe.

APPENDIX A-1 PLANNED MAINTENANCE

M-11	**Test SM-2 Automatic Crew-Overboard Light**		
System	Auxiliary	**Sub-System**	Automatic Crew-Overboard Light
Description	Test SM-2 Automatic Crew-Overboard Light	**Frequency**	Monthly
Safety Precautions			
Tools, Parts, Materials, Test Equipment			

Steps	Action
1.	Remove SM-2 from bracket and invert unit.
2.	Correct operation; beacon should begin flashing at a rate of about one flash per second.
3.	Re-invert after confirming correct operation.
4.	Check exterior of unit for damage.
5.	Check bracket security.
6.	Secure SM-2 in bracket and document test.
	Note: If test shows malfunction, or if battery replacement is required, refer to OEM Manual.

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APPENDIX A-1 PLANNED MAINTENANCE

Quarterly Maintenance

This section contains the following maintenance actions**:**

Topic	Frequency
Lubricate Zerk Fittings	Q-1
Check Power Tilt & Trim Reservoir Fluid Level	Q-2
Replace Fuel Filter	Q-3
Inspect Navigation Lights	Q-4
Replace Spark Plugs	Q-5
Inspect Steering System	Q-6
Inspect Hull	Q-7
Inspect Batteries	Q-8
Check Heading Sensor	Q-9
Inspect Hatch Gasket	Q-10
Inspect EPIRB	Q-11

APPENDIX A-1 PLANNED MAINTENANCE

Q-1	**Lubricate Zerk Fittings**				
System	Engines	**Sub-System**	Lubrication		
Description	Lubricate Zerk Fittings		**Frequency**		Quarterly
Safety Precautions	Observe standard safety precautions Perform in accordance with manufacturer's specifications				
Tools, Parts, Materials, Test Equipment	Rags Grease gun with Lithium base water proof grease				

Step	Action
1.	Clean dirt and old grease from zerk fittings.
2.	Lube the zerk fittings at the following locations: a. Tilt tube b. Steering arm assembly c. Engine cowling latches
3.	Wipe away any excessive grease.
4.	Inspect cowling and lower unit for corrosion.
5.	Clean and treat as necessary.

APPENDIX A-1 PLANNED MAINTENANCE

Q-2	**Check Power Tilt & Trim Reservoir Fluid Level**		
System	Engines	**Sub-System**	Power Tilt & Trim
Description	Check Power Tilt & Trim Reservoir Fluid Level	**Frequency**	Quarterly
Safety Precautions	Observe standard safety precautions Perform in accordance with manufacturer's specifications		
Tools, Parts, Materials, Test Equipment	Rags Flat blade screwdriver Manufacturer's recommended power tilt and trim fluid		

Step	Action
	Note: Ensure the boat is on a level surface if on a trailer.
1.	Cycle engine up and down five times.
2.	Remove reservoir fill screw and check fluid level for presence of water. Fluid level should be at the fill hole.
3.	If fluid is low, top off with power tilt and trim fluid.
4.	Install reservoir screw and cycle engine twice to purge any air from the system.

APPENDIX A-1 PLANNED MAINTENANCE

Q-3	**Replace Fuel Filter**		
System	Engines	**Sub-System**	Fuel System
Description	Replace Fuel Filter	**Frequency**	Quarterly or every 100hrs.
Safety Precautions	No smoking in the vicinity Observe standard safety precautions Perform in accordance with manufacturer's specifications		
Tools, Parts, Materials, Test Equipment	Rags Bucket Strap wrench Replacement filter		

Step	Action
1.	Turn off all battery switches and tag out of service.
2.	Remove fuel filter from filter mount.
3.	Check for presence of water in filter bowl.
4.	Clean off gasket base.
5.	Fill new filter with clean fuel.
6.	Apply a light coat of oil to the new filter gasket and install filter.
7.	Remove all tags and place in service.
8.	Attach flushing collar to engine cooling ports.
9.	Test run engine.
10.	Shut engine down.
11.	Check for leaks.

APPENDIX A-1 PLANNED MAINTENANCE

Q-4	**Inspect Navigation Lights**			
System	Electrical	**Sub-System**	Lighting System	
Description	Inspect Navigation Lights	**Frequency**	Quarterly	
Safety Precautions	Observe standard safety precautions Perform in accordance with manufacturer's specifications			
Tools, Parts, Materials, Test Equipment	Flat blade screwdriver Fine emery cloth or wire brush Electrical silicone grease			

Step	Action
1.	Turn off all battery switches and tag out of service.
2.	Secure power at breaker switch.
3.	Remove light cover and inspect light contacts for corrosion.
4.	Clean any corrosion with emery cloth or a wire brush.
5.	Apply a light coat of electrical silicone grease to bulb contact points.
6.	Reassemble all lights.
7.	Remove all tags and place in service.
8.	Test operation of all lights.

APPENDIX A-1 PLANNED MAINTENANCE

Q-5	**Replace Spark Plugs**				
System	Engines	**Sub-System**	Ignition		
Description	Replace Spark Plugs		**Frequency**		Quarterly
Safety Precautions	Observe standard safety precaution Perform in accordance with manufacturer's specifications				
Tools, Parts, Materials, Test Equipment	13/16-inch socket and ratchet Gapping tool Spark plugs Anti-seize compound Rags				

Step	Action
1.	Turn off all battery switches and tag out of service.
2.	Remove engine cowl.
3.	Using 13/16-inch socket and ratchet, remove old spark plugs from engine.
4.	Perform compression test on each cylinder.
	Note: Use manufacturer's recommended spark plugs or equivalent.
5.	Set spark plug air gap to .032-inch using gapping tool.
6	Apply light coat of anti-seize compound to the spark plug threads.
7.	Install spark plugs and torque to manufacturer's specifications.
8.	Inspect and connect spark plug wires. Use dielectric grease on the boot end of wire to prevent wires from sticking to spark plugs.
9.	Replace engine cowling.
10.	Remove all tags and place in service.
11.	Test run engines.

APPENDIX A-1 PLANNED MAINTENANCE

Q-6	**Inspect Steering System**				
System	Auxiliary	**Sub-System**	Steering System		
Description	Steering System Inspection		**Frequency**		Quarterly
Safety Precautions	Wear eye protection while under the console Observe standard safety precautions Perform in accordance with manufacturer's specifications				
Tools, Parts, Materials, Test Equipment	Wrench set Power steering fluid Rags Flashlight				

Step	Action
1.	Inspect steering wheel for cracks, looseness, or any other deformities.
2.	Inspect helm pump assembly inside helm for leaks or loose hydraulic lines.
3.	Inspect steering hoses for kinks, abrasions, cuts, or any other deformities.
4.	Remove cover from pressure pump inside aft stbd locker.
5.	Inspect pressure pump for leaks or loose hydraulic lines.
6.	Ensure pressure pump reservoir fluid level is within 1/2-inch of the top of the reservoir.
7.	Replace cover on pressure pump.
8.	Inspect the steering cylinders and all other steering components for damage, wear, and loose bolts.
9.	Turn the wheel in both directions several times to insure smooth operation.
10.	Inspect tie bars for loose fittings, wear, and deformities.

APPENDIX A-1 PLANNED MAINTENANCE

Q-7	**Inspect Hull**				
System	Auxiliary	**Sub-System**	Hull		
Description	Inspect Hull		**Frequency**		Quarterly
Safety Precautions	Observe standard safety precautions Perform in accordance with manufacturer's specifications				
Tools, Parts, Materials, Test Equipment	Flashlight Rags				

Step	Action
1.	Perform a complete visual inspection of the hull.
2.	Inspect for cracks, corrosion, loose bolts, deformities, and damaged parts in the following areas: Hull inspection plugs Performance fin Collar Rig tubes

APPENDIX A-1 PLANNED MAINTENANCE

Q-8	**Inspect Batteries**				
System	Electrical	**Sub-System**	Batteries		
Description	Inspect Batteries		**Frequency**		Quarterly
Safety Precautions	No smoking in the vicinity Wear safety goggles Wear rubber apron Observe standard safety precautions Perform in accordance with manufacturer's specifications				
Tools, Parts, Materials, Test Equipment	Rags				

Step	Action
1.	Turn off all battery switches and tag out of service.
2.	Remove batteries from the boat and place them on a piece of dunnage.
3.	Clean battery posts and connections.
4.	Clean battery compartment.
5.	Inspect battery mounting brackets and securing devices for damage and corrosion.
6.	Reinstall the batteries.
7.	Remove all tags and place in service.
8.	Test run engines and house electrical/electronic components.

APPENDIX A-1 PLANNED MAINTENANCE

Q-9	**Check Heading Sensor**				
System	Auxiliary	**Sub-System**	Heading Sensor		
Description	Check Heading Sensor		**Frequency**		Quarterly
Safety Precautions					
Tools, Parts, Materials, Test Equipment	Soft Cloth				

Step	Action
	<u>WARNING</u> **Do not use chemical cleaners. They can remove paint and markings.**
1.	Clean component with a clean soft cloth.
2.	Verify all connections are tight.
3.	Check the ground terminal for corrosion. Clean if necessary.

APPENDIX A-1 PLANNED MAINTENANCE

Q-10	**Inspect Hatch Gaskets**				
System	Auxiliary	**Sub-System**	Deck Hatches		
Description	Inspect Hatch Gaskets		**Frequency**		Quarterly
Safety Precautions					
Tools, Parts, Materials, Test Equipment	OEM Manual Acetone Clean rag				

Step	Action
1.	Inspect every 6 months for tears, cracks, or breaks.
2.	If replacement is necessary, refer to appendix A planned maintenance-section A-Annual for gasket removal and re-installation.

APPENDIX A-1 PLANNED MAINTENANCE

Q-11	**Inspect EPIRB**				
System	Auxiliary	**Sub-System**	EPIRB		
Description	Inspect EPIRB		**Frequency**		Quarterly
Safety Precautions					
Tools, Parts, Materials, Test Equipment					

Step	Action
1.	Visually inspect the EPIRB and mounting bracket for deterioration and/or residue buildup.
2.	Wipe beacon and mounting bracket with clean damp cloth to remove any residue buildup.
3.	Verify antenna is secure.
	Note: Battery should be replaced if the beacon has been activated for any use other than the self test. Refer to the OEM manual for battery replacement procedure.
4.	Check time remaining until replacement of battery is required.

APPENDIX A-1 PLANNED MAINTENANCE

Semi-Annual Maintenance

This section contains the following maintenance actions:

Topic	Frequency
Inspect Trailer Brakes and Bearings	S-1

APPENDIX A-1 PLANNED MAINTENANCE

S-1	**Inspect Trailer Brakes and Bearings**				
System	Auxiliary	**Sub-System**	Boat Trailer		
Description	Inspect Trailer Brakes and Bearings		**Frequency**		Semi-Annual or 2000 mi.
Safety Precautions	Observe standard safety precautions Perform in accordance with manufacturer's specifications				
Tools, Parts, Materials, Test Equipment	Tools as required Floor jack and stands Lithium base water proof wheel bearing grease Rags				

Step	Action
1.	The boat must be off the trailer to perform this maintenance.
2.	Remove the tires.
3.	Inspect brake discs for scoring or corrosion.
4.	Inspect wheel bearings and hub shafts for wear and deformities.
5.	Replace any worn parts.
6.	Clean and treat all rust in brake assembly.
7.	Check caliper for leaks and ensure pistons are not frozen in cylinder bores.
	Note: Some trailers are equipped with different style wheel bearing lubrication systems. Refer to manufacturer's recommendations for these type systems.
8.	Repack wheel bearings with lithium base waterproof wheel bearing grease.
9.	Inspect grease seals and replace as needed.

APPENDIX A-1 PLANNED MAINTENANCE

Step	Action
10.	Fill hub with grease.
11.	With the wheel bearings and hub packed with grease, and the seals installed in the hub, place hub on spindle and tighten spindle nut to 25 ft/lbs. while spinning the hub to seat the bearings.
12.	Back off the nut until it is free of the bearing and tighten it, again while spinning the hub, to 18-24 in/lbs.
13.	When the nut is tightened and positioned properly the wheel should turn easily with no end play in the hub.
14.	Install the nut retainer to allow the cotter pin to be installed without turning the nut. (If using a castellated nut, turn it to the closest opening in the nut taking care not to over tighten).
15.	Install bearing buddies and add grease until it moves the piston outboard by 1/8-inch or until grease escapes out of the vent hole in the bearing buddy.
16.	Install brakes and wheels; tighten wheels in a star pattern and torque to manufacturer's specs. Re-torque after first trip or 50 miles.
17.	Inspect tire tread (3/16-inch minimum depth) and condition.
18.	Check air pressure in all tires including spare.

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APPENDIX A-1 PLANNED MAINTENANCE

Annual Maintenance

This section contains the following maintenance actions:

Topic	Frequency
Adjust Engine Synchronization Linkage	A-1
Test Engine Thermostat	A-2
Tighten Engine Mounting bolts	A-3
Flush Trailer Hydraulic Brake System	A-4
Inspect Engine Water Pump	A-5
Replace Hatch Gasket	A-6
Replace SM-2 Automatic Crew Overboard Light Battery	A-7

APPENDIX A-1 PLANNED MAINTENANCE

A-1	**Adjust Engine Synchronization and Linkage**		
System	Engines	**Sub-System**	Engines
Description	Adjust Engine Synchronization Linkage	**Frequency**	Annual or during installation
Safety Precautions	Observe standard safety precautions Perform in accordance with manufacturer's specifications		
Tools, Parts, Materials, Test Equipment	Tools-as specified in manufacturer's instructions		

Step	Action
1.	Perform adjustments according to manufacturer's instructions.

APPENDIX A-1 PLANNED MAINTENANCE

A-2	**Test Engine Thermostat**				
System	Engines	**Sub-System**	Cooling System		
Description	Test Engine Thermostat		**Frequency**		Annual
Safety Precautions	Observe standard safety precautions Perform in accordance with manufacturer's specifications				
Tools, Parts, Materials, Test Equipment	Tools-as specified in manufacturer's instructions Rags Water pump gasket Thermostat				

Step	Action
1.	Turn off all battery switches and tag out of service.
2.	Test operation of thermostat as outlined in manufacturer's instructions.
3.	Replace as necessary as outlined in manufacturer's instructions.
4.	Remove all tags and place in service.
5.	Test run engines.
6.	Check for leaks.

APPENDIX A-1 PLANNED MAINTENANCE

A-3	**Tighten Engine Mounting Bolts**		
System	Engines	**Sub-System**	Engine Mounts
Description	Torque Engine Clamp Mounting Bolts	**Frequency**	Annual or every 100 hrs.
Safety Precautions	Observe standard safety precautions		
Tools, Parts, Materials, Test Equipment	Torque wrench		

Step	Action
1.	Torque engine mounting clamp bolts to 55 foot lbs.
2.	Inspect clamp bracket for cracks.

APPENDIX A-1 PLANNED MAINTENANCE

A-4	**Flush Trailer Hydraulic Brake System**			
System	Trailer	**Sub-System**	Hydraulic Brakes	
Description	Flush Trailer Brake System	**Frequency**	Annual	
Safety Precautions	Avoid contact with brake fluid on skin or in eyes Observe standard safety precautions			
Tools, Parts, Materials, Test Equipment	Wrenches Container to catch old brake fluid Safety glasses Vinyl gloves			

Step	Action
1.	Open bleeder valve on caliper farthest away from the master cylinder.
2.	Manually operate the master cylinder to flush the system of old fluid, while adding new fluid to the master cylinder. Being careful to not introduce air into the system.
3.	When old brake fluid has been flushed from the system close the bleeder valve.
4.	Repeat procedure on the remaining wheel calipers.
5.	Fill master cylinder to within ¼-inch of the top of the reservoir.
6.	Check for leaks and proper brake operation by manually operating master cylinder.

APPENDIX A-1 PLANNED MAINTENANCE

A-5	**Inspect Engine Water Pump**			
System	Engines	**Sub-System**	Water Pump	
Description	Inspect Engine Water Pump	**Frequency**	Annual	
Safety Precautions	Disable engines by securing battery switches Observe standard safety precautions Perform in accordance with manufacturer's specifications			
Tools, Parts, Materials, Test Equipment	Tools-as specified in manufacturer's instructions Rags Grease			

Step	Action
1.	Turn off all battery switches and tag out of service.
2.	Remove outboard lower unit according to manufacturer's instructions.
3.	Remove and inspect water pump according to manufacturer's instructions.
4.	Re-assemble all parts and renew all gaskets. Use anti-seize on all bolts.
5.	Check for twist in drive shaft, clean and grease splines.
6.	Install lower unit.
7.	Remove all tags and place in service.
8.	Test run engines.
9.	Check for leaks.

APPENDIX A-1 PLANNED MAINTENANCE

A-6	**Replace Hatch Gaskets**		
System	Auxiliary	**Sub-System**	Hatches
Description	Replace Hatch Gaskets	**Frequency**	Annual or As Needed
Safety Precautions			
Tools, Parts, Materials, Test Equipment	OEM manual Acetone Clean rag Aluminum primer Touch-up paint Wire brush Die grinder Zep-A-Lume, or equal aluminum etch Locktite, or equal Sikaflex, or equal adhesive/sealant 1" spatula or equivalent spreading tool New gasket, cut to length		

Step	Action
1.	Remove the old gasket and any sealant, corrosion, and other materials or debris from the gasket groove.
2.	Using a wire brush or die grinder, clean gasket groove. Bare metal should be exposed for good adhesion and sealing of the new gasket.
3.	Clean gasket groove with solvent such as acetone.
4.	If it's a painted surface and has been marred or chipped, the bare aluminum surface must be primed and painted. Follow paint manufacturer's instructions for bare metal surface preparation, application and curing time.
5.	For non-painted surface, clean gasket groove with an aluminum etch such as Zep-A-Lume.
6.	Position hatch with gasket groove facing up.
7.	Apply bead of SIKAFLEX or equal marine quality adhesive/sealant in the center of the gasket groove.

APPENDIX A-1 PLANNED MAINTENANCE

Step	Action
8.	Using spreader approximate width of groove, spread adhesive/ sealant so that a consistent film of about 8-10 mil in thickness fills the bottom of the gasket groove.
9.	Using acetone and clean rag, clean the new gasket of any powder, resin, dirt or other foreign material that would inhibit adhesion.
10.	Apply a thin coat of Locktite or equal to the surface of one end of the gasket.
11.	Align ends and press together firmly and hold for 10-20 seconds.
	Note: Do not stretch gasket during installation. Stretching can produce leaks.
12.	Place gasket into groove so that its shape is not distorted or stretched.
13.	Apply firm consistent pressure so the gasket and adhesive/sealant are force together in a uniform manner. The hatch can be dogged in the closed position to achieve a consistent pressure during cure time.
14.	Allow to cure according to manufacturer's instructions.

APPENDIX A-1 PLANNED MAINTENANCE

A-7	**Replace SM-2 Automatic Crew-Overboard Marker Light Battery**			
System	Auxiliary	**Sub-System**	Auxiliary	
Description	Replace SM-2 Battery	**Frequency**		Annual
Safety Precautions				
Tools, Parts, Materials, Test Equipment	Silicone grease			

Step	Action
1.	Hold the unit on a flat, firm surface, lens side up.
2.	Depress the top cap of the unit by pushing straight down until the swivel locks may be turned outward, clear of the cap.
3.	Using a clean cloth or gloves, grip the light lens and pull upward until the top cap is clear of the case.
4.	Turn the unit on its side, open end slightly downwards, to allow the foam filler and battery to slide out.
5.	Disconnect the battery by unscrewing the terminals from the battery posts.
6.	If required, replace the strobe module according to the manufactures specifications.
7.	Secure replacement battery terminals to the battery posts. Connect black lead to center (-) post of battery. Connect red lead to outer (+) post of battery.
8.	Assure tightness.
9.	Check for proper operation by holding the top cap assembly vertical (light lens up).

APPENDIX A-1 PLANNED MAINTENANCE

Step	Action
10.	Hold the case horizontally and slide the battery in, terminal end up (toward the open end of the case).
11.	Lubricate the top cap O-ring with silicone grease and insert the cap and foam spacer into the case.
12.	Place the unit upright on a firm surface, and press the top cap assembly until the cap slips into the case.
13.	Depress the cap until the locking swivel's can be seated into the provided recesses.
14.	Turn the locking swivels, seat them into the cap recesses and remove pressure from the top to allow it to lock.
15.	Verify proper unit operation.
16.	Place unit in mounting bracket and verify lanyard attachment.

Daily Maintenance Log

Date:

Daily Checks	Status	Performed by	Notes
Check all fluid levels	**[ ] Sat [ ] Unsat**		
Inspect lower units and propellers for marine growth	**[ ] Sat [ ] Unsat**		
Verify engine cooling ports are free of all obstructions	**[ ] Sat [ ] Unsat**		
Turn ON all battery switches	**[ ] Sat [ ] Unsat**		
Lower engines to operating position	**[ ] Sat [ ] Unsat**		
Start and run engines for 5+ minutes, log start time	**[ ] Sat [ ] Unsat**		**Start time:**
Ensure self-test alarm system is functioning, log stop time	**[ ] Sat [ ] Unsat**		**Stop time:**
Check telltale for operation of engine water pump	**[ ] Sat [ ] Unsat**		
Test operation of all lighting systems	**[ ] Sat [ ] Unsat**		
Test operation of horn	**[ ] Sat [ ] Unsat**		
Test all loudhailer functions	**[ ] Sat [ ] Unsat**		
Energize radar and test all display functions on all displays	**[ ] Sat [ ] Unsat**		
Verify displayed GPS position information is correct	**[ ] Sat [ ] Unsat**		
Test operation and accuracy of fathometer	**[ ] Sat [ ] Unsat**		
Rotate helm to the port and stbd steering limits	**[ ] Sat [ ] Unsat**		
Verify engines follow smoothly	**[ ] Sat [ ] Unsat**		
Perform radio check on local working frequencies	**[ ] Sat [ ] Unsat**		

Weekly Maintenance Log

System	Date	Performed by	Status	Notes
Propulsion				
Check lower unit oil			**[ ] Sat [ ] Unsat**	
Inspect Propellers			**[ ] Sat [ ] Unsat**	
Test Safety Shut-Off Switch			**[ ] Sat [ ] Unsat**	
Fuel				
Clean Fuel Filter Sediment Bowl			**[ ] Sat [ ] Unsat**	

Monthly Maintenance Log

System	Date	Performed by	Status	Notes
Propulsion				
Inspect Sacrificial Anodes			**[ ] Sat [ ] Unsat**	
Lubricate Propeller Shaft			**[ ] Sat [ ] Unsat**	
Fuel				
Inspect Fuel Hoses			**[ ] Sat [ ] Unsat**	
Electrical				
Inspect Electrical Ground Connections			**[ ] Sat [ ] Unsat**	
Trailer				
Inspect Boat Trailer			**[ ] Sat [ ] Unsat**	
Safety				
Inspect Fire Extinguisher			**[ ] Sat [ ] Unsat**	
Hull				
Test Window Gasket Seal			**[ ] Sat [ ] Unsat**	
Lubricate Hatch and Door Hinges			**[ ] Sat [ ] Unsat**	
Seats				
Lubricat Seat Mechanism			**[ ] Sat [ ] Unsat**	

Quarterly Maintenance Log

System	Date	Performed by	Status	Notes
Propulsion				
Lubricate Zerk Fittings			**[ ] Sat [ ] Unsat**	
Inspect Steering System			**[ ] Sat [ ] Unsat**	
Check Power Tilt & Trim Reservoir Fluid Level			**[ ] Sat [ ] Unsat**	
Replace Spark Plugs			**[ ] Sat [ ] Unsat**	
Fuel				
Replace Fuel Filter			**[ ] Sat [ ] Unsat**	
Lights				
Inspect Navigation Lights			**[ ] Sat [ ] Unsat**	
Hull				
Inspect Hull			**[ ] Sat [ ] Unsat**	
Check Heading Sensor			**[ ] Sat [ ] Unsat**	
Inspect Hatch Gasket			**[ ] Sat [ ] Unsat**	
Electrical				
Inspect Batteries			**[ ] Sat [ ] Unsat**	

Semi-Annual Maintenance Log

System	Date	Performed by	Status	Notes
Trailer				
Inspect Trailer Brakes and Bearings			**[ ] Sat [ ] Unsat**	

Annual Maintenance Log

System	Date	Performed by	Status	Notes
Propulsion				
Adjust Engine Synchronization Linkage			**[ ] Sat [ ] Unsat**	
Test Engine Thermostat			**[ ] Sat [ ] Unsat**	
Tighten Engine Mounting Bolts			**[ ] Sat [ ] Unsat**	
Inspect Engine Water Pump			**[ ] Sat [ ] Unsat**	
Trailer				
Flush Trailer Hydraulic Brake System			**[ ] Sat [ ] Unsat**	
Hull				
Replace Hatch Gasket			**[ ] Sat [ ] Unsat**	

APPENDIX B ACRONYMS AND GLOSSARY

Acronyms and Glossary

General This section contains a list of commonly used terms and acronyms used in this manual.

APPENDIX B ACRONYMS AND GLOSSARY

Acronyms

Acronym	Definition
A	Amperage
A/C	Air Conditioning
ACFT	Aircraft
ACR	Automatic Charging Relay
AGM	Absorbed Glass Mat
AH	Amp Hour
AIS	Automatic Identification System
BOSN	Boatswain
CB	Circuit Breaker
CO	Commanding Officer
DGPS	Differential Global Positioning System
DSC	Digital Selective Calling
EC	Engineering Change
EPIRB	Emergency Position Indicating Radio Beacon
GPH	Gallons Per Hour
GPM	Gallons Per Minute
GPS	Global Positioning System
HAZMAT	Hazardous Material
HF	High Frequency
HIN	Hull Identification Number
HP	Horse Power
HVAC	Heating, Ventilation, and Air Conditioning
Hz	Hertz
KHz	Kilohertz (1×10^3)
LED	Light Emitting Diode
MHz	Megahertz (1×10^6)

APPENDIX B ACRONYMS AND GLOSSARY

Acronyms

Acronym	Definition
MIG	Metal Inert Gas
MOB	Man Overboard
NAV	Navigation
NM	Nautical Miles
NEMA	National Electrical Manufacturers Association
NSN	National Stock Number
OHIP	Overhead Instrument Panel
OIC	Officer-in-Charge
PFD	Personal Flotation Device
PMS	Preventive Maintenance System
PSI	Pounds Per Square Inch
PPE	Personal Protective Equipment
SAFE	Secured Around Flotation Equipped
SINS	Scalable Integrated Navigation System
SOP	Standard Operating Procedure
SSB	Single Side Band
STBD	Starboard
TIG	Tungsten Inert Gas
UHF	Ultra High Frequency
VAC	Voltage Alternating Current
VDC	Voltage Direct Current
VHF	Very High Frequency
WAAS	Wide Area Augmentation System
XO	Executive Officer
XPO	Executive Petty Officer
XTE	Cross Track Error

APPENDIX B ACRONYMS AND GLOSSARY

Glossary

Term	Definition
Abaft	Behind, toward the stern of a vessel.
Abeam	To one side of a vessel, at a right angle to the fore-and-aft centerline.
Aft	Near or toward the stern.
Amidships	In or towards center portion of the vessel, sometimes referred to as midships.
Astern	The direction toward or beyond the back of a vessel.
Athwartships	Crosswise of a ship; bisecting the fore-and-aft line above the keel.
Azimuth	The horizontal angular direction measured from true north to a reference point in the horizontal plane (true bearing), or a horizontal angular direction measured from the bow of the boat to a reference point in the horizontal plane (relative bearing), measured clockwise from 000º through 360º.
Backing Plate	Reinforcement plate below a deck or behind a bulkhead used to back a deck fitting. It is usually made of wood or steel and distributes stress on a fitting over a larger area and prevents bolts from pulling through the deck.
Backing Spring (Line)	Line used when towing a vessel alongside which may be secured near the towing vessel's stern and the towed vessel's bow.
Ballast	Weight placed in a vessel to maintain is stability.
Beacon	Any fixed aid to navigation placed ashore or on marine sites. If lighted, they are referred to as minor lights.
Beam	The widest point of a vessel on a line perpendicular to the keel, the fore-and-aft centerline.
Below	The space or spaces that are underneath a vessel's main deck.
Bilge	The lowest point of a vessel's inner hull, which is underwater.
Bilge Alarm System	An alarm for warning of excessive water or liquid in the bilge.
Bilge Drain	A drain used for removing water or liquid from the bilge.

Glossary (cont.)

Term	Definition
Bilge Pump	A pump used to clear water or liquid from the bilge.
Bitt	A strong post of metal, on deck in the bow or stern, to which anchor, mooring, or towing lines may be fastened.
Boat Hook	A hook on a pole with a pushing surface at the end used to retrieve or pick up objects, or for pushing objects away.
Bollard	A single strong vertical fitting, usually iron, on a pier, or wharf, to which mooring lines or a hawser may be fastened.
Boom	A spar used to spread a fore-and-aft sail, especially its foot; without a sail and with a suitable lift attached; it can be used as a lifting device or derrick.
Bow	The forward end of the vessel.
Bow Line	A line secured from the bow of a vessel. In an alongside towing operation, the bow line is secured on the towing vessel at or near the bow and may act as breast line of each.
Breaking Strength (BS)	The force needed to break or part a line. BS is measured in pounds. More specifically, it is the number of pounds of stress a line can hold before it parts.
Bridle	A device attached to a vessel or aircraft (in the water) in order for another vessel to tow it. Its use can reduce the effects of yawing, stress on towed vessel fitting, and generally gives the towing vessel greater control over the tow.
Bulkhead	Walls or partitions within a vessel with structural functions such as providing strength or water tightness. Light partitions are sometimes called partition bulkheads.
Bullnose	A round opening at the forward most part of the bow through which a towline, mooring line or anchor line passes.
Buoy	A floating aid to navigation anchored to the bottom that conveys information to navigators by their shape or color, by their visible or audible signals, or both.
Buoyancy	The tendency or capacity of a vessel to remain afloat.
Capsize	To turn a vessel bottom side up.

Glossary (cont.)

Term	Definition
Catenary	The sag in a length of chain, cable, or line because of its own weight and which provides a spring or elastic effect in towing, anchoring, or securing to a buoy.
Cavitation	The formation of a partial vacuum around the propeller blades of a vessel.
Center of Gravity	Point in a ship where the sum of all moments of weight is zero. With the ship at rest, the center of gravity and the center of buoyancy are always in a direct vertical line. For surface ships, center of buoyancy is usually below center of gravity, and the ship is prevented from capsizing by the additional displacement on the low side during a roll. Thus the point at which the deck edge enters the water is critical because from here onward, increased roll will not produce corresponding increased righting force.
Centerline	An imaginary line down the middle of a vessel from bow to stern.
Chafe	To wear away by friction.
Chafing Gear	Material used to prevent chafing or wearing of a line or other surface.
Chart	A printed or electronic geographic representation generally showing depths of water, aids to navigation, dangers, and adjacent land features useful to mariners (see nautical chart).
Chine	The intersection of the bottom and the sides of a flat bottom or V hull boat.
Chock	A metal fitting through which hawsers and lines are passed. May be open or closed. Blocks used to prevent aircraft or vehicles from rolling. Also, blocks used to support a boat under repair.
Cleat	An anvil-shaped deck fitting for securing or belaying lines. Wedge cleats are used in yachting to hold sheets ready for instant release.
Combustion	Rapid oxidation of combustible material accompanied by a release of energy in the form of heat and light.
Compartment	A room or space onboard ship. Usually lettered and numbered according to location and use.
Compass	An instrument for determining direction: magnetic, depending on the earth's magnetic field for its force; gyroscopic, depending on the tendency of a free-spinning body to seek to align its axis with that of the earth.

Glossary (cont.)

Term	Definition
Coxswain	Person in charge of a boat, pronounced "COX-un".
Craft	Any air or sea-surface vehicle, or submersible of any kind or size.
Dewatering	The act of removing water from inside compartments of a vessel. Water located high in the vessel, or sufficiently off-center should be removed first to restore the vessel's stability. Used to prevent sinking, capsizing or listing.
Deck	The horizontal plating or planking on a ship or boat.
Deck Fitting	Permanently installed fittings on the deck of a vessel which can be attached to machinery or equipment.
Deck Scuttle	A small, quick-closing access hole located on the deck of a vessel.
Deep "V" Hull	A hull design generally used for faster seagoing types of boats.
Displacement Hull	A hull that achieves its buoyancy or flotation capability by displacing a volume of water equal in weight to the hull and its load.
Draft	The point on a vessel's underwater body, measured from the waterline, that reaches the greatest depth.
Drag	Forces opposing direction of motion due to friction, profile and other components. The amount that a ship is down by the stern.
Drift	The rate/speed at which a vessel moves due to the effects of wind, wave, current, or the accumulative effects of each. Usually expressed in knots.
Drop Pump	A portable, gasoline-powered pump that is transported in a water tight container. Used for de-watering a vessel.
Eductor	A siphon device that contains no moving parts. It moves water from one place to another by forcing the pumped liquid into a rapidly flowing stream. This is known a s the venturi effect. Dewatering equipment used to remove fire fighting and flooding water from a compartment in a vessel.
Emergency Position-Indicating Radio Beacon (EPIRB)	A device, usually carried aboard a maritime craft, that transmits a signal that alerts search and rescue authorities and enables rescue units to locate the scene of the distress.

Glossary (cont.)

Term	Definition
Eye	The permanently fixed loop at the end of a line.
Eye Splice	The splice needed to make a permanently fixed loop at the end of a line.
Fairlead	A specialized fitting, such as a block, chock, or roller used to change the direction and increase effectiveness of a line or cable. It will, in most cases, reduce the effects of chafing.
Fatigue	Physical or mental weariness due to exertion. Exhausting effort or activity. Weakness in material, such as metal or wood, resulting from prolonged stress.
Fender	A device of canvas, wood, line, cork, rubber, wicker, or plastic hung over the side of a boat/ship.
Fender Board	A board that is hung outboard of the vessel's fenders. Used to protect the side of a vessel.
Fitting	Generic term for any part or piece of machinery or installed equipment.
Fixed Light	A light showing continuously and steadily, as opposed to a rhythmic light.
Floating Aid to Navigation	A buoy.
Fore	Something situated at or near the front. The front part, at, toward, or near the front; as in the forward part of a vessel.
Forward	Toward the bow of a vessel.
Freeboard	Distance from the weather deck to the waterline on a vessel.
Global Positioning System (GPS)	A satellite-based radio navigation system that provides precise, continuous, worldwide, all-weather three-dimensional navigation for land, sea and air applications.
Grabline	A line hung along a vessel's side near the waterline used for the recovery of persons in the water or to assist in the boarding of the vessel.
Grommet	A round attaching point, of metal or plastic, normally found on fenders, tarps, etc.

Glossary (cont.)

Term	Definition
Gunwale	The upper edge of a boat's side. Pronounced "gun-ul".
Hatch	The covering, often watertight, placed over an opening on the horizontal surface of a boat/ship.
Hawsepipe	A through deck fitting normally found above a line locker/hold which allows for the removal of line without accessing the compartment from below deck. Normally only slightly larger in diameter than the line itself.
Heading	The direction in which a ship or aircraft is pointed.
Helm	The apparatus by which a vessel is steered; usually a wheel or tiller.
Hoist	To lift. Display of signal flags at yardarm. The vertical portion of a flag alongside its staff.
Hoisting Cable	The cable used to perform a boat/helo hoisting evolution.
Hull	The body or shell of a ship or seaplane.
Hull Integrity	The hull's soundness.
Impeller	A propulsion device that draws water in and forces it out through a nozzle.
Inboard	Toward the center of a ship or a group of ships, as opposed to outboard.
Inboard/ Outdrive (I/O)	An inboard engine attached through the transom to the outdrive.
Keel	The central, longitudinal beam of a ship from which the frames and hull plating rise.
Knot	A unit of speed equivalent to one nautical mile (6,080 feet) per hour. A measurement of a ship's speed through water. A collective term for hitches and bends.
Lazarette	A compartment in the extreme after part of the boat generally used for storage.
Life Jacket	See personal floatation device.
Life Ring (Ring Buoy)	A buoyant device, usually fitted with a light and smoke marker, for throwing to a person-in-the water.
Longitude	A measure of angular distance in degrees, minutes, and seconds east or west of the Prime Meridian at Greenwich.

Glossary (cont.)

Term	Definition
Longitudinal	A structural member laid parallel to the keel upon which the plating or planking is secured. Longitudinals usually intersect frames to complete the skeletal framework of a vessel.
Loudhailer	A loudspeaker; public address system.
Magnetic Compass	A compass using the earth's magnetic field to align the compass card (see compass).
Mast	A spar located above the keel and rising above the main deck to which may be attached sails, navigation lights, and/or various electronic hardware. The mast will vary in height depending on vessel type or use.
Mooring Line	A chain or synthetic line that attaches a floating object to a stationary object. (e.g. dock, sinker).
Mooring Buoy	A white buoy with a blue stripe, used for a vessel to tie up to, also designates an anchorage area.
Navigation	The art and science of locating the position and plotting the course of a ship or aircraft.
Noise	The result of the propeller blade at the top of the arc transferring energy to the hull.
Outboard	In the direction away from the center line of the ship. Opposite is inboard. Also, an engine which is attached to the transom of a vessel.
Outdrive	A transmission and propeller or jet drive attached to the transom of a vessel.
Personal Flotation Device (PFD)	A general name for various types of devices designed to keep a person afloat in water (e.g., life preserver, vest, cushion, ring, and other throwable items).
Personnel Marker Light (PML)	A device that uses either a battery or chemical action to provide light for the wearer to be seen during darkness.
Planing Hull	A boat design that allows the vessel to ride with the majority of its hull out of the water once its cruising speed is reached (e.g., 8-meter RHI).
Port	The left side of the vessel looking forward toward the bow.

Glossary (cont.)

Term	Definition
Port Hole	An opening in the hull, door, or superstructure of a boat/ship often covered with a watertight closure made of metal or wood.
Port Light	A port hole closure or covering having a glass lens through which light may pass.
Prop Wash	The result of the propeller blade at the top of the arc transferring energy to the water surface.
Propeller	A device consisting of a central hub with radiating blades forming a helical pattern and when turned in the water, creates a discharge that drives a boat.
RACON	See radar beacon.
Radar	Radio detecting and ranging. An electronic system designed to transmit radio signals and receive reflected images of those signals from a target in order to determine the bearing and distance to the target.
Radar Beacon (RACON)	A radar beacon that produces a coded response, or radar paint, when triggered by a radar signal.
Radiobeacon	An electronic apparatus which transmits a radio signal for use in providing a mariner a line of position. First electronic system of navigation. Provided offshore coverage and became the first all-weather electronic aid to navigation.
Rig	To devise, setup, arrange. An arrangement or contrivance. General description of a ship's upper works; to set up spars or to fit out. A distinctive arrangement of sails (rigging), as in a schooner rig. An arrangement of equipment and machinery, as an oil rig.
Rigging	The ropes, lines, wires, turnbuckles, and other gear supporting and attached to stacks, masts and topside structures. Standing rigging more or less permanently fixed. Running rigging is adjustable, (e.g., cargo handling gear).
Rhode	The line to which a small boat rides when anchored. Also called and anchor line.
Rubrail	A permanent fixture, often running the length of a boat, made of rubber that provides protection much as a fender would.
Sampson Post	Vertical timber or metal post on the forward deck of a boat used in towing and securing. Sometimes used as synonym for king post.

Glossary (cont.)

Term	Definition
Scope	The length of anchor line or chain. Number of fathoms of chain out to anchor or mooring buoy. If to anchor, scope is increased in strong winds for more holding power. Also, the length of towline or distance from the stern of the towing vessel to the bow of the tow.
Screw	A vessel's propeller.
Scupper	An opening in the gunwale or deck of a boat which allows water taken over the side to exit. Common to most self-bailing boats.
Scuttle	A small, quick-closing access hole; to sink a ship deliberately.
Sea Chest	Intake between ship's side and sea valve or seacock. Sailor's trunk. A through-hull fitting used in the vessels engine cooling systems. It allows the vessel to take on seawater through a closed piping system.
Sea Chest Gate Valve	A gate valve used in between the sea chest and the fire pump or engine cooling system.
Sea Cock	A valve in the ship's hull through which seawater may pass.
Shackle	A U-shaped metal fitting, closed at the open end with a pin, used to connect wire, chain, or line.
Shaft	A cylindrical bar that transmits energy from the engine to the propeller.
Ship	Any vessel of considerable size navigating deepwater, especially one powered by engines and larger than a boat. Also, to set up, to secure in place. To take something aboard.
Siren	A sound signal which uses electricity or compressed air to actuate either a disc or a cup-shaped rotor.
Skiff Hook (Kicker Hook)	A ladder hook or a stainless steel safety hook to which a six inch length of stainless steel round stock has been welded. A hook that is used in attaching a tow line to a small trailerable boat, using the trailer eyebolt on the boat.
Sling	A type of rescue device used by a helicopter to hoist uninjured personnel; a lifting device for hoisting cargo.
Sound Signal	A device that transmits sound, intended to provide information to mariners during periods of restricted visibility and foul weather; a signal used to communicate a maneuver between vessels in sight of each other.

Glossary (cont.)

Term	Definition
Spring Line	A mooring line that makes an acute angle with the ship and the pier to which moored, as opposed to a breast line, which is perpendicular, or nearly so, to the pier face; a line used in towing alongside that enables the towing vessel to move the tow forward and/or back the tow (i.e., tow spring and backing spring).
Stanchion	A vertical metal or wood post aboard a vessel.
Starboard	The right side of the vessel looking forward toward the bow.
Station Keeping	The art of keeping a boat in position, relative to another boat, aid , or object with regard to current, sea, and/or weather conditions.
Steerage	The act or practice of steering. A ship's steering mechanism.
Stem	The principal timber at the bow of a wooden ship, to which the bow planks are rabbeted. Its lower end is scarfed to the keel, and the bowsprit tests on the upper end. The cutwater, or false stem (analogous to false keel), is attached to the fore part of the stem and may be carved or otherwise embellished, especially in the vicinity of the head, which usually rests upon it. In steel ships, the stem is the foremost vertical or near-vertical strength member, around which or to which the plating of the bow is welded or riveted. Compare stern-post.
Stern	The extreme after end of a vessel.
Stokes Litter	A rescue device generally used to transport non-ambulatory persons or persons who have injuries that might be aggravated by other means of transportation.
Strobe Light	A device that emits a high intensity flashing light visible for great distances. Used to attract the attention of aircraft, ships, or ground parties, it flashes white light at 50 plus or minus 10 times per minute.
Strut	An external support for the propeller shaft integral to the hull/under water body.
Superstructure	Any raised portion of a vessel's hull above a continuous deck (e.g., pilot house).
Survival Kit	A kit designed to aid a person-in-the-water to survive. Consists of a belt attached around the waist. A personal signal kit is also attached.

Glossary (cont.)

Term	Definition
Taffrail	A rail around a vessel's stern over which a towline is passed. Used to reduce the effects of chafing on the towline.
Tag Line	Line used to steady a load being swing in or out.
Thimble	A metal ring grooved to fit inside a grommet or eye splice.
Through Bolt	A bolt that is used to fasten a fitting to the deck. It goes through the deck and backing plate (located below deck).
Tie Down	A fitting that can be used to secure lines on a deck or dock.
Topside	The area above the main deck on a vessel; weather deck.
Tow Line	A line, cable, or chain used in towing a vessel.
Tow Strap	When towing alongside, the tow strap is secured near the towing vessel's bow and the towed vessel's stern (see spring line).
Towing Bridle	See bridle.
Transom	The transverse aftermost part of a square stern boat.
Trim	The fore-and-aft inclination of a ship, down by the head or down by the stern. Sometimes used to include list. Also means shipshape, neat.
Trim Control	A control that adjusts the propeller axis angle with horizontal.
Vari-Nozzle	A fire-fighting nozzle having a fully adjustable spray head that allows the operator to deliver a wide range of spray patterns (from stream to low velocity fog).
Venturi Effect	To move water from one place to another by entraining the pumped liquid in a rapidly flowing stream. It is the principle used by the eductor in dewatering a vessel.
Waist and/or Tag Line	Lines used to secure the hull or cabin bridles in position for towing.
Watertight Integrity	The closing down of openings to prevent entrance of water into vessel.

APPENDIX C ELECTRICAL CONNECTIONS

C Electrical Connections

SAFE Boats, International utilizes a range of connectors to include; butt-connectors, screw-down spade connectors, and Deutsch connectors.

There are two series of Deutsch connectors that provide the various pin configurations. Deutsch series DT connectors provide the smaller 2, 6, 8, and 12 configurations, and accept 14-20 AWG. Deutsch DT connectors are typically utilized on the component connection for ease of removal and replacement of individual equipment and components.

Deutsch series HD connectors provide the larger pin configurations; 12, 21, and 23 pin, and accept 6-22 AWG. The HD series Deutsch connectors make up the equipment harnesses and can typically be found in the radar arch, OHIP, and forward electronics space. For boat specific locations of Deutsch connectors, refer to the boat drawings and wire table list provided with the boat. Contact SAFE Boats, International for further details.

APPENDIX C ELECTRICAL CONNECTIONS

C.1 Testing Continuity

Continuity testing is done to determine whether a circuit is open or closed. Example, a wall switch is closed when turned to the "on" position and open when turned "off". An open circuit cannot conduct electricity. A closed circuit has continuity.

To test the continuity of a circuit requires the use of a multimeter or a continuity tester.

CAUTION

This test should be done when current is NOT present. Always turn off the main circuit breaker before attempting a continuity test. Failure to comply may result in serious injury to personnel or equipment.

Table C.1. Continuity Testing

Step	Action
	Note 1: The symbol for ohm is **Ω.** If there is more than one ohm setting, choose X1. An analog meter uses a needle to indicate the measured value. A digital meter performs the same test functions as an analog but provides a numeric reading.
1.	Set the multimeter to the ohm setting.
	Note 2: While the probes are not touching anything, the multimeter will indicate a reading of infinity-meaning that the circuit is open. When the two probes touch each other, the reading changes to zero-indicating a closed circuit or complete. A complete circuit is one that can conduct electricity, an open circuit cannot.
2.	Touch each probe to one of the terminals (or poles) of the device. If the reading changes to zero the device has continuity.
3.	To test a switch, place a probe on each pole of the switch. When the switch is moved from the "off" to the "on" position, the meter reading should change from infinity to roughly zero. This implies the switch is working.

Table C.2. Accessing Cabin Overhead Wire Way

Step	Action
	Tools required: • Philips Head Screwdriver
	Note 1: Two persons required for accessing overhead wire way.
1.	**Tag out in accordance with local command electrical safety instructions.**
2.	Verify circuit breakers are set to the OFF position.
3.	With one person supporting wire way cover plate, remove securing screws from port and stbd sides of the wire way.
4.	Refer to Appendix C.6 for Deutsch DT disconnect procedure to the overhead lights.
5.	Lower wire way cover plate and set out of the way.
6.	To reinstall, reverse procedure using appendix C, table C.7 for Deutsch DT connection procedure to reconnect the overhead lights.

Table C.3. Accessing OHIP Wiring

Step	Action
1.	Shut off all battery panel switches and tag out of service.
	CAUTION **The OHIP is heavy and awkward. Use two persons to perform this action. One person to hold the OHIP in place, and one person to remove the screws.**
2.	Remove six socket head screws securing OHIP to cabin overhead. Retain screws for later installation.
3.	Lower OHIP.
4.	To raise OHIP, reverse procedure.

Table C.4. Wire Stripping and Crimping Procedure

Step	Action
	Tools required: • Wire Stripping Tool • Wire Cutter • Heat Gun • Connectors
1.	Using wire cutters, trim wire lead to provide clean connection.
2.	Verify length necessary to strip for clean connection.
	Note 1: Conductor (wire) strands should be fully inserted into connector, insulation should meet connector end. (No exposed conductor strands.)
3.	Using wire stripping tool, insert wire into appropriate size wire gauge on the tool (figure C.4a).
	 **Figure C.4a. Wire Stripping**

Table C.4. Wire Stripping and Crimping Procedure (cont.)

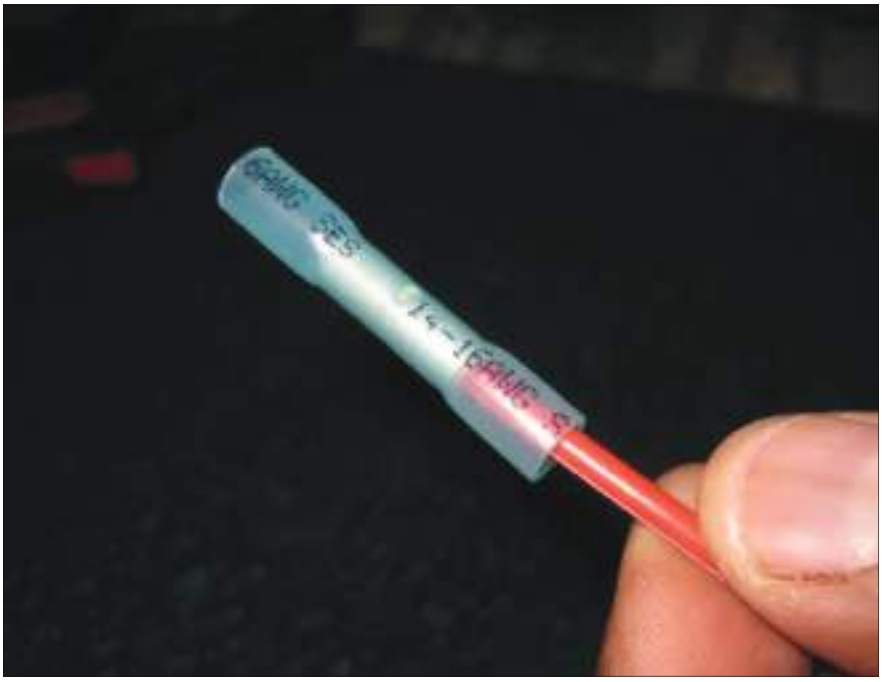
Step	Action
4.	Close stripping tool around wire and pull insulation off the end of wire.
	Note 2: Refer to table C.5 for Deutsch pin crimping procedure.
5.	Insert wire into connector (figure C.4b and C.4c), ensure all wire strands are within connector.
	 **Table C.4b. Example Butt Connector**

Table C.4. Wire Stripping and Crimping Procedure (cont.)

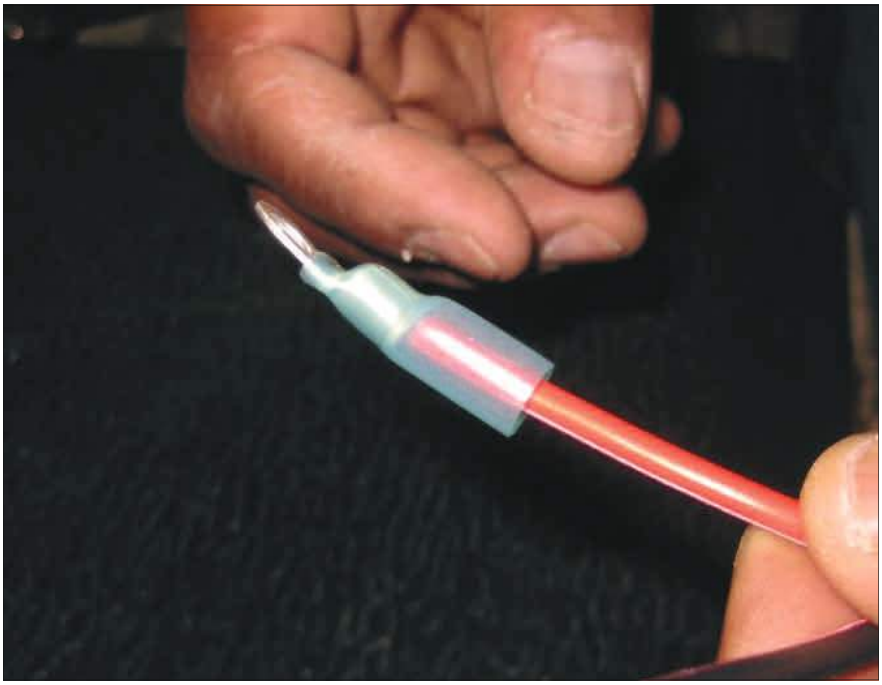
Step	Action
	

Table C.4c. Example Screw Down Spade Connector

Table C.4. Wire Stripping and Crimping Procedure (cont.)

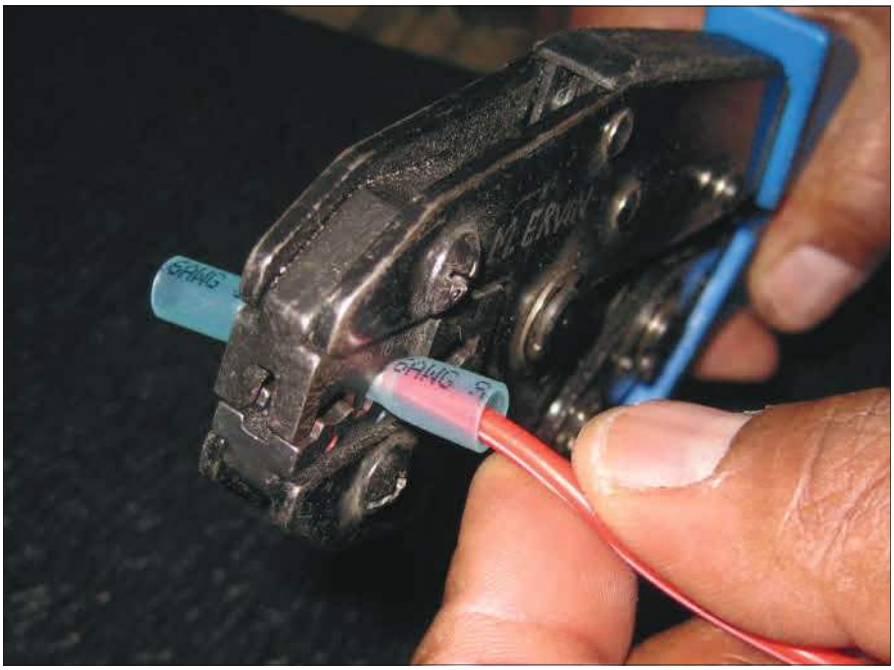
Step	Action
6.	Crimp connector to secure wire (figure C.4d).
	 **Table C.4d. Crimping Connection**

Table C.4. Wire Stripping and Crimping Procedure (cont.)

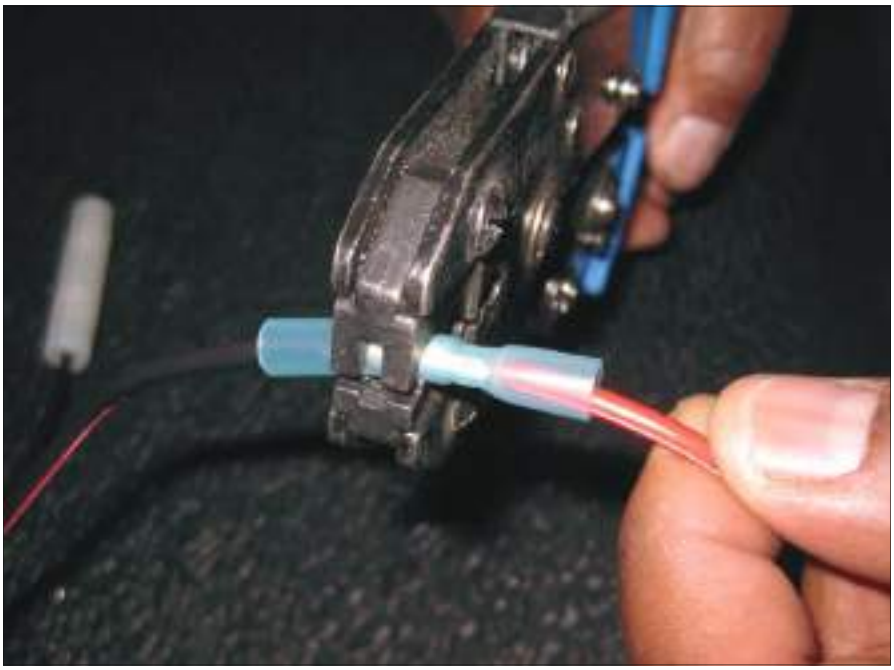
Step	Action
7.	For butt connector, repeat steps 4 thru 6 for opposing connection (figure C.4e).
	 **Table C.4e. Crimping Opposing Butt Connection**
8.	Pull on wires to ensure a secure crimp connection.

Table C.4. Wire Stripping and Crimping Procedure (cont.)

Step	Action
9.	Using heat gun, apply heat by waving heat gun over connection until connector shrinks tight to wires (figure C.4f). This provides for a water-tight connection.
	 **Table C.4f. Heat Shrinking Connector**

Table C.5. Deutsch Pin Crimping Procedure

Step	Action
	Tools required: • Wire Stripper/Cutter • Deutsch Crimp Tool • Deutsch Pins
	Note 1: Ensure wire stripping does not damage the conductor strands.
1.	On the component to be installed, strip ends of wire following table C.4, being careful to only strip enough insulation for insertion into new pin. Insulation should touch the pin when fully inserted and conductor strands should be seen through inspection hole in pin (figure C.5a).
	 **Figure C.5a. Deutsch Pin Inspection Hole**
	Note 2: All wire strands must be located within the pin.
2.	Insert conductor strands into new pin.

Table C.5. Deutsch Pin Crimping Procedure (cont.)

Step	Action
3.	Verify and adjust calibration of Deutsch crimping tool for correct wire size. The end of the connection pin should be flush with the opening in the Deutsch crimping tool (figure C.5b).
	 **Figure C.5b. Deutsch Crimping Tool**
	Note 3: Contacts must only be crimped once.
4.	Insert wire with connection pin into Deutsch crimping tool and crimp pin. Verify wire is securely attached by pulling. Repeat for additional pins.

Table C.6. Deutsch DT Disconnect Procedure

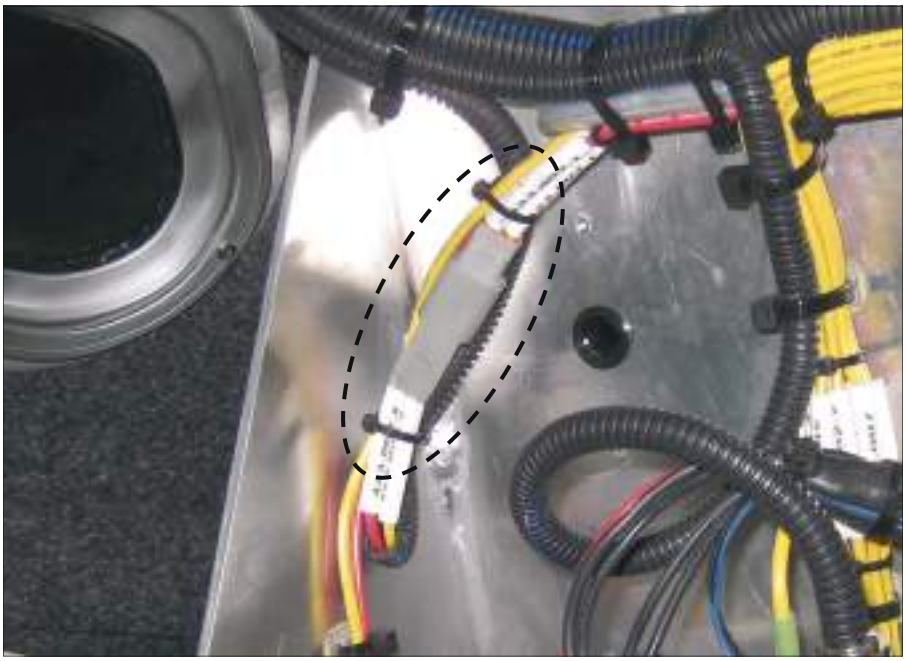
Step	Action
	Tools required: • Wire Stripper/Cutter • Needle Nose Pliers • Deutsch Removal Tool • Deutsch Crimp Tool • Deutsch Pins • Philips Screw Driver
1.	**Tag out in accordance with local command electrical safety instructions.**
2.	Verify component circuit breaker is set to the OFF position.
3.	Refer to table 423.1 for lowering radar arch or table C.3 for access to OHIP wiring.
	 **Figure C.6a. Deutsch DT Connector**

Table C.6. Deutsch DT Disconnect Procedure (cont.)

Step	Action
4.	Separate the Deutsch DT connector ends.
	Note 1: Do not use metal tools to perform extraction of wedge or connecting pins.
5.	Using Deutsch removal tool, insert tool into slot in green wedge (figure C.6b), and pry out wedge. Retain wedge for reinstallation.
	 **Figure C.6b. Deutsch Wedge Removal Slot**

Table C.6. Deutsch DT Disconnect Procedure (cont.)

Step	Action
6.	Below each pin is a securing clip (figure C.6c), insert Deutsch removal tool between clip and pin. Apply pressure away from pin while pulling wire and pin out. Repeat for additional pins. Retain Deutsch connector for reinstallation.
	 **Figure C.6c. Deutsch Pin Securing Clips**
7.	Remove bolts securing component and retain for later installation.
8.	Remove component. See table C.5 for Deutsch pin crimping procedure.

Table C.7. Deutsch DT Connection Procedure

Step	Action
	Tools required: • Needle Nose Pliers • Male Side Deutsch Connector • Screw driver
1.	Verify all battery panel switches are shut off and tagged out of service.
2.	Verify component circuit breaker is set to the OFF position.
3.	Follow appropriate procedure; table C.3 for accessing OHIP wiring, or table 423.1 for lowering the radar arch.
4.	Ensure Deutsch pins on replacement component have been crimped properly, refer to table C.5 for Deutsch pin crimping procedure.
5.	Insert component wires with Deutsch pins, through access hole or wire way. Secure component with bolts previously removed.
6.	Insert pin(s) into male Deutsch DT connector. When fully inserted pin should click into place. Pull back to ensure proper connection has been made. Repeat for additional pins.
7.	After all pins are secured in place, insert green wedge using needle nose pliers (figure C.7a).

Table C.7. Deutsch DT Connection Procedure (cont.)

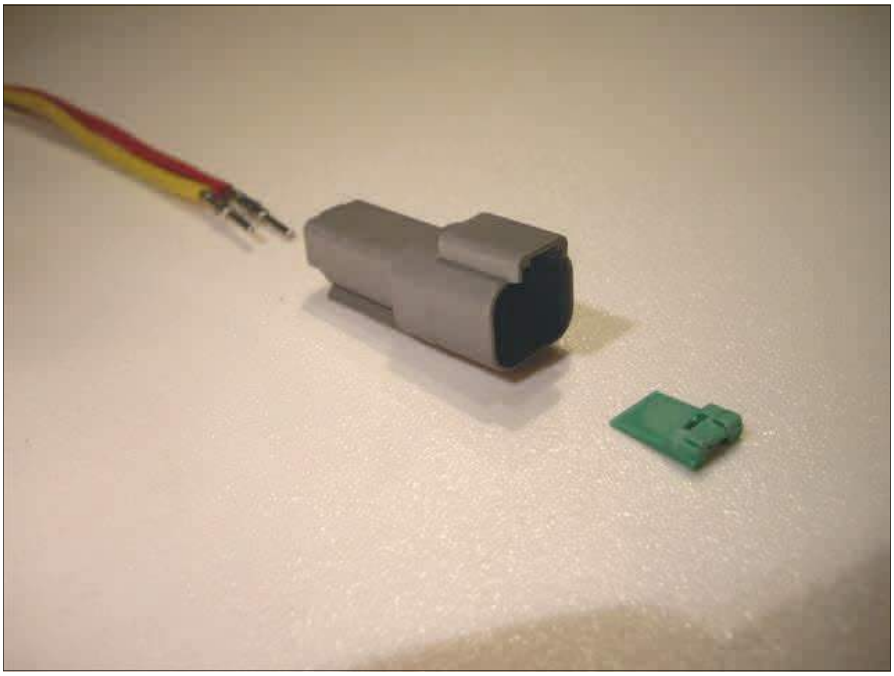
Step	Action
	 **Figure C.7a. Male Deutsch Connection**
8.	Connect the two Deutsch connector ends.
9.	Reverse procedure table C.3 accessing OHIP wiring, or 423.1 for lowering radar arch.
10.	Verify component circuit breaker is set to the ON position.
11.	Verify all battery panel switches are turned on, remove tags and place in service.
12.	Verify operation of component.

Table C.8. Deutsch HD Series Removal Procedure

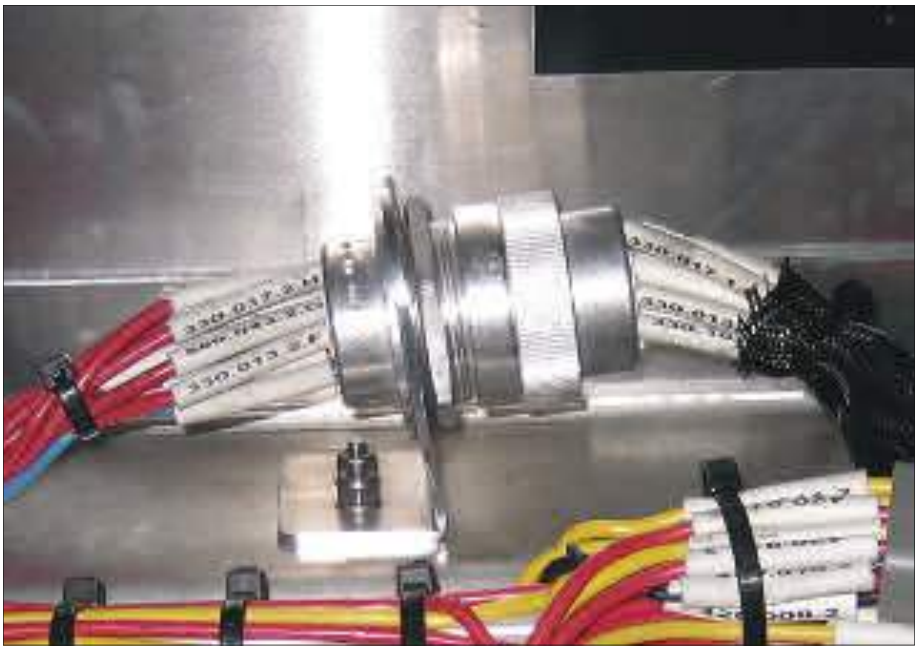
Step	Action
	Tools required: • Wide grip pliers • Needle Nose Pliers • Deutsch Removal Tool • Electrical Tape
	Note 1: Use boat electrical drawings and wire table to determine correct connection(s) to be replaced. Typical installation may require opposite end of wire to be removed from wire way and opposing Deutsch connector end. Contact SAFE Boats, International to receive details on Deutsch HD series connections and locations specific to vessel.
	 **Figure C.8a. Deutsch HD Connector**
1.	**Tag out in accordance with local command electrical safety instructions.**

Table C.8. Deutsch HD Series Removal Procedure (cont.)

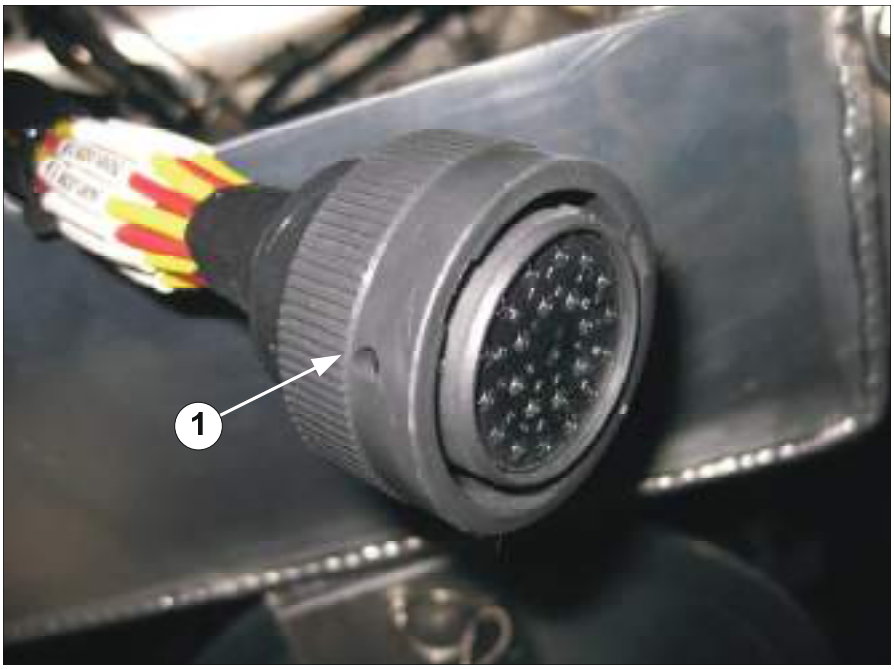
Step	Action
2.	Verify circuit breakers are set to the OFF position.
3.	Refer to table C.2 for accessing cabin overhead wire way.
	Note 2: Radar arch wiring harness can be completely removed for wire replacement. Cut zip-ties in cabin overhead wire way to remove harness.
4.	Prior to removing Deutsch HD connection, locate both ends of wire to be replace. Deutsch HD series connectors are typically used as wiring harnesses.
5.	Turn the quick connect-disconnect bayonet coupling (1, figure C.8b), on the female side of the Deutsch connector counter clock -wise to unlock and separate Deutsch connector ends.
	 **1. Quick Connect-Disconnect Bayonet Coupling** **Figure C.8b. Female Side of Deutsch HD Connector**

Table C.8. Deutsch HD Series Removal Procedure (cont.)

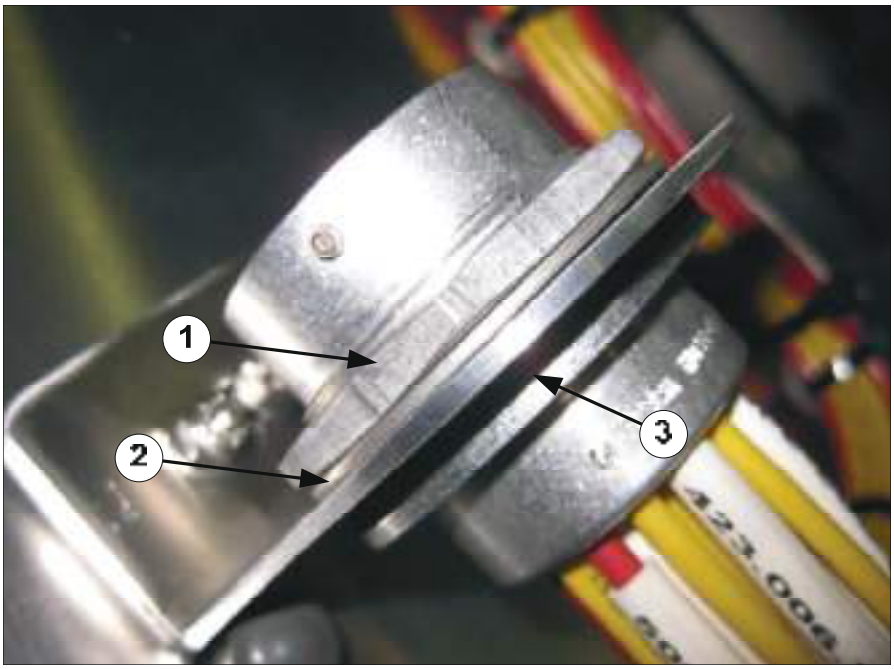
Step	Action
6.	If connection to be replaced is on the female side of the connector, proceed to step 6.
7.	If connection to be replaced is on male side of Deutsch connector, use wide grip pliers and remove securing nut and locking washer (1, 2, figure C.8c), from HD connector. Retain for reinstallation.
	 **1. Securing Nut** **2. Locking Washer** **3. Gasket** **Figure C.8c. Deutsch HD Mount**
8.	Remove the male side of the Deutsch connector from the mounting bracket. Retain gasket for reinstallation (3, figure C.8c).
9.	Locate and verify wire to be removed.

Table C.8. Deutsch HD Series Removal Procedure (cont.)

Step	Action
	Note 3: Do not use metal tools to perform extraction of wedge or connecting pins.
10.	Insert Deutsch removal tool onto the wire to be removed and slide into the Deutsch connector (figure C.8d).
	 **Figure C.8d. Deutsch Removal Tool**

Table C.8. Deutsch HD Series Removal Procedure (cont.)

Step	Action
11.	Remove wire from Deutsch connector (figure C.8e).
	 **Figure C.8e. Wire Removal**
	Note 4: Deutsch HD connectors are utilized as harnesses throughout the boat. Typical installation may require opposite end of wire to be removed from wire way and opposing Deutsch connector end. It is recommended that boat drawings and wire tables are utilized, as well as contacting SAFE Boats for boat specific details.
12.	Using electrical tape, secure replacement wire to the wire to be removed.
13.	Remove wire. Old wire will run new wire through wire way during removal.
14.	Refer to table C.9 for Deutsch HD series connection procedure.

Table C.9. Deutsch HD Series Connection Procedure

Step	Action
	Tools required: • Wide grip pliers • Needle Nose Pliers • Deutsch Removal Tool
	Note 1: Use boat electrical drawings or wire table to determine correct connection(s) to be replaced. Contact SAFE Boats, International to receive details on Deutsch HD series connections and locations specific to vessel.
1.	**Tag out in accordance with local command electrical safety instructions.**
2.	Verify circuit breakers are set to the OFF position.
3.	Refer to table C.8 for Deutsch HD series disconnect procedure.
4.	Determine connection to be replaced and verify.
5.	Refer to table C.4 for wire stripping and table C.5 for Deutsch pin crimping procedure.
6.	Verify label is transferred to both ends of new wire connection.

Table C.9. Deutsch HD Series Connection Procedure (cont.)

Step	Action
7.	Insert new wire with Deutsch pin into Deutsch HD connector (figure C.9a), ensure correct placement.
	 **Figure C.9a. New Connection Insertion**
8.	Pull back on connection to ensure Deutsch connector pin and wires are securely set.
9.	Reverse table C.8 to reconnect Deutsch HD series connection.

Table C.10. Testing for Faulty Breaker

Step	Action
	Tools required: • phillips screwdriver • Voltage meter • Replacement breaker
1.	Disconnect all loads.
2.	If breaker resets with all known loads disconnected, begin re-connecting devices one by one.
3.	If breaker does not reset and does not put out voltage (table C.1), on the load terminal even with all known loads disconnected, breaker is faulty.
4.	Refer to C.11 for replacing faulty breaker.

Table C.11. Replacing Blue Sea Faulty Breaker

Step	Action
	Tools required: • phillips screwdriver • Voltage meter • Replacement breaker • Breaker brand name • Breaker part # • Breaker size • Breaker type
	Note 1: Access for removal of the breaker is from the cuddy cabin stbd side electronics space.
	Note 2: Always remove load from breaker before shutting it off.
1.	Shut off all branch circuits.
	Note 3: With main breaker off, the buss bar is isolated from incoming voltage.
2.	Shut off main breaker.
3.	Check for voltage on any adjacent two breakers to ensure panel is dead.

Table C.11. Replacing Blue Sea Faulty Breaker (cont.)

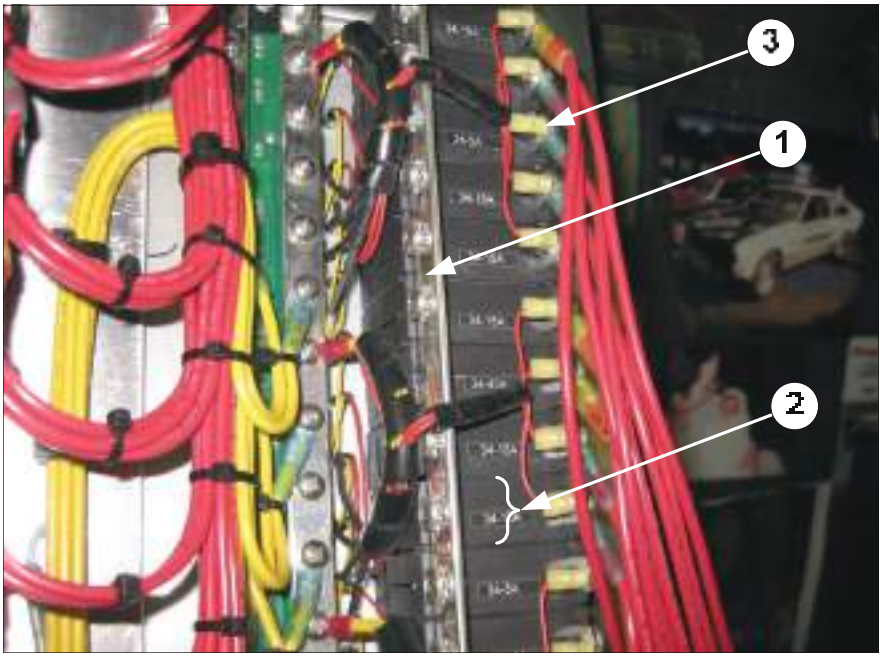
Step	Action
4.	Using phillips screwdriver, loosen full length of buss bar (1, figure C.11a), to provide enough space for removal and installation of breaker.
	 **1. Breaker Buss Bar** **2. Breaker** **3. Breaker Load Terminal** **Figure C.11a. Breaker Panel Connections**

Table C.11. Replacing Blue Sea Faulty Breaker (cont.)

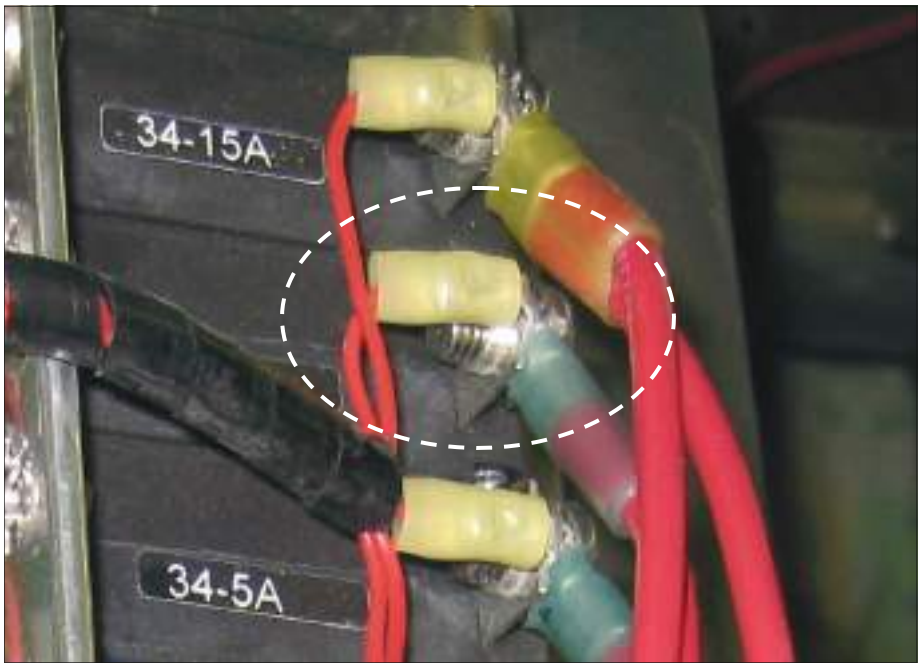
Step	Action
5.	Disconnect the wire from the load terminal of the breaker (figure C.11b), and pull wire out of the way.
	 **Figure C.11b. Breaker Load Connection**

Table C.11. Replacing Blue Sea Faulty Breaker (cont.)

Step	Action
6.	Remove two phillips securing screws from front of breaker (figure C.11c). Retain for later installation.
	 **Figure C.11c. Breaker Securing Screws**
7.	Remove breaker from back of panel.
8.	Insert replacement breaker from back of panel.
9.	Re-install two phillips securing screws in front of breaker.
10.	Re-attach wire to load terminal in the back of the breaker.
11.	Inspect for any potential problems, such as loose terminals and tighten all connections.
12.	Using phillips head screwdriver, tighten full length of buss bar.

Table C.11. Replacing Blue Sea Faulty Breaker (cont.)

Step	Action
13.	Ensure all branch circuit breakers are shut off.
14.	Turn on main breaker.
15.	One by one, turn on branch circuit breakers.
16.	Check and test to ensure all systems are normal.

Table C.12. Replacing Blue Sea 360 Panel Faulty Breaker

Step	Action
	Tools required: • Phillips screwdriver • Voltage meter • Replacement breaker
	Note 1: Access for removal of the breaker is from the fwd cabin port side electronics space.
	Note 2: Always remove load from breaker before shutting it off.
1.	Shut off all branch circuits.
	Note 3: With main breaker off, the buss bar is isolated from incoming voltage.
2.	Shut off main breaker.
3.	Check for voltage on any adjacent two breakers to ensure panel is dead.

Table C.12. Replacing Blue Sea 360 Panel Faulty Breaker (cont.)

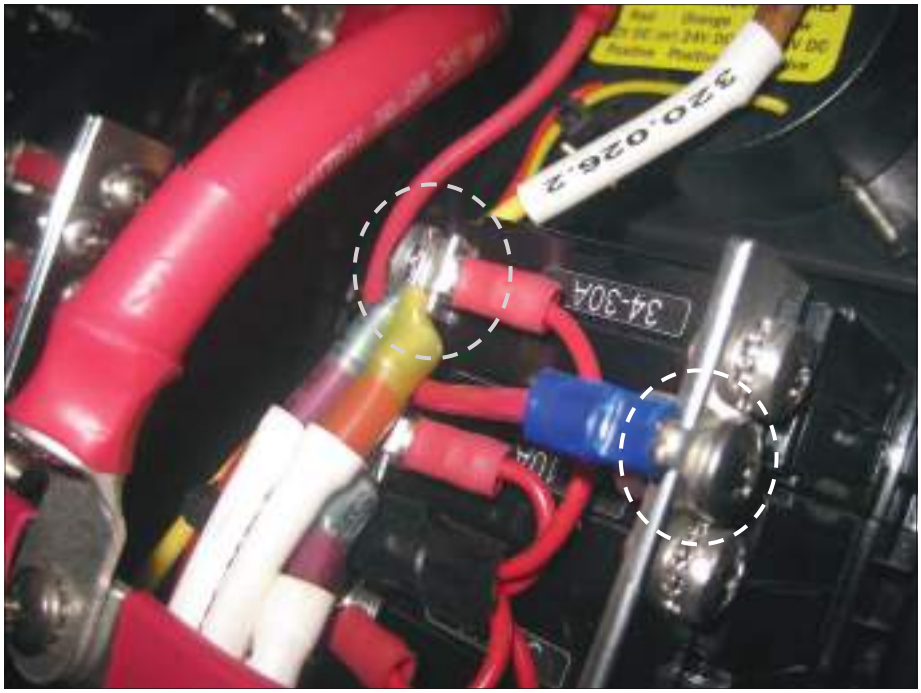
Step	Action
4.	Using phillips screwdriver, remove all connecting wires of breaker load terminal (figure C.11a), from breaker.
	 **Figure C.11a. Breaker Load Terminal Connections**

Table C.12. Replacing Blue Sea 360 Panel Faulty Breaker (cont.)

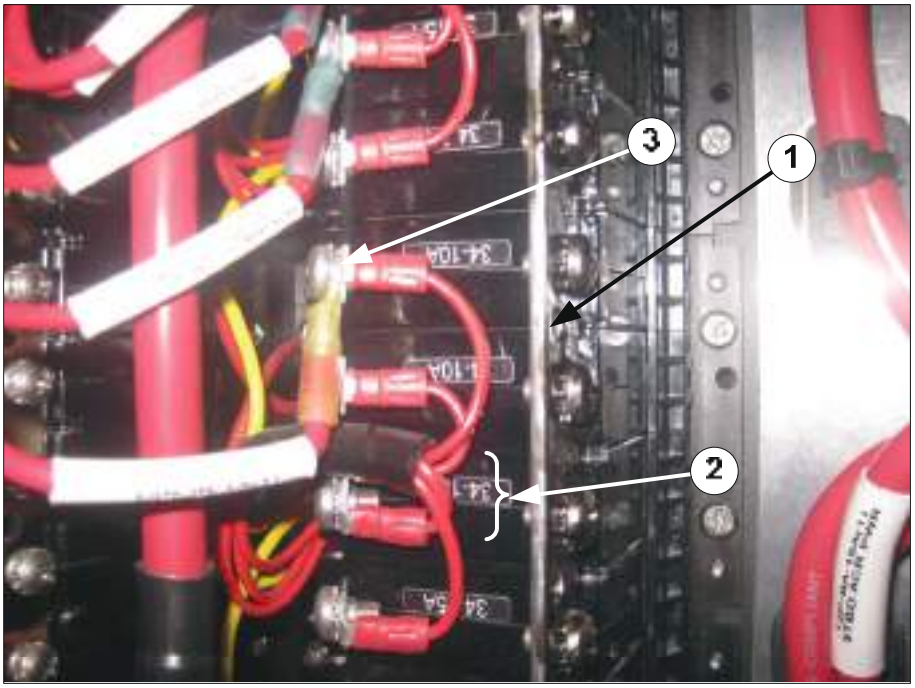
Step	Action
5.	Using phillips screwdriver, loosen full length of buss bar (1, figure C.11b), to provide enough space for removal and installation of breaker.
	 **1. Breaker Buss Bar** **2. Breaker** **3. Breaker Load Terminal** **Figure C.11b. Breaker Panel Connections**

Table C.12. Replacing Blue Sea 360 Panel Faulty Breaker (cont.)

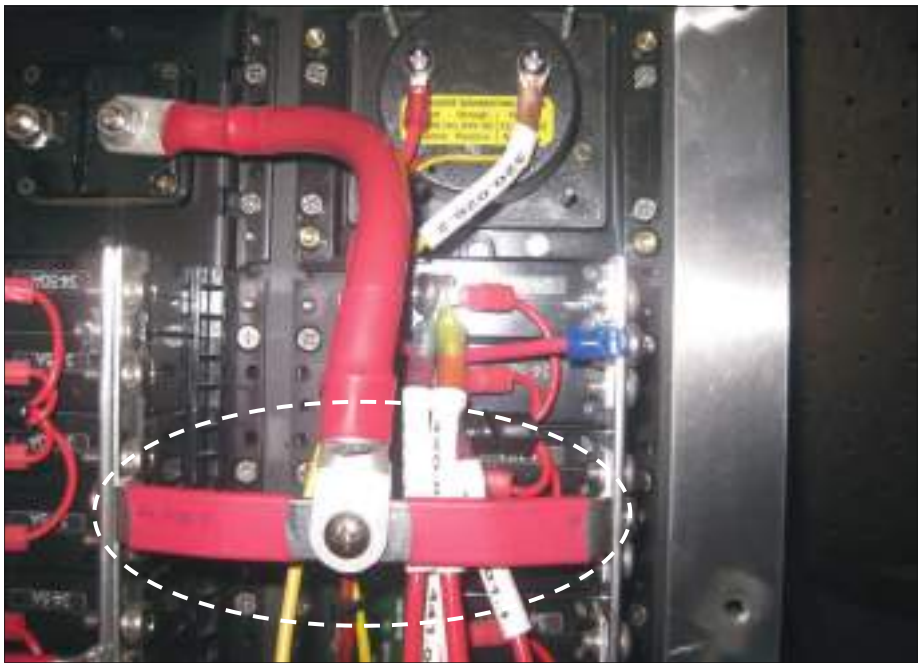
Step	Action
5.	Using philips head screwdriver, remove connecting bar (figure C.11c), from both panels.
	 **Figure C.11c. Breaker Panel Connecting Bar**

Table C.12. Replacing Blue Sea 360 Panel Faulty Breaker (cont.)

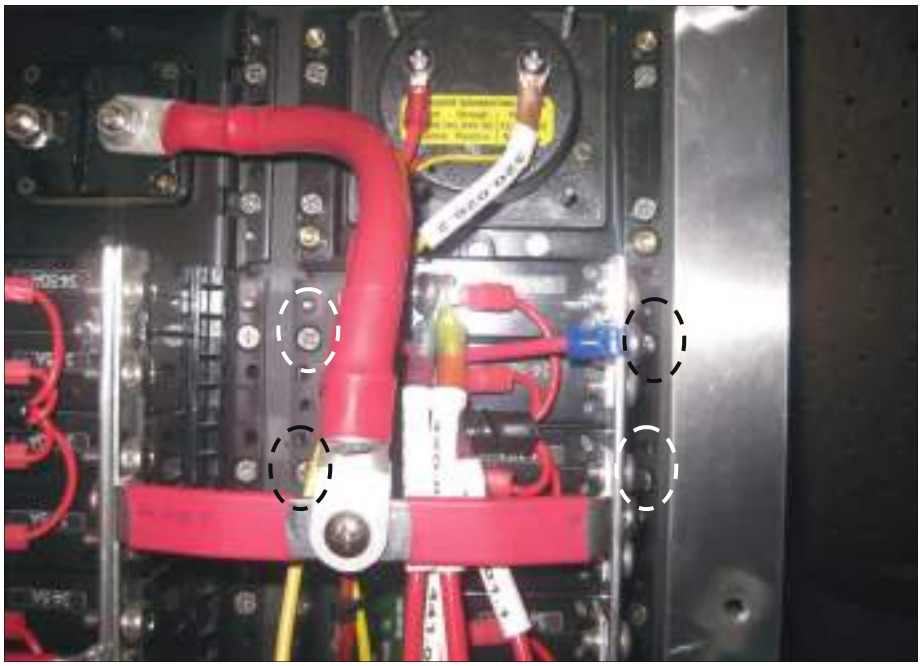
Step	Action
6.	Using philips head screwdriver, remove four securing screws (figure C.11d) from breaker.
	 **Figure C.11d. Breaker Securing Screws**

Table C.12. Replacing Blue Sea 360 Panel Faulty Breaker (cont.)

Step	Action
7.	Remove cover plate of faulty breaker (figure C.11e), from front of panel.
	 **Figure C.11e. Front Breaker Plate**

Table C.12. Replacing Blue Sea 360 Panel Faulty Breaker (cont.)

Step	Action
8.	Remove two phillips securing screws from front of breaker (figure C.11f). Retain for later installation.
	 **Figure C.11f. Individual Breaker Securing Screws**

Table C.12. Replacing Blue Sea 360 Panel Faulty Breaker (cont.)

Step	Action
9.	Remove breaker from back of panel.
10.	Insert replacement breaker from back of panel.
11.	Re-install two phillips securing screws in front of breaker.
12.	Re-install front cover plate to breaker.
13.	Re-install four securing screws to back of breaker.
14.	Re-install connecting bar to both buss bars.
15.	Using phillips head screwdriver, tighten full length of buss bar.
16.	Re-attach wire to load terminal in the back of the breaker.
17.	Inspect for any potential problems, such as loose terminals and tighten all connections.
18.	Ensure all branch circuit breakers are shut off.
19.	Turn on main breaker.
20.	One by one, turn on branch circuit breakers.
21.	Check and test to ensure all systems are normal.

Table C.13. Replacing Airpax Panel Faulty Breaker

Step	Action
	Tools required: • Phillips screwdriver • Voltage meter • Replacement breaker
	Note 1: Always remove load from breaker before shutting it off.
1.	Shut off all branch circuits.
	Note 2: With main breaker off, the buss bar is isolated from incoming voltage.
2.	Shut off main breaker.
3.	Check for voltage on any adjacent two breakers to ensure panel is dead.

Table C.13. Replacing Airpax Panel Faulty Breaker (cont.)

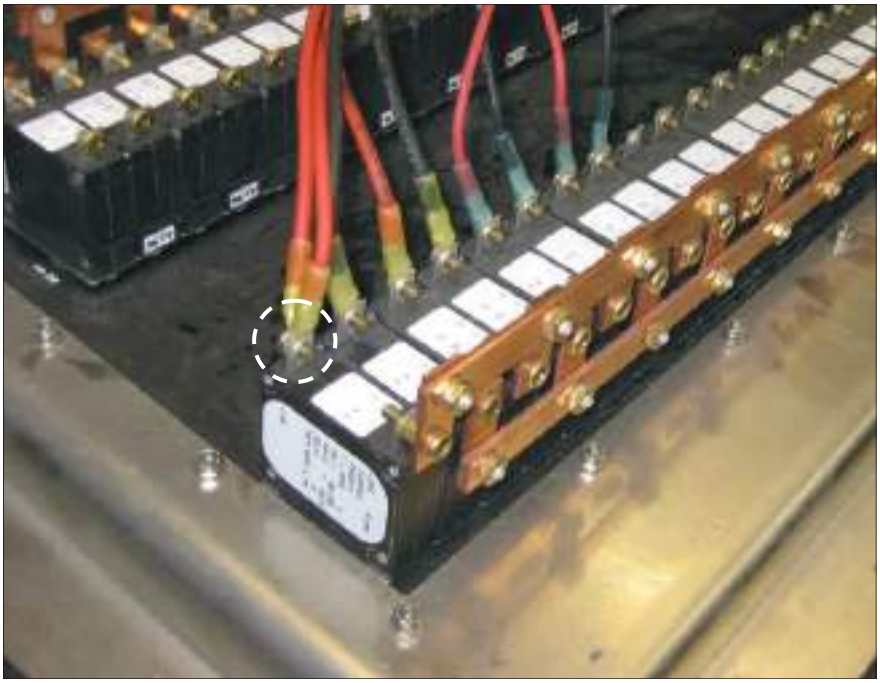
Step	Action
4.	Using phillips screwdriver, remove all connecting wires of breaker load terminal (figure C.13a), from breaker.
	 **Figure C.13a. Breaker Load Terminal Connection**

Table C.13. Replacing Airpax Panel Faulty Breaker (cont.)

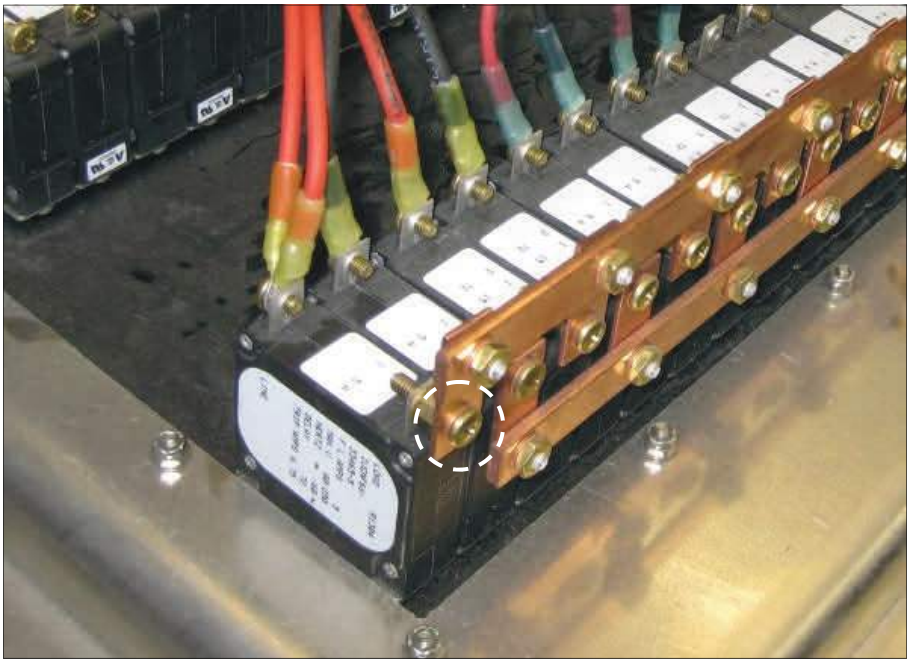
Step	Action
5.	Using Phillips head screwdriver, remove single screw securing breaker to bus bar (figure C.13b).
	 **Figure C.13b. Breaker Panel Bus Bar Connection**

Table C.13. Replacing Airpax Panel Faulty Breaker (cont.)

Step	Action
6.	Remove securing screws (figure C.13c), that secure Plexiglas in front of breaker panel.
	

Figure C.13c. Front Breaker Plate

Table C.13. Replacing Airpax Panel Faulty Breaker (cont.)

Step	Action
7.	Remove Phillips securing screw from front of breaker panel (figure C.13d). Retain for later installation.
	 **Figure C.13d. Individual Breaker Securing Screw**

Table C.13. Replacing Airpax Panel Faulty Breaker (cont.)

Step	Action
8.	Remove nut from toggle switch at front of breaker panel (figure C.13e). Retain for later installation.
	 **Figure C.13e. Breaker Toggle Switch Securing Nut**

Table C.13. Replacing Airpax Panel Faulty Breaker (cont.)

Step	Action
9.	Remove breaker from back of panel.
10.	Insert replacement breaker from back of panel.
11.	Re-install toggle switch nut in front of breaker panel.
12.	Re-install Phillips breaker securing screw in front of breaker panel.
13.	Re-install bus bar securing screw to back of breaker.
14.	Re-attach wire to load terminal in the back of the breaker.
15.	Inspect for any potential problems, such as loose terminals and tighten all connections.
16.	Re-install front cover plate to breaker panel.
17.	Ensure all branch circuit breakers are shut off.
18.	Turn on main breaker.
19.	One by one, turn on branch circuit breakers.
20.	Check and test to ensure all systems are normal.

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