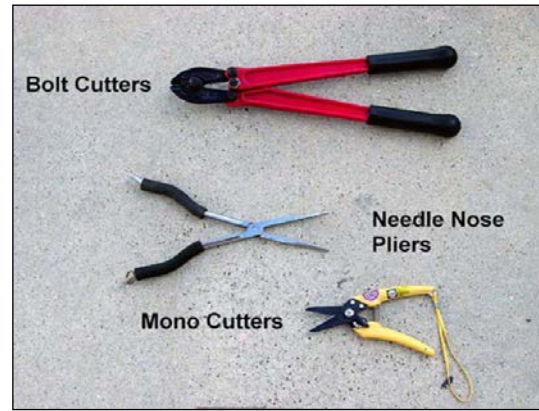
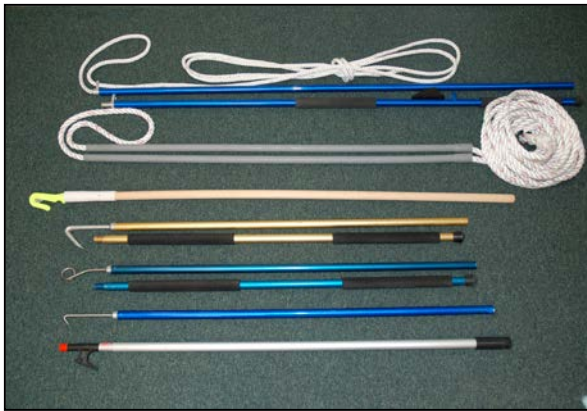




## DESIGN STANDARDS AND EQUIPMENT FOR CAREFUL RELEASE OF SEA TURTLES CAUGHT IN HOOK-AND-LINE FISHERIES



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May 2019

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The NOAA/Laforce Line Cutter was designed by Lionel Laforce, the NOAA/Arceneaux Line Clipper by Stuart (Joe) Arceneaux, the NOAA/Chain-link Dehooker by Charles Bergmann, the collapsible hoop net by Nick Hopkins, and the JLC TL-1 and JLC-ZC-2 handle-free line cutters by Charles Bergmann, James Barbour, and Lionel Laforce. Some of the devices were conceptualized by members from the industry: the turtle tether by Jay McCormack (current version was designed by ARC), the Ninja Sticks by Tony Geismann and Georg Hinteregger, the Cylinder Dehooker by Doug Roby, the Scotty's Dehooker by Scott Drabinowitz, the large turtle hoist by Jim Budi and Malcolm MacLean, and the ARC Dehookers by Shawn Dick.



## Chapter 1

## Introduction

The purpose of the careful release equipment described in this document is to increase post-release survival of incidentally-captured sea turtles and other animals by releasing them with minimal injury. These design standards describe the minimum specifications to construct or purchase gear that has been approved by the NMFS Southeast Fisheries Science Center (SEFSC) for use. Please check with the applicable regulations as the final authority for required tools and specifications in each fishery. This design standards manual is the companion document to the NMFS SEFSC Technical Memorandum Careful Release Protocols for Sea Turtle Release with Minimal Injury (NMFS-SEFSC-TM-735), which details the proper use of this equipment.

These specifications have been revised based upon field-testing of equipment, user feedback, and product design updates resulting in part from experiments in the Northeast Distant (NED) statistical reporting area and subsequent experiments and observations. This document contains the NMFS SEFSC approved design standards for currently certified release gear. However, individual fisheries may have more specific design standards; check with the applicable regulations as the final authority for required tools and specifications in each fishery. Note that all approved release gear previously constructed according to original Atlantic Highly Migratory Species (HMS) Pelagic Longline Fishery design standards (69 FR 40736, July 6, 2004) still qualify for that fishery under these current standards.

***The agency welcomes the submission of innovative new tool designs for approval and certification. A sample of fabricated copies of existing designs, as well as new designs for consideration, must be certified by NMFS SEFSC before use in a fishery by submitting them for testing at:***

NOAA Fisheries Harvesting Systems Unit  
Southeast Fisheries Science Center Mississippi Laboratory  
202 Delmas Avenue  
Pascagoula, MS 39567  
228-549-1769; [John.mitchell@noaa.gov](mailto:John.mitchell@noaa.gov)

Gear specialists and researchers will assess each item's usefulness and safety in removing gear from animals during laboratory and/or field trials. When new items are certified by the SEFSC, and subsequent rulemaking is completed, a notice will be published in the Federal Register. Tools that do not meet the specifications given here are not allowed for use, as inferior quality devices and those tools with incorrect dimensions or sharp edges could be dangerous. NMFS does not recommend or endorse any proprietary product or material mentioned in this document. However, example models of certified commercially available products are listed for convenience. Other products meeting minimum design standards may be available or may be constructed. The use of registered or trademarked products is by reference only; no endorsement or affiliation is implied for any of these products.

## Design Standards for Careful Release Equipment

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## Chapter 2                      Equipment for Sea Turtles Not Boated

In circumstances where a sea turtle is too large to be boated, or conditions preclude the safe boarding of the animal, vessels must possess, maintain, and utilize the following equipment in accordance with applicable fishery regulations for releasing the turtle with minimal residual gear and injury.

### **Turtle Control Devices**

Turtle control devices were developed in response to safety concerns for vessel crew members and for incidentally captured sea turtles, as well as to facilitate the likelihood of maximum gear removal. Their function is to control the front flippers of the sea turtle so that the animal can be controlled at the side of the vessel during gear removal. Restraint is most effective when a pair of turtle control devices is used. Currently, there are two approved turtle control device styles, the “Ninja Sticks” and the “Turtle Tether.” Both reduce safety risks associated with removing gear from active sea turtles not boated, particularly leatherbacks. Minimum design standards are as follows:

#### **(1) Ninja Sticks**

##### ***(a) Design Standards:***

*(i) Line.* Approximately 30 – 35’ of 1/2” to 5/8” soft lay polypropylene line, nylon or similar line is fed through 2 PVC conduit, fiberglass, or similar sturdy poles and knotted using an overhand (recommended) knot at the end of both poles or otherwise secured. There should be 18 – 24” of exposed rope between the poles to be used as a working surface to capture and secure the flipper. Knot the line at the ends of both poles to prevent line slippage if they are not otherwise secured. The remaining line is used to tether the apparatus to the boat unless an additional tag line is used.

*(ii) Extended reach handles.* Two lengths (cut to freeboard height) of rigid electrical conduit sunlight resistant 3/4” Schedule 40 PVC, fiberglass, aluminum or similar should be used. Check applicable regulations for required minimum handle length (e.g., the U.S. Highly Migratory Species Pelagic Longline Fisheries require a minimum length equal to or greater than 150% of the freeboard or a minimum of 6’, whichever is greater. Freeboard is defined for these purposes (other definitions exist) as the working distance between the top rail of the gunwale to the water’s surface, and will vary based on the vessel design).

##### ***(b) Example Model(s) Meeting Current Design Standards:***

*(i) “Ninja Sticks” (Plate 1)*

## **(2) Turtle Tether**

### ***(a) Design Standards:***

*(i) Line.* 15 – 20' of 1/2" hard lay negative buoyancy line (e.g., Samson® crab rope #SSR-100-MHL) or similar is used to make a 30" loop to slip over the sea turtle's flipper. The line is fed through a 3/4" inside diameter fair lead, eyelet or eyebolt at the working end of a pole and through a 3/4" eyelet or eyebolt in the midsection. A 1/2" quick release cleat (e.g., 4 – 5" long Clamcleat® or similar) holds the line in place near the end of the pole. A final 3/4" eyelet or eyebolt should be positioned 7" behind the cleat to secure the line, while allowing a safe working distance to avoid injury when releasing the line from the cleat.

*(ii) Extended reach handle.* The line must be securely fastened to an extended reach handle or pole. Check applicable regulations for required minimum handle length (e.g., the U.S. Highly Migratory Species Pelagic Longline Fisheries require a minimum length equal to or greater than 150% of the freeboard or a minimum of 6', whichever is greater. Freeboard is defined for these purposes (other definitions exist) as the working distance between the top rail of the gunwale to the water's surface, and will vary based on the vessel's design). There is no restriction on the type of material used to construct this handle as long as it is sturdy. The handle must include a tag line to attach the tether to the vessel to prevent the turtle from breaking away with the tether still attached.

### ***(b) Example Model(s) Meeting Current Design Standards:***

*(i) Turtle Tether (e.g., ARC Model 8' BWFA Turtle Tether) (Plate 2)*

## **Equipment to Remove Line and Netting**

### **(1) Monofilament Cutters**

Monofilament cutters should be used to remove netting, entangling line, or line as close as possible to the eye of the hook in the event that the hook was swallowed, or when the hook cannot be removed safely. This reduces the amount of gear retained by the animal in the event that all gear cannot be removed. Minimum design standards are as follows:

### ***(a) Design Standards:***

*(i) General.* These must be a minimum of 6" in length overall with a minimum 1" long, 5/8" wide blades when closed.

### ***(b) Example Model(s) Meeting Current Design Standards:***

*(i) Jinkai Model MC-T and MC-A; Fisherman's Ideal Supply House and SNL Corp monofilament cutter models 1278 and CM100; Momoi Anvils mono cutters, serrated mono cutters, and scissor style mono cutters; Fiskars Multi-purpose cutter.*

## **(2) Long-handled Line Cutter**

Line cutters are designed to cut high-test monofilament line as close as possible to the hook and to assist in removing other line and netting from entangled sea turtles, in an effort to minimize remaining gear upon release. NOAA Fisheries has established minimum design standards for line cutters (65 FR 16347, March 28, 2000, and 66 FR 17370, March 30, 2001) that can be purchased or fabricated using available and low cost materials. The minimum design standards for line clippers or cutters are as follows:

### ***(a) Design Standards:***

*(i) A protected and secured cutting blade.* The cutting blade(s) must be capable of cutting 2.0 – 2.1 mm diameter monofilament line (400# test) or polypropylene multi-strand material (e.g., braided or tarred mainline), and it should be maintained in working order. The blade must be curved, recessed, contained in a holder, or otherwise designed to facilitate its safe use to prevent direct contact between the cutting surface and the sea turtle or the user. The cutting instrument must be securely attached to an extended reach handle and easily replaced. One extra set of replacement blades meeting these standards must also be carried on board to replace all cutting surfaces on the line cutter;

*(ii) Extended reach handle.* The line cutter blade must be securely fastened to an extended reach handle or pole. Check applicable regulations for required minimum handle length (e.g., the U.S. Highly Migratory Species Pelagic Longline Fisheries require a minimum length equal to or greater than 150% of the freeboard or a minimum of 6', whichever is greater. Freeboard is defined for these purposes (other definitions exist) as the working distance between the top rail of the gunwale to the water's surface and will vary based on the vessel design). For flexibility of configuration during use and for storage purposes, it is recommended that the handle break down into sections, but this is not a requirement. There is no restriction on the type of material used to construct this handle as long as it is sturdy and facilitates the secure attachment of the cutting blade.

### ***(b) Example Model(s) Meeting Current Design Standards:***

*(i) NOAA/Arceneaux Line Cutter (Plate 3).* The NOAA/Arceneaux Line Cutter can be fabricated by securely attaching a flat hardened stainless steel or plastic seat belt cutter with recessed cutting blades (such as the Lifesaver II Seat Belt Cutter™, Lifesaver Seat Belt Cutter™, Innovative Scuba Razor Line Cutter or similar) to an extended reach handle using bolts and/or cable ties. A replacement blade set would require one additional seat belt cutter;

*(ii) NOAA/Laforce Line Cutter (Plate 4).* The Laforce Line Cutter has a cutting end manufactured from a 6" long 1/2" diameter aluminum rod with a 4-1/8" end at a 45° angle with two 420 C stainless steel serrated cutting blades secured inside the angle. It

must be attached to an extended reach handle. A set of replacement blades would require two stainless steel serrated cutting blades for the NOAA/Laforce Line Cutter.

### **(3) Remote Handle-free Line Cutter**

***Remote handle-free line cutters should only be used on animals that are hooked but not entangled. Using a remote line cutter on an entangled animal would release the animal with the entangling line still attached, greatly increasing the risk of mortality.*** Therefore, a remote handle-free line cutter does not replace the need for a long-handled line cutter to be used for animals that are entangled.

The cutter is lowered down the leader until it bottoms out against the eye of the hook, where the tag line is then pulled to cut the leader just above the hook.

#### ***(a) Design Standards:***

*(i) A protected and secured cutting blade.* The cutting blade(s) must be capable of cutting 2.0 – 2.1 mm diameter monofilament line (400# test) or polypropylene multi-strand material, known as braided or tarred mainline, and it should be maintained in working order. The blade must be designed to facilitate safe use so that direct contact between the cutting surface and the sea turtle or the user is prevented. The line cutter must be securely attached to a tether, which is used to lower the line cutter to the eye of the hook, pulled to cut the line, and to retrieve the line cutter.

#### ***(b) Example Model(s) Meeting Current Design Standards:***

*(i) JLC-ZC-2 (Plate 5).* The main body of the line cutter is composed of a cylinder constructed from 2-3/8" outside diameter (OD) and 1-5/8" inside diameter (ID) 316L or 304L stainless steel pipe. The cylinder is constructed by cutting two 0.787" end caps (flanges) off both ends of a 5-1/2" section of pipe. Both end caps are then modified by cutting a 0.787" vertical section out of the length of the pipe and then a 2-3/4" long, 3/8" wide horizontal section around the edge of the pipe, leaving a 3/8" rim of steel along the 2-3/4" section. A 0.374" wide groove is then cut at a 20° angle along the length of the 4" pipe. Each end cap is then tungsten inert gas (TIG) welded onto the pipe such that the vertical cuts in each end cap is positioned as indicated in Plate 5 and form a continuous groove, hereafter referred to as the line guide. Rough edges must be sanded smooth using a cylinder hone. A steel ring is then welded 5/8" from the bottom of the back side of the cylinder to facilitate mounting of a spring (0.031-0.037" wire diameter, e.g., Gardner Spring # 37047GS or 37049GS) from the loop to the mounting hole on the lever and blade assembly. Using a tap, create 1/4" x 20 threads on each side of the pipe at 90° and 270° at a distance 1.5" from the top to facilitate attachment of the lever.

The lever is constructed of three pieces of 316L or 304L stainless steel flat bar that is 13/16" wide and 1/8" thick. The upper (cutting arm) of the lever is 5-1/2" long, and ring angles are made at 1-3/4" and 4-1/2" along its length. Two blade mounting holes are

drilled into the top of the cutting arm in locations indicated in Plate 5. The lever handle is constructed of two 5.5" sections of steel bar bent at approximately 45° angles 2" from the front edge and then tapered at approximately 3-5/16" so when the left and right sections are joined, they form a "wishbone" shape as shown in Plate 5. When TIG welded together, the handle of the lever should be lined up with the center of the cylinder when connected.

(ii) *JLC-TL-1 (Plate 6)*. The main body of the line cutter is composed of two 316L or 304L stainless steel cylinders connected with two flanges. The inner cylinder is 5-1/8" long with a 1-5/8" outside diameter (OD) and a 1-1/4" inside diameter (ID). The outer cylinder is 5" long with a 2-3/8" OD and a 1-5/8" ID. The 316L or 304L stainless steel flanges are 3/16" thick with a 2-3/8" OD and a 1-5/8" ID.

Tungsten inert gas (TIG) weld one flange to one end of the inner pipe, place main pipe over the inner pipe, and then weld the remaining flange on the other end of the inner pipe. This should allow the inner pipe to rotate while not allowing the main pipe to slip off the inner pipe. Next, place the assembly in a vise to allow the cutting of a 3/16" cut through both main and inner pipe with flanges at the same time. The cut should only go through one side of the assembly. Rough edges must be sanded smooth using a cylinder hone. After this is complete, drill and tap three 1/4" X 20 holes on the main pipe: the first is 2-1/2" from the top of the pipe on the backside, and the other two are 2" down from the top of the main pipe to mount the lever and blade assembly on either side of the pipe assembly. A steel ring is then welded 5/8" from the bottom of the back side of the cylinder to facilitate mounting of a spring (0.031-0.037" wire diameter, e.g., Gardner Spring # 37047GS or 37049GS) from the loop to the mounting hole on the lever and blade assembly. The lever construction is described above in the description of the JLC-ZC-2.

### **Equipment to Remove Hooks**

Dehooking devices may be designed to remove internal hooks, external hooks, or both. The dehooking end must be securely fastened to the extended reach handle, and the tools should be designed to allow a twisting motion, which is necessary for circle hook removal.

#### **(1) Long-handled Dehooker for Internal Hooks**

Some long-handled dehooking devices are designed to remove internal hooks from sea turtles that cannot be boated, and they may be used to remove external hooks as well. Because this design should shield the point of the hook and prevent it from re-engaging, this device also may be used to engage a loose hook during line removal when the turtle is entangled but not hooked.

Minimum design standards are as follows:

**(a) Design Standards:**

(i) *Hook removal device.* The hook removal device must be constructed of 3/16" - 5/16" marine grade stainless steel (316L or 304L) or similar (designed to resist corrosion during exposure to salt water) and have a dehooking end no larger than 1-7/8" outside diameter. This device must securely control the leader while shielding the point to prevent the hook from re-engaging during removal. The hook removal device cannot have any unprotected sharp terminal points, as these could cause injury to the mouth and esophagus during hook removal. The device must be of a size appropriate to secure the range of hook sizes and styles used on the vessel in the applicable fishery (e.g., 16/0 - 20/0 circle hooks in the Atlantic pelagic longline swordfish and tuna fisheries would require use of 5/16" wire and an outside diameter of 1-7/8");

(ii) *Extended reach handle.* Check applicable regulations for required minimum handle length (e.g., the U.S. Highly Migratory Species Pelagic Longline Fisheries require a minimum length equal to or greater than 150% of the freeboard or a minimum of 6', whichever is greater. Freeboard is defined for these purposes (other definitions exist) as the working distance between the top rail of the gunwale to the water's surface and will vary based on the vessel design). For flexibility of configuration during use and for storage purposes, it is recommended that the handle break down into sections, although this is not a requirement. There is no restriction on the type of material used to construct this handle as long as it is sturdy and facilitates the secure attachment of the hook removal device.

**(b) Example Model(s) Meeting Current Design Standards:**

(i) *Long-handled NOAA/Chain-link Dehooker (Plate 7).* This device, constructed of 3/16" - 5/16" 316L or 304L marine grade stainless steel, has two 2-3/4" rounded prongs at the end to form a uniform gap of at least 7/32". Note: This dehooker is approved for removing external circle or J-hooks, and internal circle hooks. It cannot not be used to remove internal J-hooks.

(ii) *Long-handled Pigtail Style (ARC) Dehooker - ARC 6', 8' and 12' Pole Big Game Dehooker Models (Plate 8).* These devices are constructed of a 5/16" 316L or 304L stainless steel rod curled into a pigtail spiral loop end with no exposed terminal point, and they are recommended for hook sizes 6/0 to 20/0. The specifications here describe the model designed for use with large hooks from 16/0 - 20/0 (i.e., for use in pelagic longline fisheries). See p. A15-1 for the functional range of loop diameters and offset angles to accommodate smaller hook sizes in other hook-and-line fisheries. The rod is 7" from point of attachment to the end of the loop, and includes a 5.3° angle offset to shield the point of the hook. The loop is designed at a 12.2° angle bend from the rod and has an inside diameter of 1-1/4" and an outside diameter of 1-7/8" with an 1/8" gap between rod and loop to facilitate line engagement. Some models are manufactured with a three-part anodized aluminum pole that breaks down into 4' sections for storage.



*Note: The “pigtail-style” dehookers described in this document are manufactured by Aquatic Release Conservation, Inc. (ARC). ARC has stated that their dehookers are covered by their U.S. and international patents, specifically identifying U.S. Patent # 4,914,853, #6,840,002 and U.S. Design Patent # 382,628, as well as modifications to these patents. In essence, ARC has given permission, by means of a license, to all individual fisheries participants to make, have made, construct, and use, any of its patented dehookers provided that these dehookers are for individual use. No authority is granted by ARC to make dehookers for resale or for gifts. For details, refer to the ARC website located at: <http://dehooker4arc.com/disclaimer.cfm>. The government has not studied any of the ARC patents, and therefore has no opinion whatsoever as to the validity of these patents or whether making or using the ARC dehookers would infringe patents of others.*

## **(2) Long-handled Dehooker for External Hooks**

Some long-handled dehookers are designed for use on externally hooked sea turtles that cannot be boated. The long-handled dehooker for internal hooks will also satisfy this purpose.

Minimum design standards are as follows:

### **(a) Design Standards:**

*(i) Hook removal device.* The dehooker must be constructed of 3/16” – 5/16” marine grade stainless steel (316L or 304L) rod if constructing a wire style dehooker (e.g., the pigtail and J-style dehookers). When constructing other styles (e.g., chain-link and cylinder dehookers), marine grade stainless steel (316L or 304L) must be used. The design should be such that the hook can be rotated out without pulling it out at an angle, as described in the NMFS-SEFSC TM-735 Careful Release Protocols. The dehooking end should be blunt with all edges rounded (it is critical that there are no sharp edges) and the outside diameter must be no greater than 1-7/8”; a smaller diameter end may be more appropriate in fisheries which often encounter small turtles or use small hooks. The device must be of a size appropriate to secure the range of hook sizes and styles used on the vessel in the applicable fishery (e.g., 16/0 – 20/0 circle hooks in the Atlantic pelagic longline swordfish and tuna fisheries would require use of 5/16” wire and an outside diameter of 1-7/8”);

*(ii) Extended reach handle.* The hook removal device must be securely fastened to an extended reach handle or pole. Check applicable regulations for required minimum handle length (e.g., the U.S. Highly Migratory Species Pelagic Longline Fisheries require a minimum length equal to or greater than 150% of the freeboard or a minimum of 6’, whichever is greater. Freeboard is defined for these purposes (other definitions exist) as the working distance between the top rail of the gunwale to the water’s surface and will vary based on the vessel design).

**(b) Example Model(s) Meeting Current Design Standards:**

(i) *Long-handled NOAA/Chain-link Dehooker (Plate 7)*. This device has two 2-3/4" rounded prongs at the end to form a uniform gap of at least 7/32". Note: this dehooker cannot be used to remove J-hooks.

(ii) *Long-handled Cylinder Dehooker (Plate 9)*. This device has a 3 3/4" long cylinder (1 5/8" outside diameter) with four 1/8" notches at 90° angles on the edge and a 1/8" diagonal slit to capture the line across the length of the cylinder. To attach the working end to a long handle, two pieces of 1/4" x 1" x 3" flat bar one at upper end and one at the midrange of the central rod can be welded and formed around long handled pole and securely fastened using a through bolt.

(iii) *Long-handled J-Style Dehooker or "Flip Stick" [e.g., ARC Model 6' Pole J-style Dehooker (Plate 10)]*. The dehooker must be constructed of 3/16" – 5/16" diameter marine grade stainless steel (316L or 304L) rod with a 1" dehooking end angled at 45° back toward the rod forming a "J" shape.

(iv) *Long-handled Pigtail Style (ARC) Dehooker – ARC 6', 8' and 12' Pole Big Game Dehooker Models (Plate 8)*. These devices are constructed of a 5/16" 316L or 304L stainless steel rod curled into a pigtail spiral loop end with no exposed terminal point, and they are recommended for hook sizes 6/0 – 20/0. The rod is 7" from point of attachment to the end of the loop, and includes a 5.3° angle offset to create a 1/8" gap between rod and loop to facilitate line engagement. The loop is designed at a 12.2° angle bend from the rod and has an inside diameter of 1-1/4" and an outside diameter of 1-7/8". Some models are manufactured with a three-part anodized aluminum pole that breaks down into 4' sections for storage.

**Long-handled Device to Pull an "Inverted V" during Disentanglement**

This tool is used to pull a "V" when implementing the "Inverted V" dehooking technique for disentangling and dehooking entangled sea turtles. Minimum design standards are as follows:

**(a) Design Standards:**

(i) *Hook end*. The device, such as a boat hook, gaff, or long-handled J-style dehooker must be constructed of stainless steel or aluminum. The semicircular or "J" shaped end must be securely attached to a handle. A sharp point, such as a gaff hook, is only to be used in holding the line and must never contact the sea turtle;

(ii) *Extended reach handle*. The device must be securely fastened to an extended reach handle or pole. Check applicable regulations for required minimum handle length (e.g., the U.S. Highly Migratory Species Pelagic Longline Fisheries require a minimum length equal to or greater than 150% of the freeboard or a minimum of 6', whichever is greater. Freeboard is defined for these purposes (other definitions exist) as the working distance

## Design Standards for Careful Release Equipment

between the top rail of the gunwale to the water's surface and will vary based on the vessel design).

***(b) Example Model(s) Meeting Current Design Standards:***

*(i) Any approved long-handled J-Style Dehooker or "Flip Stick" (Plate 10); Davis Telescoping Boat Hook to 96" Model 85002A; West Marine Boat Hook (various models); Aftco 6' Taper-Tip Black Anodized Aluminum Gaff.*

Design Standards for Careful Release Equipment

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## Chapter 3 Bringing Incidentally Captured Sea Turtles on Board

Whenever possible, sea turtles must be brought on board immediately and handled in accordance with the procedures outlined in the standards for the handling of incidentally caught sea turtles, unless extreme sea conditions prevent the crew from safely boating the turtle. Generally, all turtles less than 3' straight carapace length should be boated. Vessels should maintain and utilize the following equipment and release the turtle with minimal injury:

### **Boating the Turtle**

**(1) Dip Net.** A dip net facilitates the safe handling of sea turtles by allowing them to be brought onboard for gear removal without causing further injury to the animal. The turtle must never be brought onboard without a net or hoist. Using the involved gear to raise the turtle may result in serious injury and impact post-release survivorship, especially in cases where the turtle has ingested the hook. NMFS has established minimum design standards for the dip nets (65 FR 16347, March 28, 2000 and 66 FR 17370, March 30, 2001). These minimum design standards for dip nets are as follows:

#### ***(a) Design Standards:***

*(i) Size of dip net.* The dip net must have a sturdy net hoop of at least 31" inside diameter and a bag depth of at least 38" to accommodate turtles less than 3' carapace length. The bag mesh openings may not exceed 3" bar measure, defined as the non-stretched distance between a side knot and a bottom knot of a net mesh, also known as the square mesh measurement. There must be no sharp edges or burrs on the hoop or where it is attached to the handle. There is no requirement for the hoop to be circular as long as it meets the minimum specifications;

*(ii) Extended reach handle.* The dip net hoop must be securely fastened to an extended reach handle or pole. Check applicable regulations for required minimum handle length (e.g., the U.S. Highly Migratory Species Pelagic Longline Fisheries require a minimum length equal to or greater than 150% of the freeboard or a minimum of 6', whichever is greater. Freeboard is defined for these purposes (other definitions exist) as the working distance between the top rail of the gunwale to the water's surface and will vary based on the vessel design). For flexibility of configuration during use and for storage purposes, it is recommended that the handle break down into sections, although this is not a requirement. There is no restriction on the type of material used to construct this handle, as long as it is sturdy enough to support a minimum of 100 lbs. without bending or breaking when lifted vertically, and facilitates the sturdy attachment of the net hoop.

#### ***(b) Example Model(s) Meeting Current Design Standards:***

*(i) Dip Net (Plate 11); Bluewater Tackle; Howell Tackle; Hi-Liner Fishing Gear and Tackle; Fisherman's Ideal Supply House; Half Hitch; SNL Corp., etc.*

**(2) Collapsible Hoop Net.** This compact device is capable of lifting at least 100 pounds, while easily stowing aboard small vessels. Similar to a small turtle hoist and dip net, the collapsible hoop net has no handle, and the frame is constructed of stiff wire cable that can be coiled to compress the size for convenient storage.

**(a) Design Standards:**

The collapsible hoop net must have a minimum 31” inside diameter and a bag depth of at least 38” to accommodate turtles less up to 3’ straight carapace length. The bag mesh openings may not exceed 3” bar measure, defined as the non-stretched distance between a side knot and a bottom knot of a net mesh, also known as the square mesh measurement. There must be no sharp edges or burrs on the hoop. The device must be capable of lifting 100 pounds. No extended reach handle is needed on this type of net, although the rope handle length must be 6 feet or 150% of freeboard height, whichever is greater.

**(b) Example Model(s) Meeting Current Design Standards:**

*(i) Collapsible Hoop Net (Plate 12).* This net is constructed of two rings of stainless steel cable with a 2-1/2” x 3 mm Euroline® webbing mesh bag and three 9’ pieces of 3/8” three-strand poly line to form a bridle. It has a 36” diameter frame when extended, and folds to 18” wide for storage. See Plate 12 for full fabrication instructions.

**(3) Turtle Hoist.** A hoist is recommended to bring turtles onboard that cannot be boated using a dip net, or where storage constraints on the vessel do not allow for an extended reach handle.

Minimum design standards are as follows:

**(a) Small Turtle Hoist.** In some cases, such as on a vessel with a high freeboard distance or if there is not enough room for storing a dip net, an extended reach handle may be impractical, even with small turtles. A supportive frame with mesh netting, but without an extended reach handle, may be best in these circumstances.

**(i) Design Standards:**

*(i) General.* The frame must be capable of supporting at least 100 pounds, with a minimum inside diameter of 31” to accommodate turtles up to 3’ straight carapace length. This frame can be hinged or otherwise designed so that it can be folded for ease of storage as long as it can be quickly reassembled. If the frame is designed to fold or break down for storage, the hardware must be self-contained (e.g., barrel bolts on both sides to lock down frame with no loose pieces like through bolts and nuts), and there must be no sharp edges. The shape of the frame does not matter (e.g., round, square, rectangular, or a “U-shaped” or “J-shaped” basket) as long as it meets the required specifications and securely contains the turtle. The frame may be constructed of heavy-duty stainless steel tubing welded into shape or polyvinyl chloride (PVC) pipe (recommended 2” diameter with a

## Design Standards for Careful Release Equipment

required minimum strength of Schedule 40) connected and glued at the corners using 90° elbow fittings. PVC pipes can be drilled to facilitate water drainage for ease of hauling. A shallow bag net with mesh openings not to exceed 3" x 3" (bar measure) must be securely affixed to the frame, and lines (e.g., polypropylene, nylon, polyester) must be securely attached to each corner to control and retrieve the frame and net. The lines can be operated using a pulley system if available on the vessel. No rigid extended reach handle is needed on this type of net, although the rope handle length must be 6' or 150% of freeboard height, whichever is greater.

### **(ii) Example Model(s) Meeting Current Design Standards:**

*(i) Small Turtle Hoist (Plate 13).* This is a frame net without a handle, with a square, rectangular or round stainless steel, aluminum or Schedule 40 PVC frame with a mesh bag securely affixed and lines attached to the corners or at least three points around a circle to bring turtles onboard.

**(b) Large Turtle Hoist.** This style is recommended for boating large turtles, such as leatherbacks, which need a supportive platform while onboard.

### **(i) Design Standards:**

*(i) General.* The hoist should be designed so that when onboard, the turtle is suspended above the deck on a platform of mesh netting supported by a rigid ring, and contained within a webbing fence a minimum of 18" high. The top two rings (1-3/4" 50 series aluminum round bar) should be 7'6" in diameter, and the bottom ring (1-1/2" 50 series aluminum round bar) should be 4' in diameter. The middle and bottom rings are connected using 12 angled (25") spoke braces of 23" (1" 50 series aluminum round bar or 6061 T6 1" Schedule 40 pipe) welded in place with an appropriate welding wire (5052, 6061 or 3003 wire). Knotless polypropylene 8 mm 600 ply netting, 6.5" stretch is stretched across the middle ring. The fence is supported by the top and middle rings, which are connected by a 3 mm, 4.7" stretch mesh braided polyethylene webbing to create a fence a minimum of 18" high, wrapped along the top ring with 1/2" polypropylene rope. 8" x 2-1/2" rubber cookies (4 per each of 12 sections) can be used on the middle ring to facilitate rolling the hoist up the side of the vessel and to cushion impact of hoist against the side of the vessel. In rough seas, a vang is necessary to hold the hoist close to side of vessel. A three or four point bridle is attached to the top ring using pairlinks and 3/4" nylon 3-strand line, and a hydraulic lift is used to bring hoist aboard. The hoist should be capable of lifting a minimum of 1/2 ton.

### **(ii) Example Model(s) Meeting Current Design Standards:**

*(i) Large Turtle Hoist (Plate 14).* This hoist (designed, in part, and constructed by Blue Water Fishing Tackle Co., Inc., D.N. Kelley Shipyard, Diversified Marine

LLC, Eagle Eye II Corporation, Polar Packaging, Inc., Reidar's Manufacturing, Inc., F/V Sea Hawk, and Scandia, Inc.) was designed to bring leatherbacks onboard following the above specifications. Modifications to the vessel will likely be necessary to install the hoist, including: a platform to house the lift, alterations to the boom including strongback, pivoting gooseneck, hydraulic ram attachment and reinforcement, hydraulic ram, hydraulic runs, or a duel winch arrangement, and for safe lifting, a 2200 PSI planetary hydraulic winch with hydraulic runs, control and rigging (SS wire and blocks).

### **Holding the Turtle**

#### **(1) Cushion/support Device.**

##### ***(a) Design Standards:***

*(i) General.* The device must effectively cushion and support the animal while it is onboard. It must be appropriately sized to support fully a range of turtle sizes. It must be puncture proof (e.g., no inner tubes, pool toys) and it cannot be a primary safety device (e.g., primary life ring or life jacket dedicated to personnel onboard).

##### ***(b) Example Model(s) Meeting Current Design Standards:***

*(i) A standard automobile tire.* A standard (not from a truck or heavy equipment) passenger vehicle tire not mounted on a rim, free of exposed steel belts, is effective for supporting the turtle while it is onboard. If the turtle is too large for the tire, it must be contained and supported on an alternative cushioned surface. An assortment of sizes is recommended to accommodate a range of turtle sizes.

*(ii) Boat cushion.* A standard boat cushion will effectively support smaller turtles.

*(iii) Large turtle hoist.* This style is recommended for supporting large turtles, such as leatherbacks, which need a supportive platform while onboard.



## Chapter 4      Equipment for Opening the Mouth of Boated Turtles

### Opening the Mouth

In many cases, a mouth opener or gag must be used in order to remove internal hooks from boated turtles. It must be designed to allow access to the hook or line without causing further injury to the turtle. It is recommended that at least one type allow for hands-free operation of the gear removal devices once the gag is in place (only the canine mouth gag satisfies this recommendation, see item (5) below). Design standards are included in the item description. A minimum of two of the seven different types of mouth openers or gags from the following list are required and will offer the necessary flexibility:

### Mouth Openers and/or Mouth Gags

**(1) Block of Hard Wood.** A smooth block of hard wood is an inexpensive, effective and practical mouth-gagging device that meets these requirements and is readily available on most vessels. Placed in the corner of the jaw, it is used to gag open the mouth. The wood must be of a type that does not splinter (e.g., maple) with rounded edges, and it must be sanded smooth, if necessary. The dimensions must be 10" x 3/4" x 3/4" or appropriately sized for the size of turtles that might be caught. Any block of hard wood meeting these specifications is acceptable. A long-handled, wire brush with a maple wooden handle and the wires removed is an inexpensive, effective and practical device that meets these requirements (e.g., Forney 10-1/4" Wood Shoe Handled Stainless Steel Wire Scratch Brush Model 70520). A wooden hammer handle (without the head attached) may be suitable, providing it is made from wood that does not splinter under pressure (e.g. ash, maple);

**(2) Hank of Rope.** A lanyard of braided soft rope (e.g., nylon, polypropylene, polyester) can be folded to create a hank (coil or bundled loops) of rope. Placed in the corner of the jaw, it is used to gag open the mouth. A 6' lanyard of minimum 3/16" braided soft rope can be folded to create a hank of rope. Any size soft braided or twisted rope is acceptable, provided it creates a hank of approximately 2 - 4" thickness;

**(3) Set of Two Sturdy Dog Chew Bones.** These "chew bones" are inexpensive, easy to handle, and sold in several sizes. Placed in the corner of the jaw, the chew bone is used to gag open the mouth. They must be designed of durable nylon, zylene resin, or thermoplastic polymer, strong enough to withstand biting without splintering. One large 5-1/2" – 8" (e.g., "Giant" 8" or "Wolf" 5-1/2") and one small 3-1/2" – 4-1/2" (e.g., "Regular" 4-1/2") dog chew bones are required and will accommodate a variety of beak sizes. Example models meeting current specifications include: Nylabone<sup>®</sup> Dura Chew<sup>®</sup> (a trademark owned by T.F.H. Publications, Inc.) and Galileo<sup>®</sup> (a trademark owned by T.F.H. Publications, Inc.) dog chew bones;

**(4) Set of Four PVC Couplings.** Inexpensive PVC couplings can be positioned inside the mouth to allow access to the back of the mouth. They must be held in place with needle-nose pliers. Standard Schedule 40 PVC couplings in a variety of sizes (1", 1-1/4", 1-1/2", and 2") will ensure proper fit and access. A set includes all four sizes;

**(5) Set of Three Canine Mouth Gags.** The use of canine mouth gags is highly recommended to hold the mouth open, as the gag locks into the open position and allows for hands free operation once it is in place. These tools are for use only on small and medium sized turtles, as larger turtles may be able to crush the mouth gag. A set of canine mouth gags includes one of each of the following sizes: small (5"), medium (6"), and large (7"). They must be constructed of stainless steel. A set includes one of each size and can be purchased through veterinary supply businesses. An example set meeting these specifications is JorVet® Model #J0051A, J0051B, and J0051C;

**(6) Large Avian Oral Speculum.** An avian oral speculum (for large birds) gives you the ability to hold the mouth open and control the head with one hand while removing the hook with the other hand. This tool is for use only on small turtles, as larger turtles may be able to crush the speculum. The avian oral speculum must be 9" long, and constructed of 3/16" wire diameter surgical stainless steel (Type 304). Example models meeting these specifications include: JorVet® Model J0051Z and Krusse Model 273117. The wire must be covered with 8" of clear vinyl tubing (5/16" outside diameter, 3/16" inside diameter), friction tape, or similar to pad the surface. These can be purchased through veterinary supply businesses;

**(7) Set of Two Rope Loops with Protective Tubing.** A set consists of two pieces of poly braid rope covered with light duty garden hose or similar flexible tubing each tied or spliced into a loop to provide a one-handed method for keeping the mouth open. The upper loop gives the user control using one hand, and the second loop is secured on the lower beak and held using the user's foot for extra control. This keeps the mouth open to allow access to the hook and/or line. Two 36" lengths of poly-braid rope (3/8" diameter suggested) are each covered with an 8" section of 1/2" - 3/4" tubing, and each length is tied or spliced, resulting in two loops. Any set of rope loops covered with tubing meeting these specifications is acceptable.

## Chapter 5      Equipment for Removing Gear from Boated Turtles

Assess what the best hook removal technique is in each circumstance. Depending on the position and depth of the hook, needle-nose pliers and/or bolt cutters may be the most efficient way to remove hooks. If required, dehooking devices may be used to remove external or internal hooks (if the insertion point of the hook can be seen). All short-handled dehooking tools for removing internal hooks must have a bite block to protect the turtle's beak. They must also be designed to allow a twisting motion, which is necessary for circle hook removal.

### **Needle-nose Pliers**

Long needle-nose pliers can be used to assist in removal of hooks that are embedded in the animal's flesh and must be twisted during removal, or for removing hooks from the front of the mouth. They are also useful in holding PVC splice couplings in place when used as mouth openers. Minimum design standards are as follows:

#### ***(1) Design Standards:***

*(i) General.* They must be a minimum of 11" in length. It is recommended that these be of stainless steel material or other corrosion resistant metal material.

#### ***(2) Example Model(s) Meeting Current Design Standards:***

*(i) 12" S.S. NuMark Model #030 281 109 87; Offshore Angler® Stainless Longreach Pliers Model #38-481-759-00; P-Line® Stainless 11" Long Nose Pliers, Anglers' Choice SPPK-836 11" Straight Long Nose Pliers; Baker 11" Stainless Steel Longnose Pliers, Tekton 3490 11-Inch Long Reach Long Nose Pliers, Pittsburgh® 15" Long Nose Locking Pliers; Mustad Extra Long Reach Heavy-Duty Fishing Pliers for Saltwater; Rapala Long Reach Pliers 11".*

### **Bolt Cutters**

Bolt cutters are essential for removing hooks, and must be of a size practical to be used inside the turtle's mouth. They are used to cut off the eye or point so that the hook can be pushed through easily without causing further injury to the sea turtle. They also are used to cut off as much of the hook as possible when the remainder cannot be removed. Minimum design standards are as follows:

#### ***(1) Design Standards:***

*(i) (i) General.* They must be a minimum of 14" in total length, with a minimum of 4" long blades that are a minimum of 2-1/4" wide when closed. They must be able to cut hard metals such as hardened carbon steel hooks up to 1/4" diameter, and they must be capable of cutting through the hooks used on a vessel.

**(2) Example Model(s) Meeting Current Design Standards:**

*(i) H.K. Porter Model 1490 AC*

**Equipment to Remove Line and Netting**

**(1) Monofilament Cutter.** Monofilament cutters should be used to remove line as close as possible to the eye of the hook in the event that the hook was swallowed, or when the hook cannot be removed safely. This reduces the amount of gear retained by the animal in the event that the hook cannot be removed. Minimum design standards are as follows:

**(a) Design Standards:**

*(i) General.* These must be a minimum of 6” in length overall with a minimum of 1” long, 5/8” wide blades when closed.

**(b) Example Model(s) Meeting Current Design Standards:**

*(i) Jinkai Model MC-T and MC-A; Fisherman’s Ideal Supply House and SNL Corp. monofilament cutter models 1278 and CM100; Momoi Anvils mono cutters, serrated mono cutters, and scissor style mono cutters; Fiskars Multi-purpose cutter.*

**Short-handled Dehooker for Internal Hooks**

This type of dehooker is designed to remove internal hooks from boated sea turtles, including hooks in the front of the mouth, as well as external hooks. It is critical that these tools have the exact approved specifications, including proper offset angles (for applicable styles) and blunt ends. Tools that do not meet these design standards may be dangerous and cause additional injury. Approved designs must have the minimum design standards as follows:

**(1) Design Standards:**

*(i) Hook removal device.* The dehooker must be constructed of 3/16” – 5/16” marine grade stainless steel (316L or 304L) rod if constructing a wire style dehooker (e.g., ARC “pigtail” dehooker). When constructing other styles (e.g., chain-link dehooker), marine grade stainless steel (316L or 304L) must be used for all components. The end must allow the hook to be secured and the point to be shielded without re-engaging during the removal process. The dehooking end must be no larger than 1-7/8” outside diameter; a smaller diameter end may be more appropriate in fisheries that often encounter small turtles or use small hooks. It cannot have any unprotected terminal points or sharp edges as this could cause injury to the esophagus during hook removal. A sliding PVC bite block must be used to protect the beak and facilitate hook removal if the turtle bites down on the dehooking device. The bite block should be constructed of a 3/4” – 1” inside diameter high impact plastic cylinder (e.g., Schedule 80 PVC) that is 4 – 6” long to allow for at least 5” of slide along the shaft. The device must be of a size appropriate to secure the range of hook sizes and styles used on the vessel in the applicable fishery (e.g., 16/0

– 20/0 circle hooks in the Atlantic pelagic longline swordfish and tuna fisheries would require use of 5/16” wire and an outside diameter no greater than 1-7/8”);

(ii) *Handle length.* The handle must be 16” – 24” long with an approximately 4 – 6” long tube T-handle, wire loop handle or similar.

**(2) Example Model(s) Meeting Current Design Standards:**

(i) *The NOAA/Chain-link Dehooker (Plate 7).* This device has two 2-3/4” rounded prongs at the end to form a uniform gap of at least 7/32”. It has a 3/4” inside diameter high impact plastic cylinder bite block 5” in length. Note: This dehooker is approved for removing external circle or J-hooks, and internal circle hooks. It should not be used to remove internal J-hooks because the hook point cannot be protected from re-engaging the sea turtle during hook removal.

(ii) *Bite-block Pigtail (ARC) Dehooker – ARC 17” Bite-Block Deep-Hooked (Sea Turtle) Dehooker (Plate 15).* The specifications here describe the model designed for use with large hooks from 16/0 – 20/0 (i.e., for use in pelagic longline fisheries). See p. A15-1 for the functional range of loop diameters and offset angles to accommodate smaller hook sizes in other hook-and-line fisheries. This device is constructed of a 3/16” - 5/16” diameter 316L or 304L stainless steel rod curled into a pigtail spiral loop end. The loop is placed at a 5.3° angle offset to create a 1/8” gap between rod and loop to facilitate line engagement. The loop is designed at a 12.2° angle bend from the rod, and an inside diameter of 13/16” and an outside diameter of 1-5/16”. It has a 3/4” I.D. high impact plastic cylinder bite block 4 – 6” in length.

**Short-handled Dehooker for External Hooks**

These dehookers are designed for use when the hook is external, or when hooks are located in the front of the mouth. Minimum design standards are as follows:

**(1) Design Standards:**

(i) *Hook removal device.* The dehooker must be constructed of 3/16” – 5/16” marine grade stainless steel (316L or 304L) rod if constructing a wire style dehooker (e.g., the ARC, Scotty’s and J-Style dehookers). When constructing other styles (e.g., chain-link and cylinder dehookers), marine grade stainless steel (316L or 304L) must be used for all components. The design should be such that the hook can be rotated out without pulling it out at an angle, and the dehooking end must be blunt and all edges rounded (it is critical that there are no sharp edges). The device must be of a size appropriate to secure the range of hook sizes and styles used on the vessel in the applicable fishery (e.g., 16/0 - 20/0 circle hooks in the Atlantic pelagic longline swordfish and tuna fisheries would require use of 5/16” wire and an outside diameter of 1-7/8”);

(ii) *Handle length.* The handle length must be 16 – 24”, with an approximately 4 – 6” long tube T-handle, wire loop handle or similar.

**(2) Example Model(s) Meeting Current Design Standards:**

(i) *NOAA/Chain-link Dehooker (Plate 7).* This device has two 2-3/4” rounded chain links that form prongs at the dehooking end to form a uniform gap of at least 7/32”. Around the rod, it has a 3/4” inside diameter high impact plastic cylinder bite block 5” in length.

(ii) *Cylinder Dehooker (Plate 16).* The dehooking end of this device has a 3-3/4” long cylinder (1-5/8” outside diameter) with four 1/8” deep notches at 90° angles cut in to the terminal end of the cylinder, and a 1/8” diagonal slit cut through the cylinder to capture the line across the length of the cylinder.

(iii) *J-Style Dehooker (Plate 10) [e.g., ARC Commercial 16” or 36” J-Style Dehooker].* The dehooker must be constructed of 3/16” – 5/16” diameter marine grade stainless steel (316L or 304L) rod with a 1” dehooking end at a 45° angle to the rod forming a “J” shape.

(iv) *Scotty’s Dehooker (Plate 17).* This device has two 1-1/4” long prongs at the end to form a 3/4” wide fork. This device is approved for removing external circle or J-hooks from turtles boated. It should not be used to remove any internal hooks;

(v) *Squeeze Handle Dehooker.* This device must be constructed of stainless steel. It grasps the hook by placing the back of the hook shank on the slot of the working end, and squeezing the handle causes the hook to rotate out. It can be used on hooks up to 10/0 in size, but not larger hooks;

(vi) *Bite-Block Pigtail (ARC) Dehooker – ARC 17” Bite-Block Deep-hooked (Sea Turtle) Dehooker (Plate 15).* This device is constructed of a 3/16 to 5/16” 316L or 304L stainless steel rod curled into a pigtail spiral loop end. The loop is placed at a 5.3° angle offset to create a 1/8” gap between rod and loop to facilitate line engagement. The loop is designed at a 12.2° angle bend from the rod, and an inside diameter of 13/16” and an outside diameter of 1-5/16”. It has a 3/4” I.D. high impact plastic cylinder bite block 5” in length. This model may be notched to improve effectiveness with circle hooks.

## Appendix A

### DESIGN SCHEMATICS FOR CAREFUL RELEASE EQUIPMENT

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**Plate 1**

**T&G NINJA STICKS**

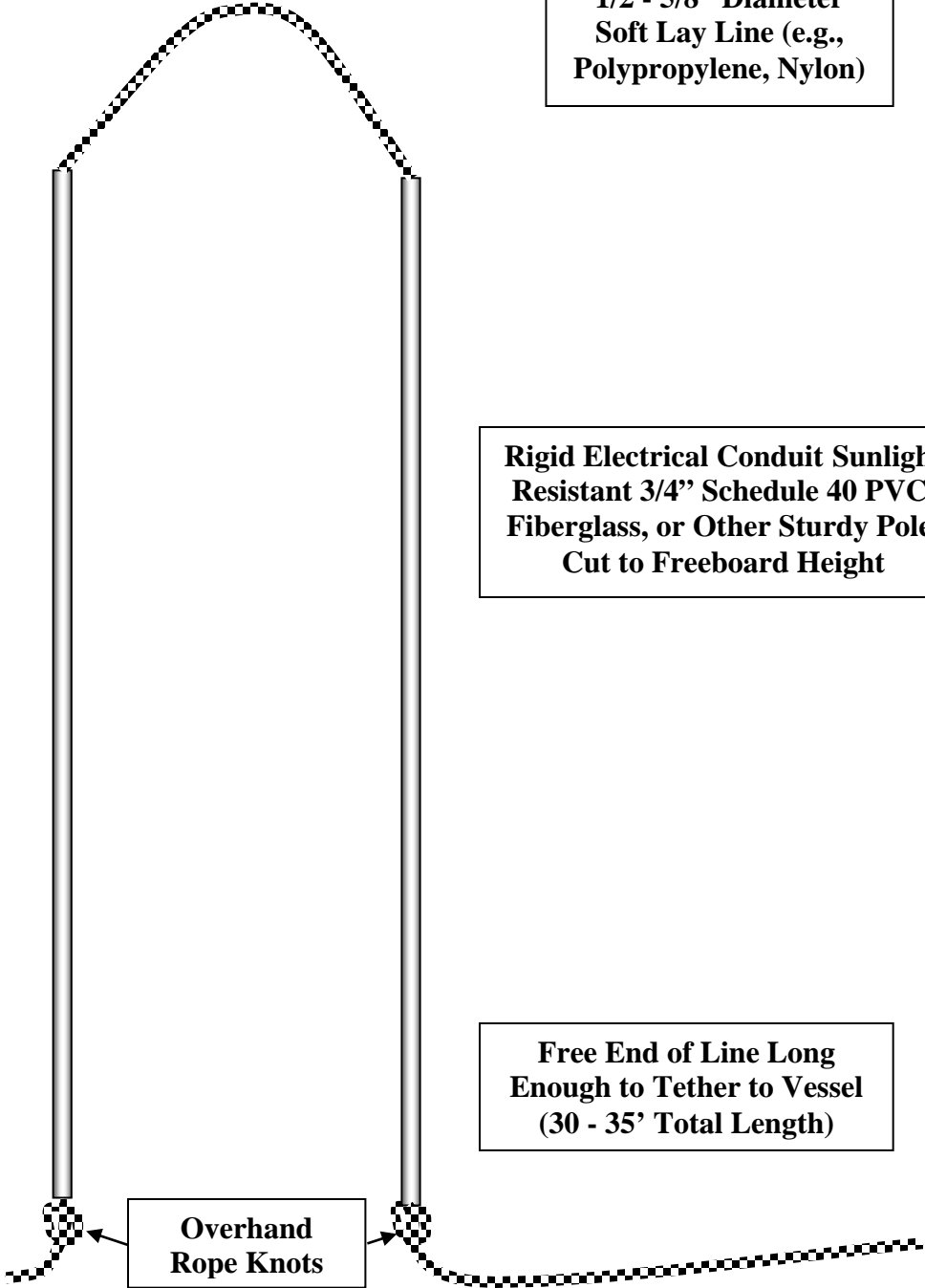
**18 - 24" Exposed  
Working Section of Line**

**1/2 - 5/8" Diameter  
Soft Lay Line (e.g.,  
Polypropylene, Nylon)**

**Rigid Electrical Conduit Sunlight  
Resistant 3/4" Schedule 40 PVC,  
Fiberglass, or Other Sturdy Pole,  
Cut to Freeboard Height**

**Free End of Line Long  
Enough to Tether to Vessel  
(30 - 35' Total Length)**

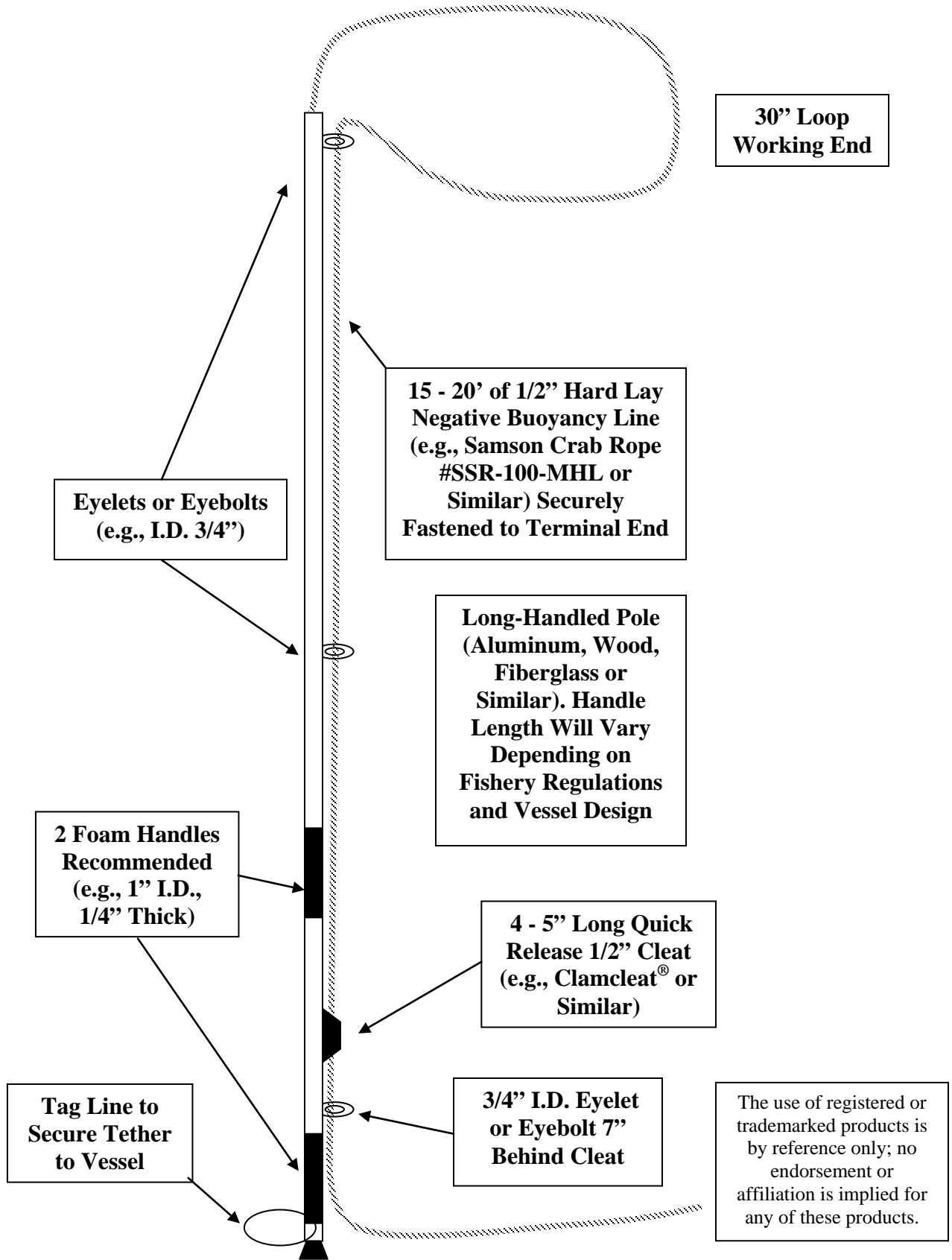
**Overhand  
Rope Knots**



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# Plate 2

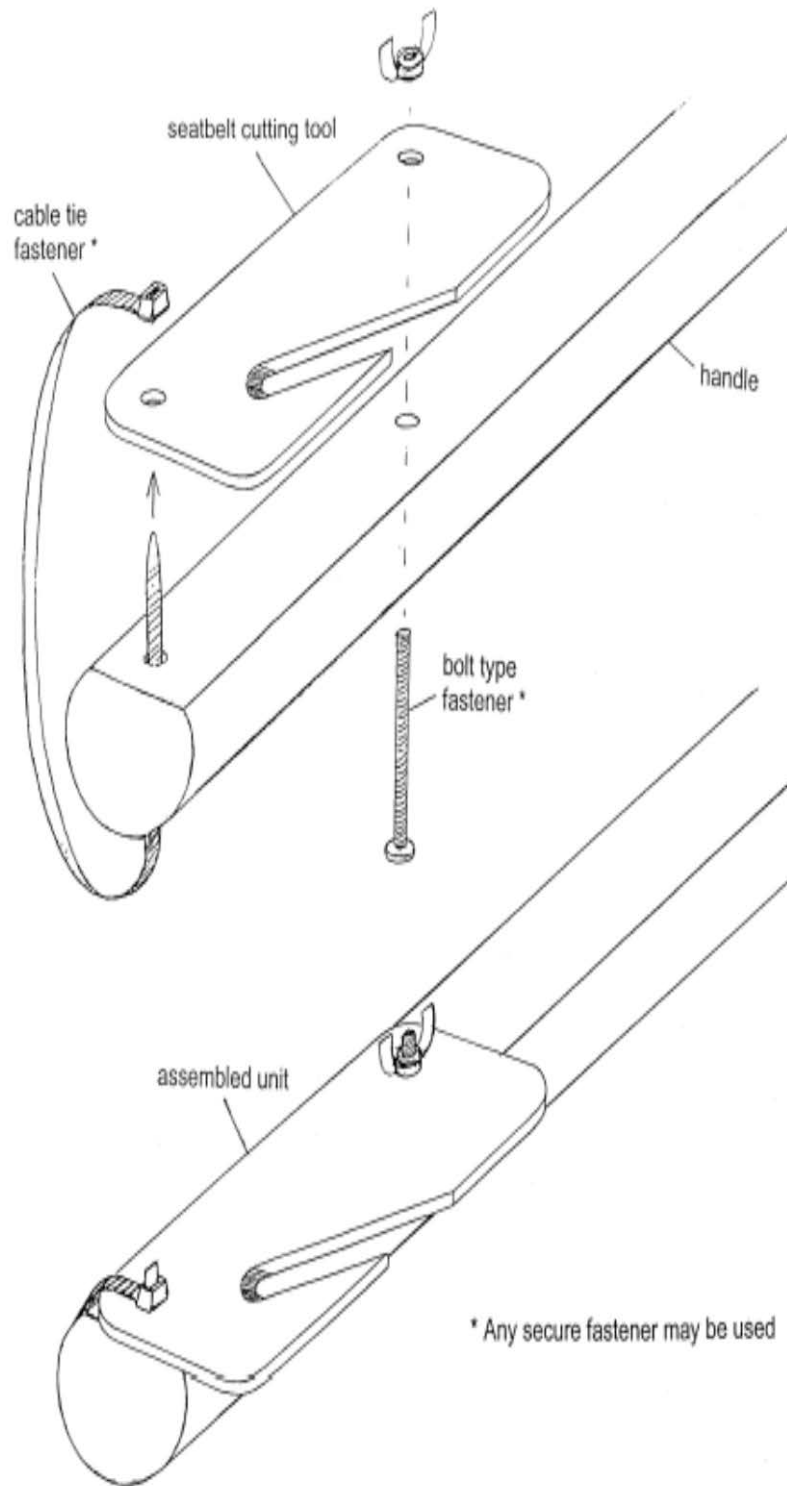
# TURTLE TETHER



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**Plate 3**

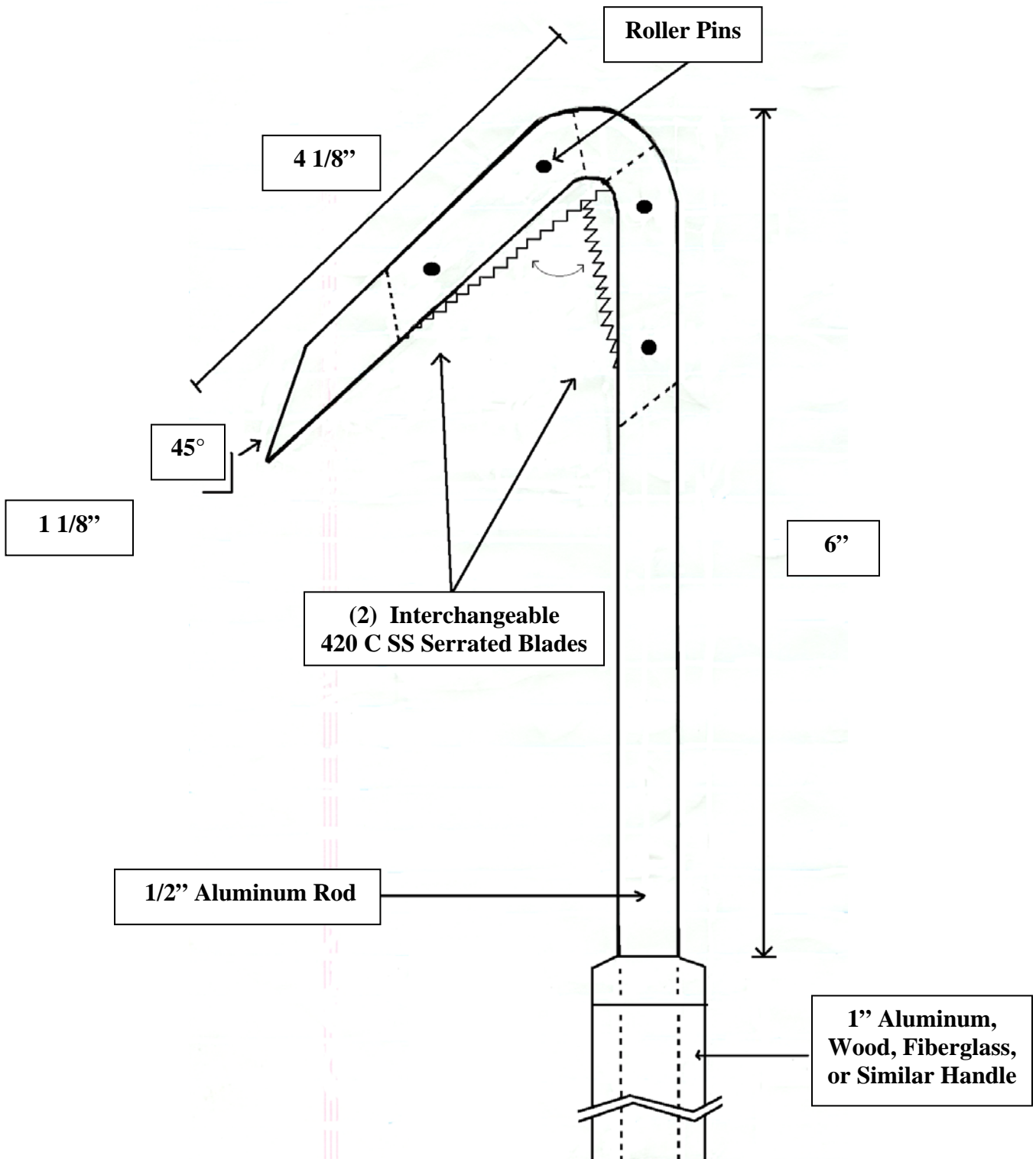
**NOAA/ARCENEUX LINE CUTTER**



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**Plate 4**

**NOAA/LAFORCE LINE CUTTER**



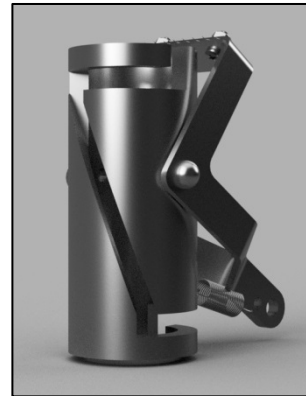
Modified Version of Diagram Provided by ARC

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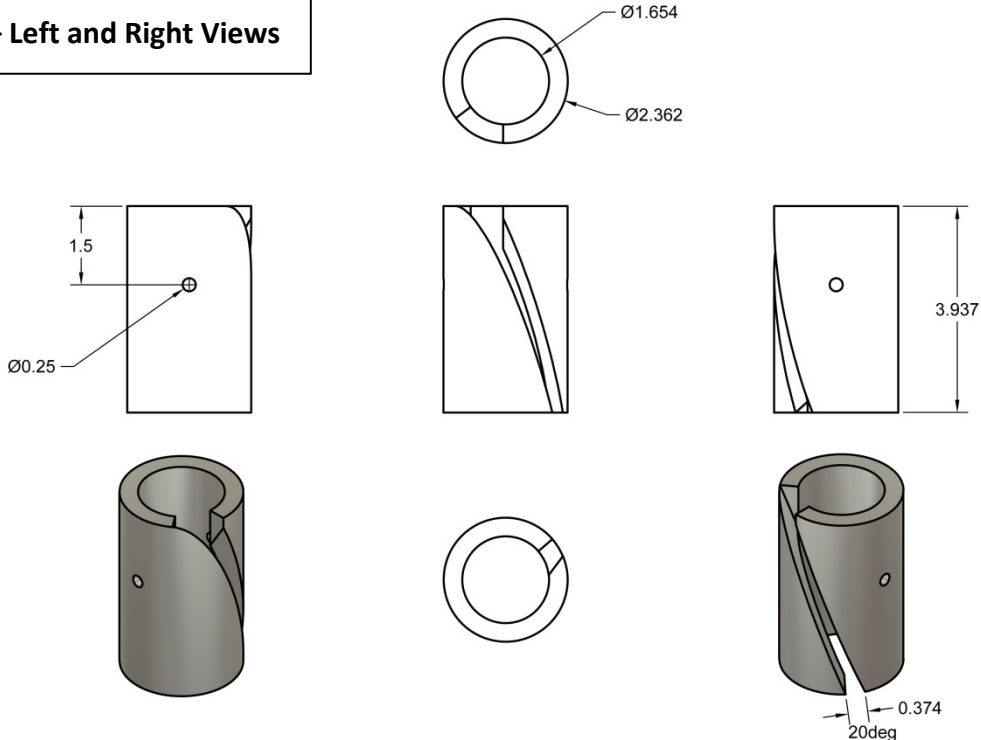
**Plate 5**

**JLC-ZC-2 LINE CUTTER**

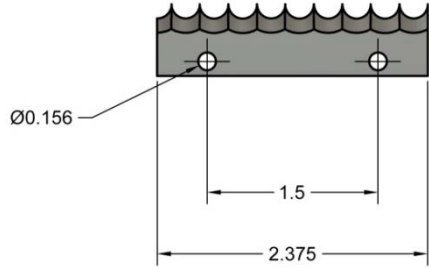


Line cutter designed by J. Barbour, L. LaForce, and C. Bergmann.  
Figures courtesy of R. Caillouet. NMFS Pascagoula Laboratory.

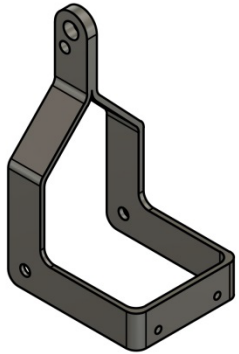
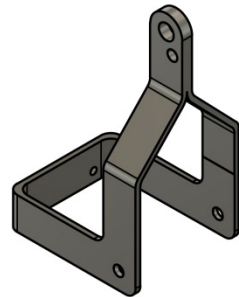
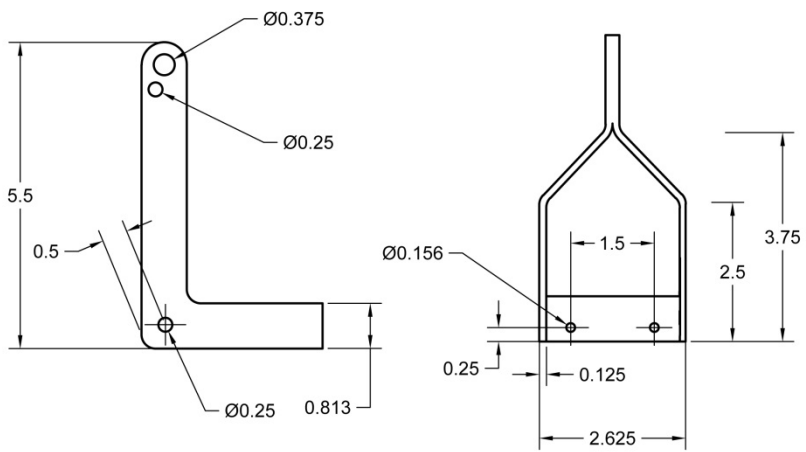
**Main Tube – Left and Right Views**



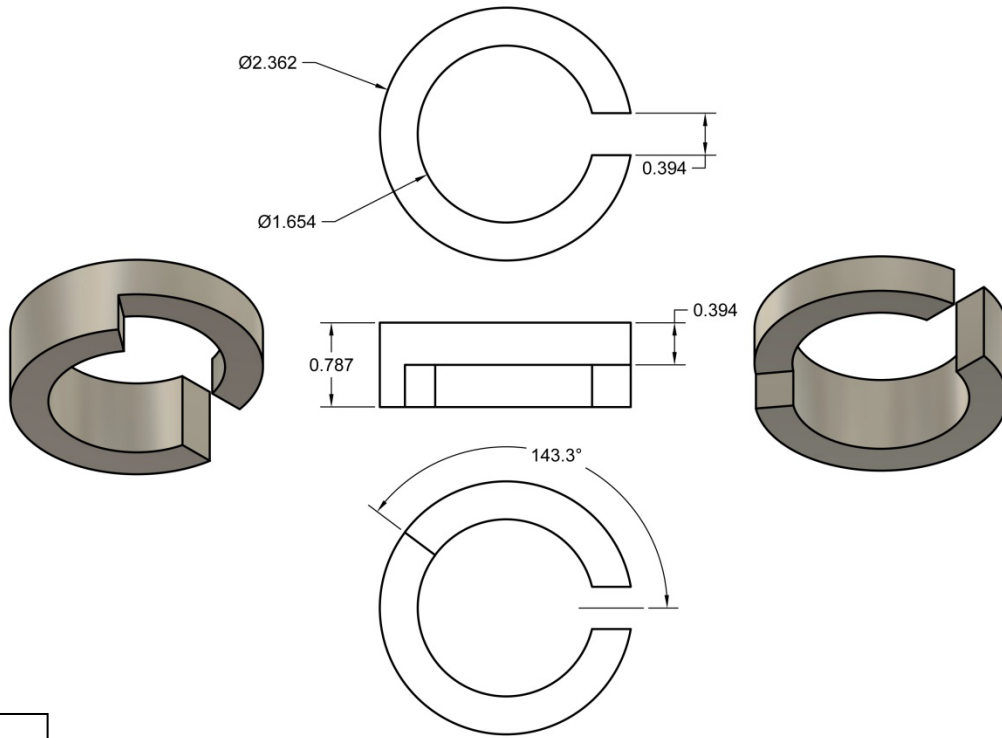
**Blade**



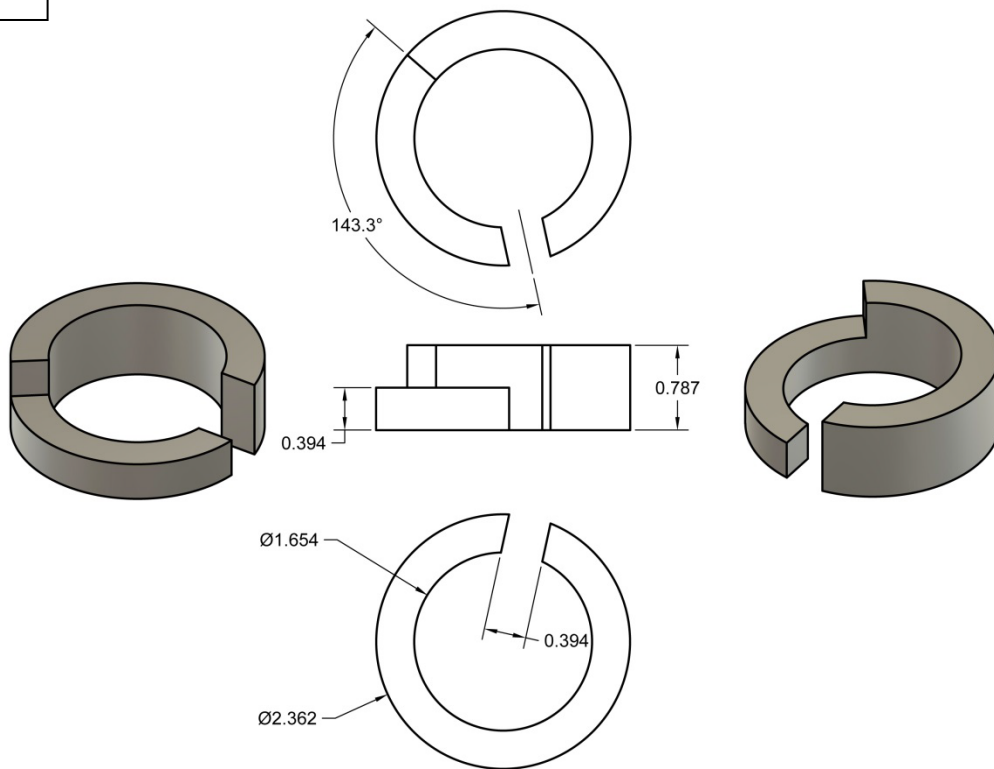
**Cutter Arm**



**Top Flange**



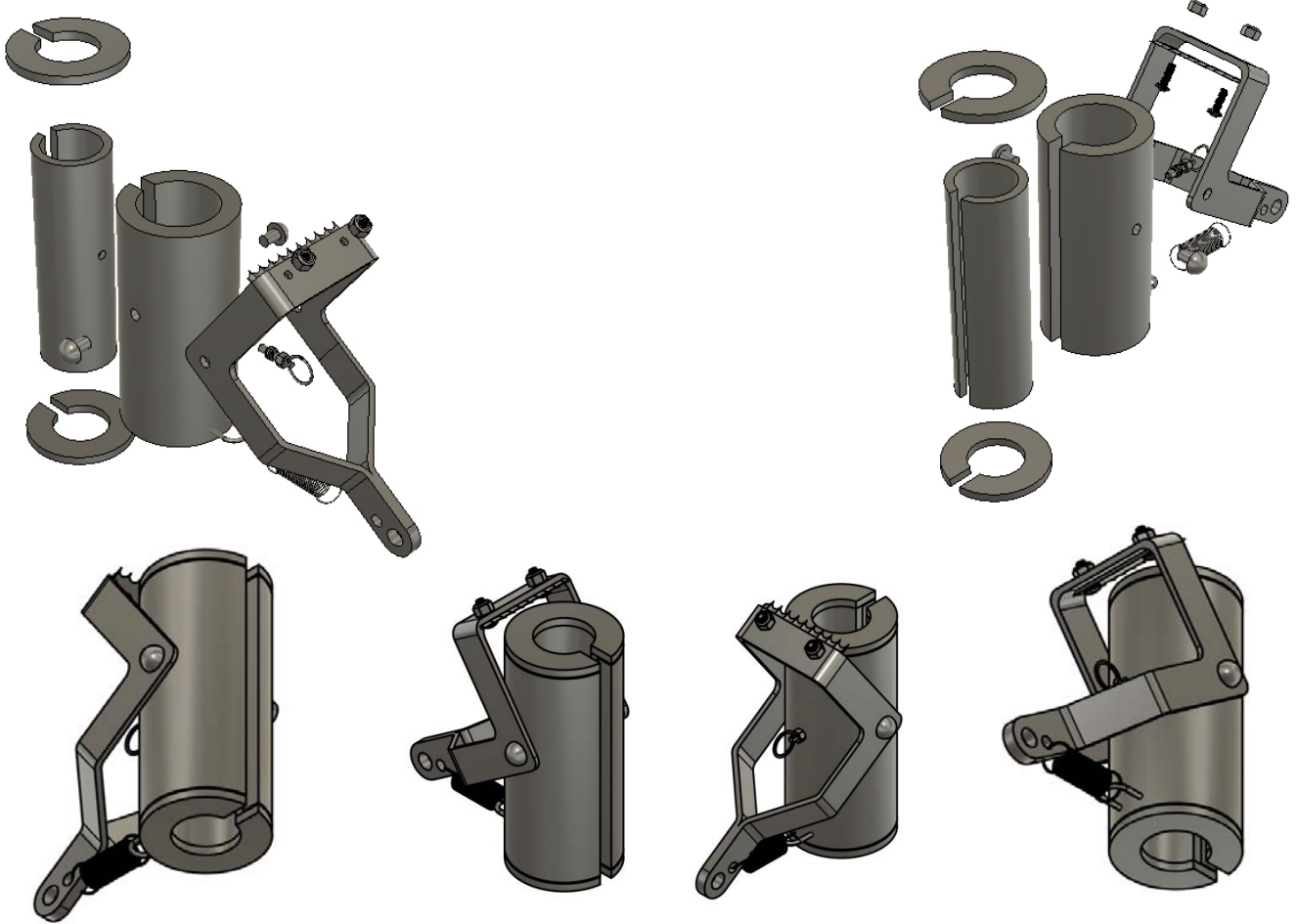
**Bottom Flange**



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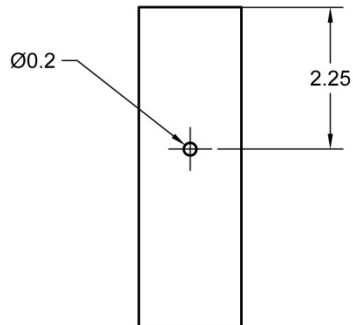
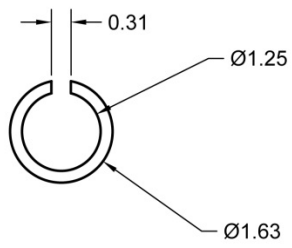
**Plate 6**

**JLC-TL-1 LINE CUTTER**

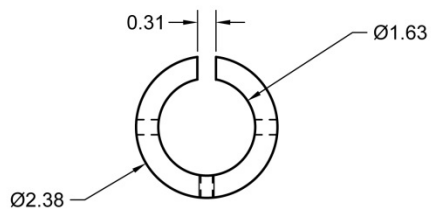
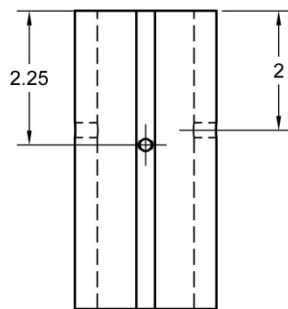
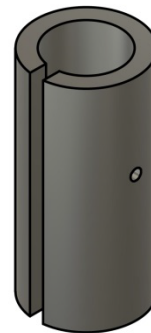
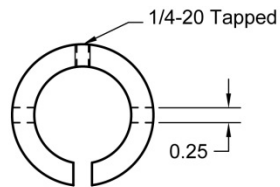


Line cutter designed by J. Barbour, L. LaForce, and C. Bergmann.  
Figures courtesy of R. Caillouet. NMFS Pascagoula Laboratory

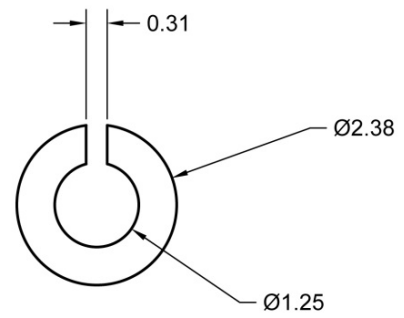
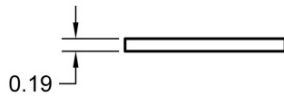
**Inner Tube**



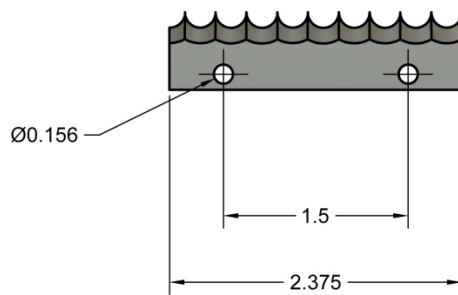
**Outer Tube – Left and Right Views**



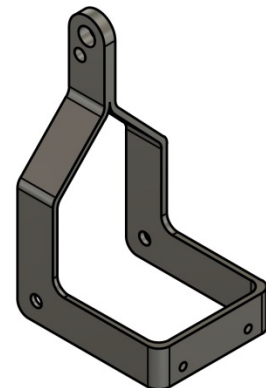
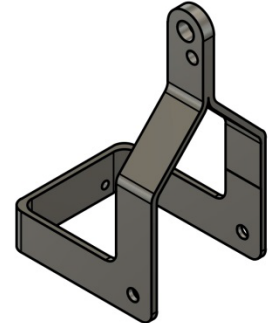
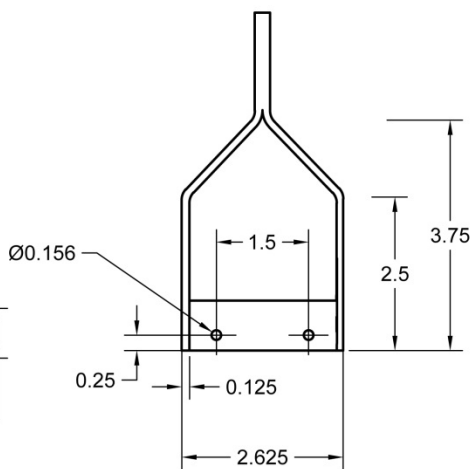
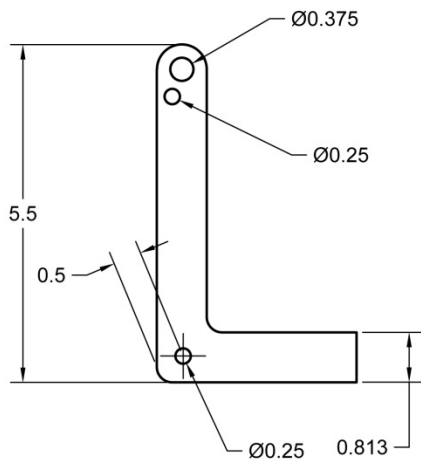
**Flange**



**Blade**



**Cutter Arm**

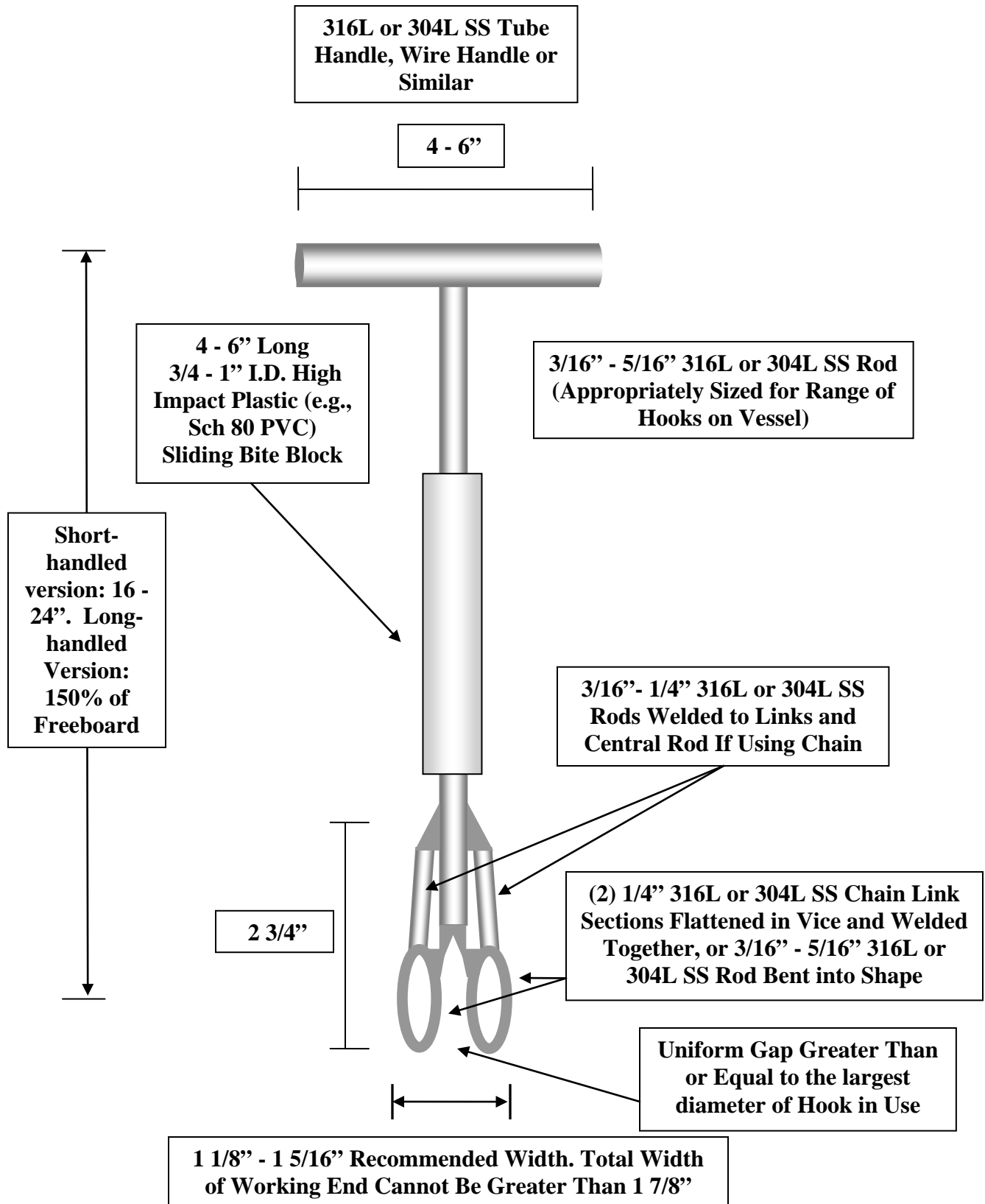


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**Plate 7**

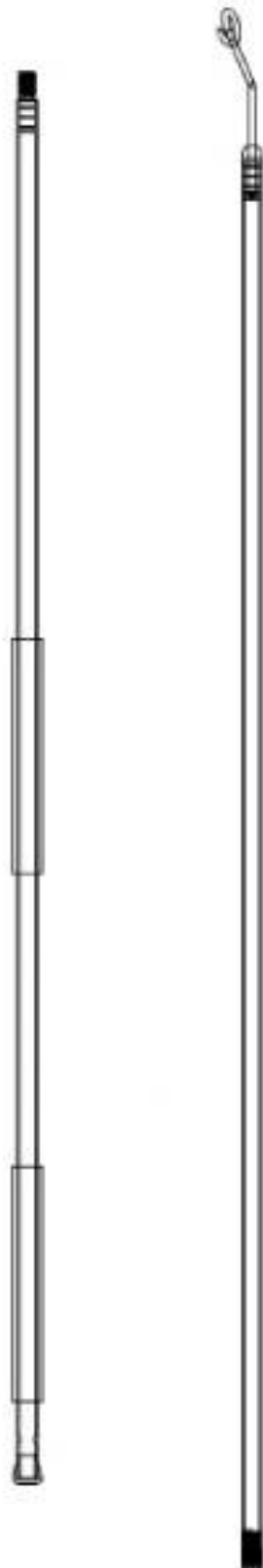
**NOAA/CHAINLINK DEHOOKER**



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**Plate 8**

**LONG-HANDLED PIGTAIL STYLE  
(ARC) DEHOOKER**



**3/16" - 5/16" 316L or 304L SS Rod**

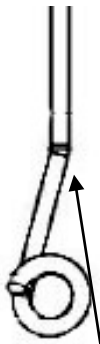
**Total Length 4 - 12' Depending on Freeboard Height. Working End Must Be Securely Attached to Sturdy Handle (e.g., Wood, Aluminum, Fiberglass) (2 Breakdown Pole Sections Depicted Here).**

**Detail of Working End**

**2 Foam Handles (Optional) (e.g., 1" I.D., 1/4" Thick)**

**5 - 7" From Point of Insertion to End of Curl**

**5.3° - 13° (Range) Offset Angle to Shield the Point of the Hook**



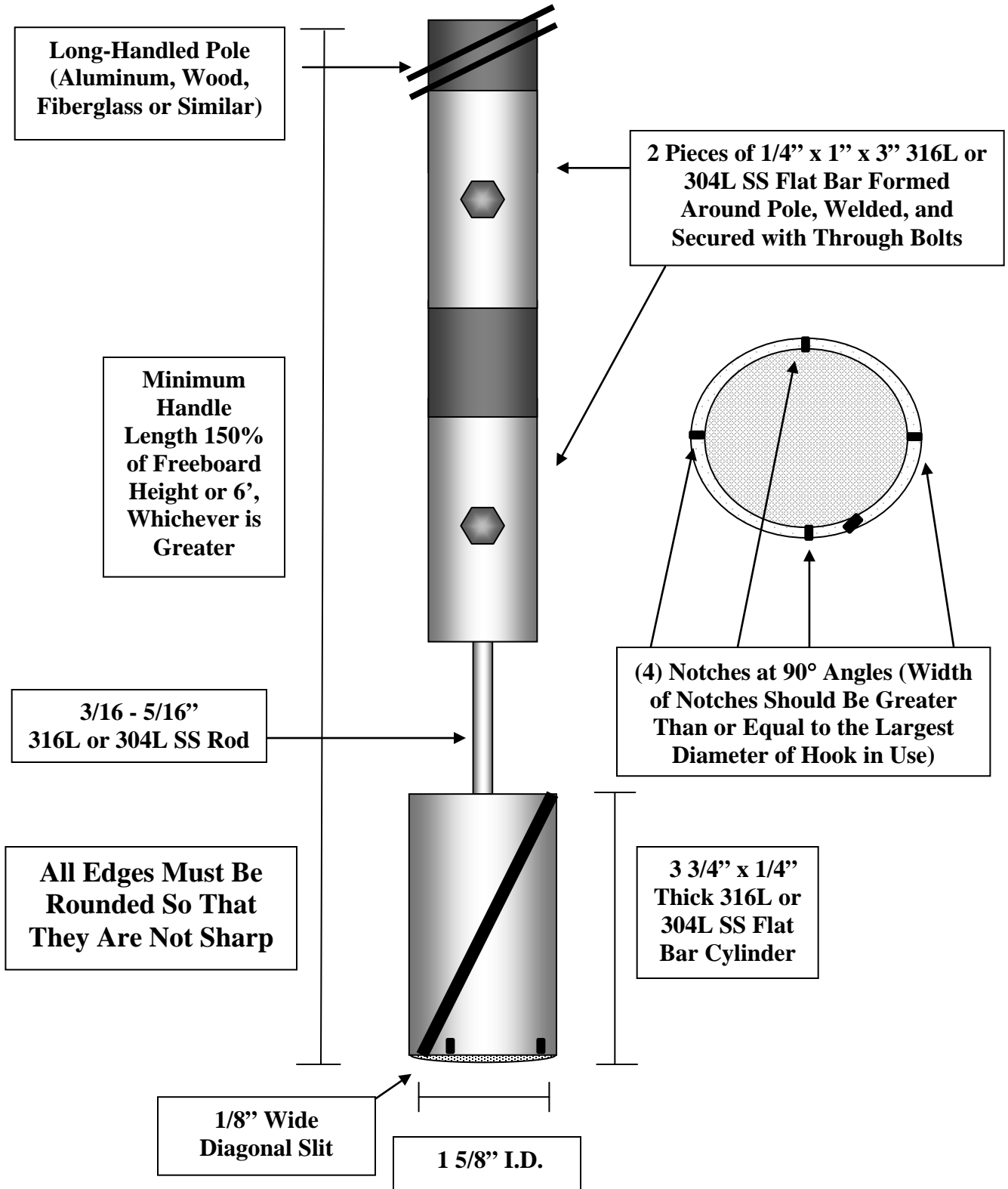
**Loop I.D. 1 1/4" and O.D. No Greater than 1 7/8" with 1/8" Gap Between Rod and Loop to Facilitate Line Engagement**

**12.2° to 24° (Range) Angle Bend from the Rod to Accept a Range of Hook Sizes**

**Modified Version of Diagram Provided by ARC  
U.S. Patent # 4,914,853; U.S. Design Patent # 382,628**

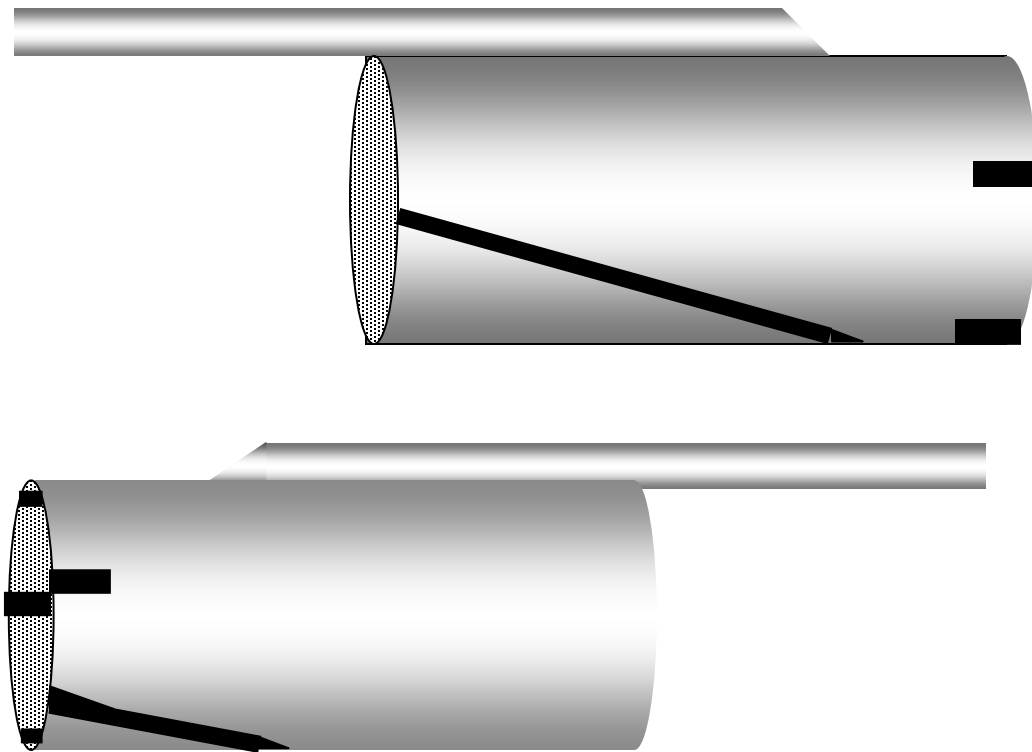
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# Plate 9 LONG-HANDLED CYLINDER DEHOOKER



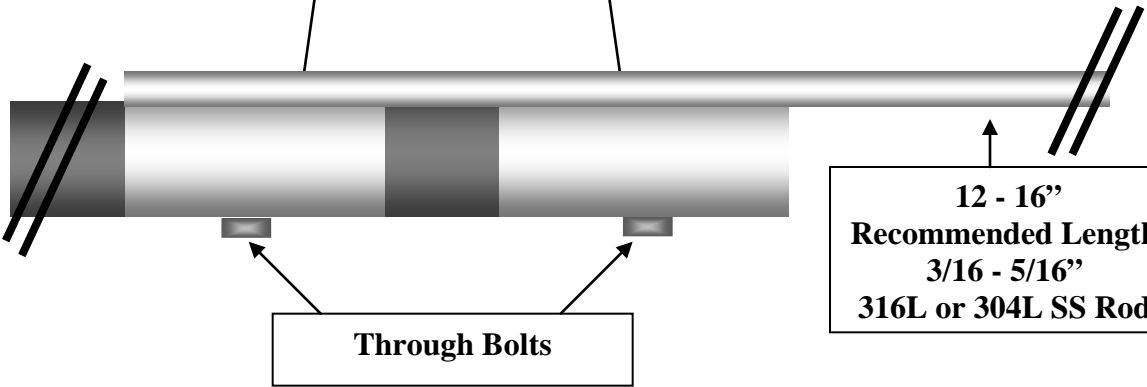
**Plate 9 Continued**

**Side Views**



**All Edges Must Be Rounded So That They Are Not Sharp**

**2 Pieces of 1/4" x 1" x 3" 316L or 304L SS Flat Bar  
Formed Around Pole and Welded to Central Rod**

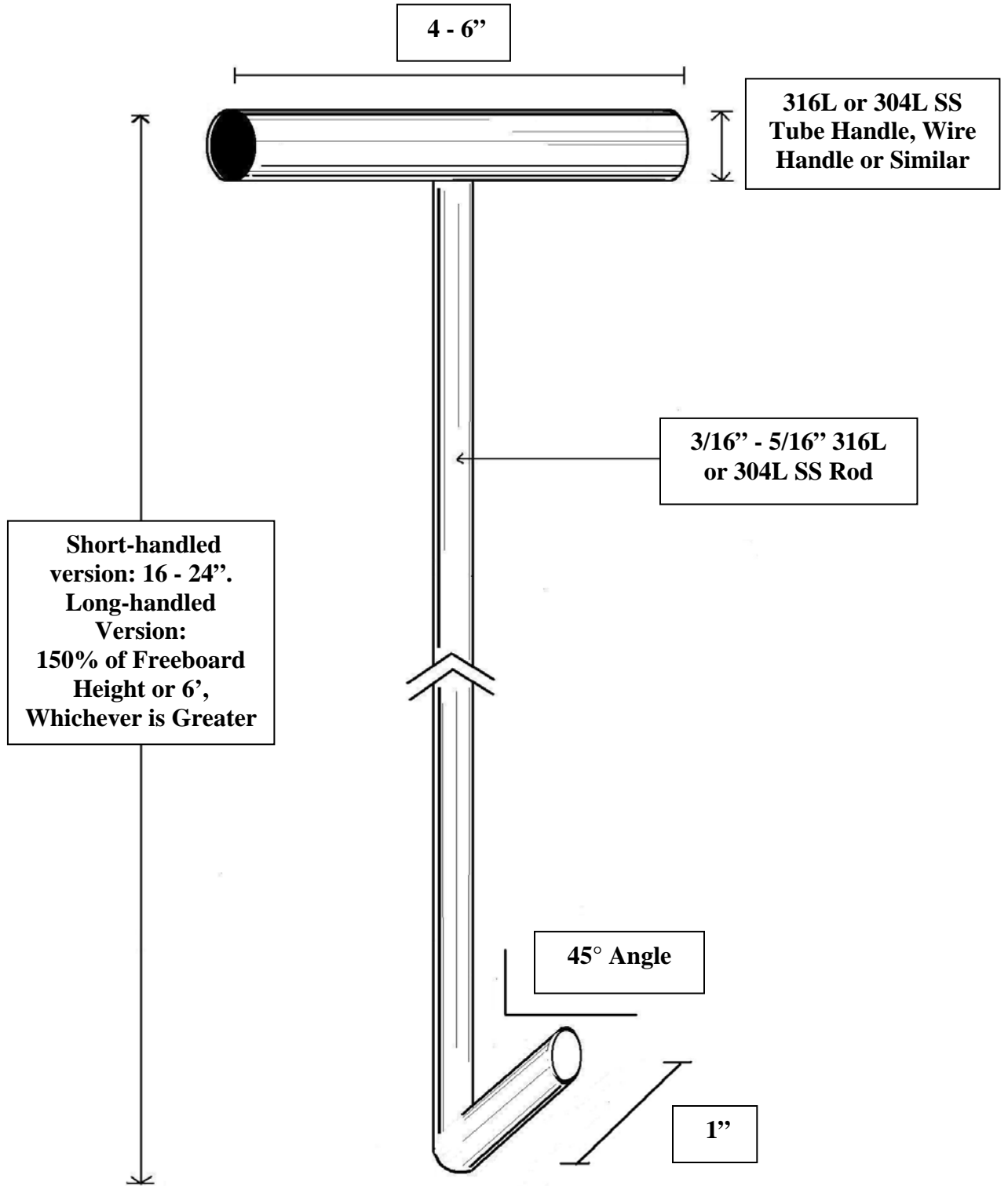


**Through Bolts**

**Attachment Method May Vary as Long as Working End Is Securely Attached**

**Plate 10**

**J- STYLE DEHOOKER**



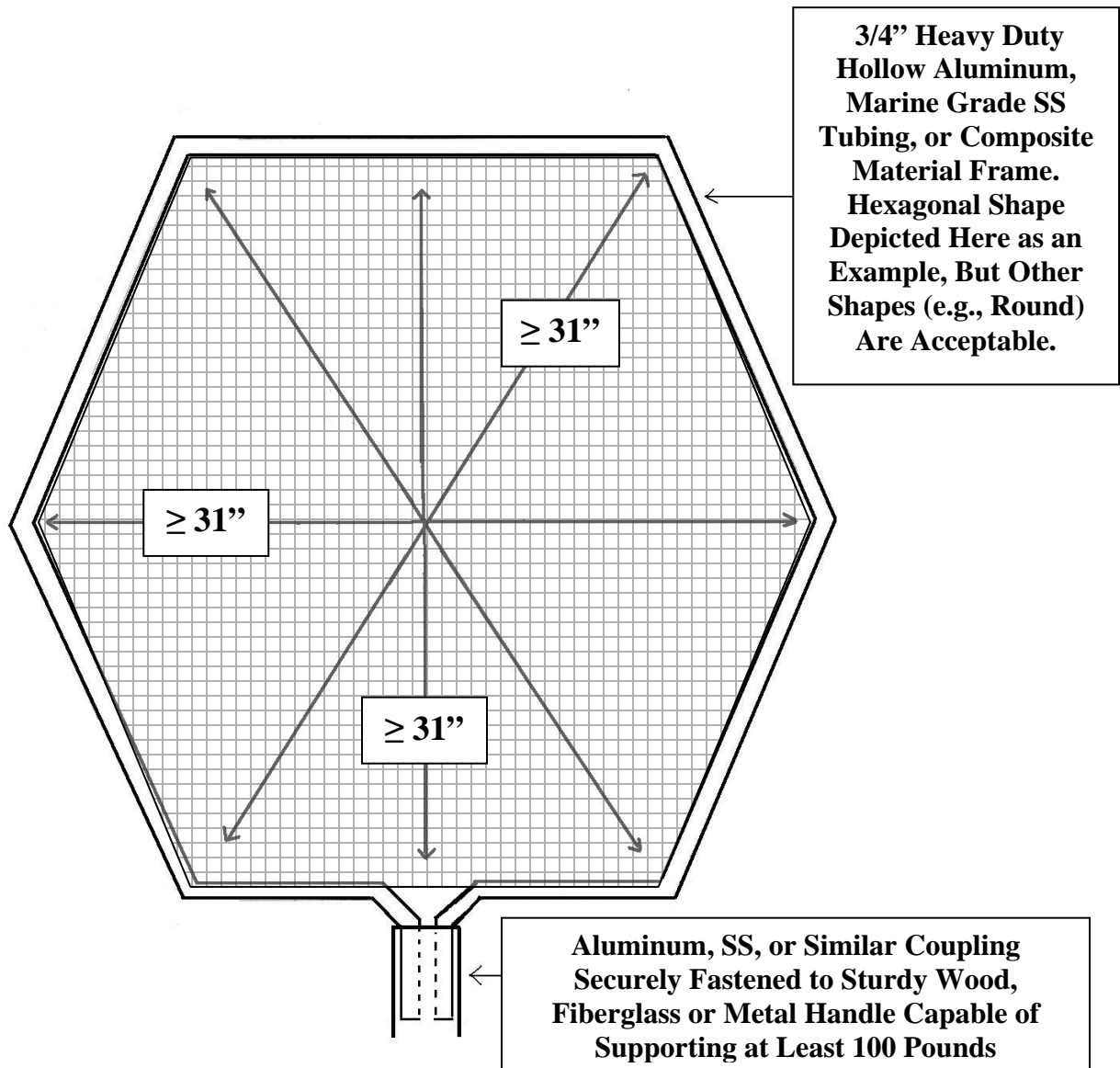
Modified Version of Diagram Provided by ARC

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# Plate 11

# DIP NET

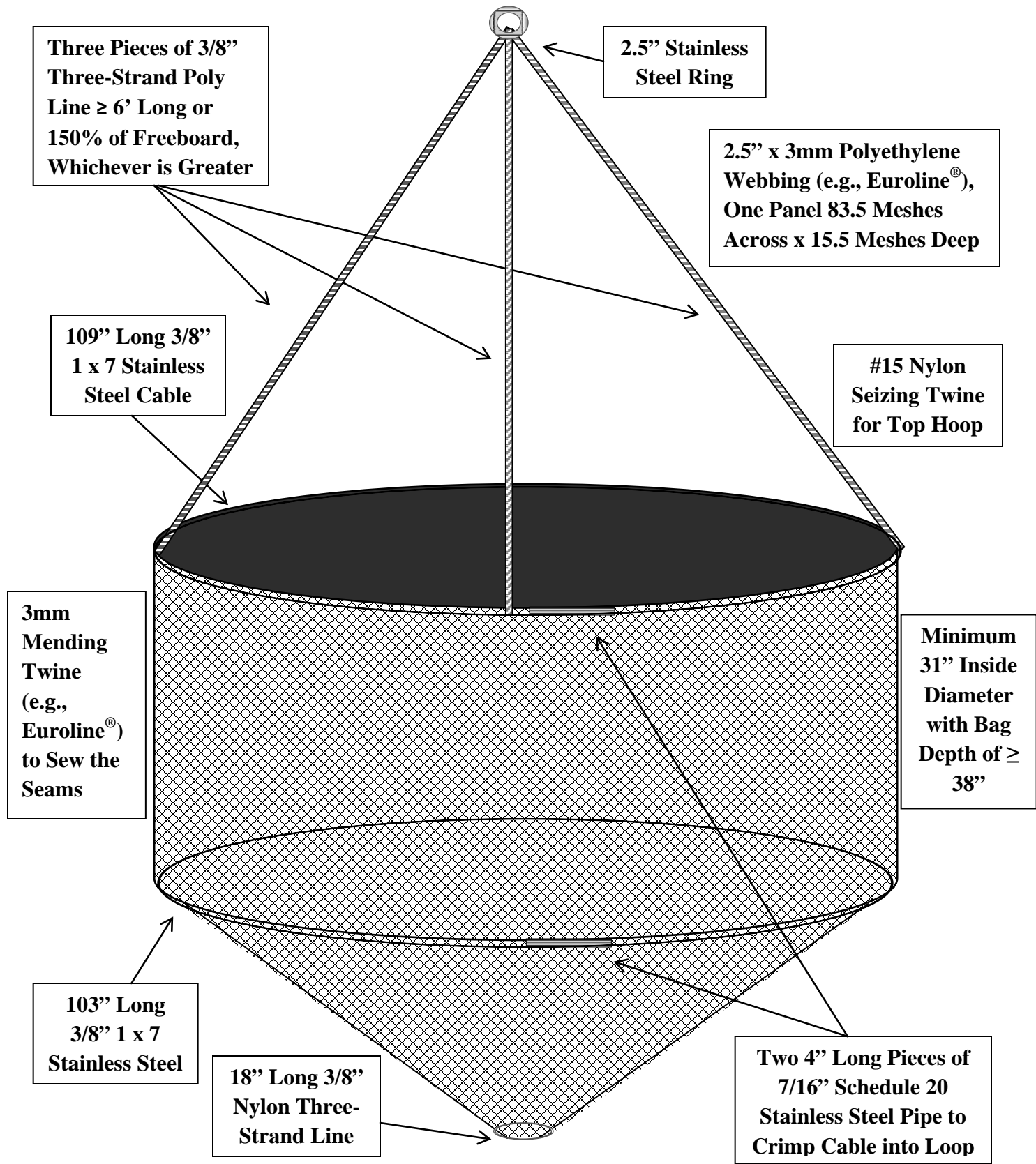


Modified Version of Diagram Provided by ARC

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# Plate 12

# COLLAPSIBLE HOOP NET

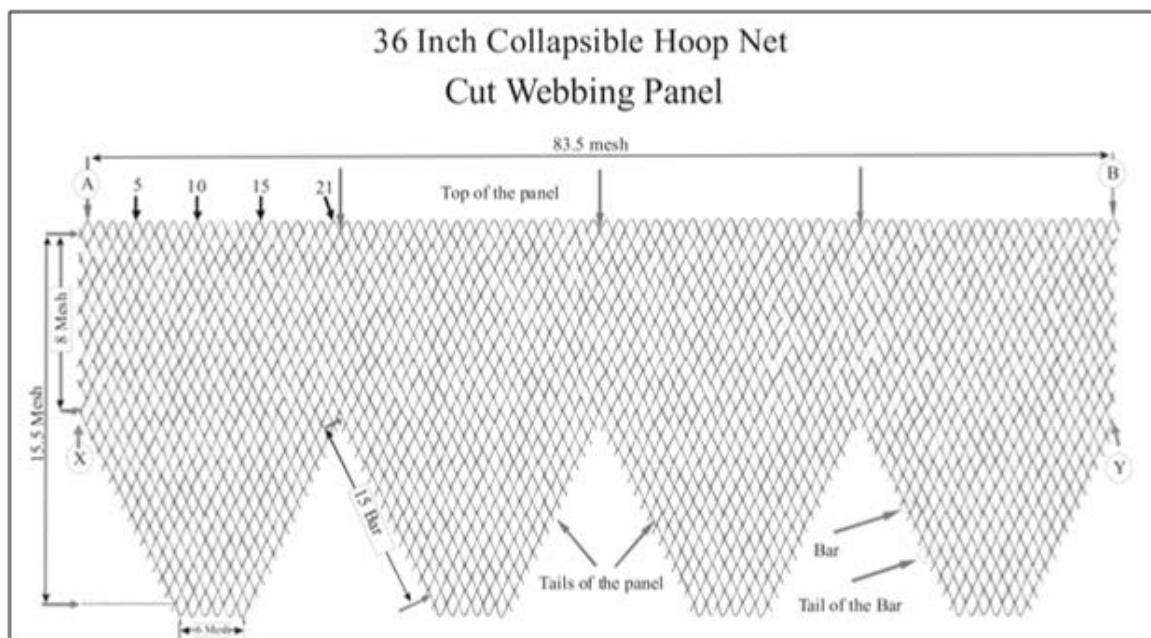


Net Designed by Nick Hopkins  
NMFS Harvesting Systems Unit

# Fabrication Instructions

## Cutting the webbing

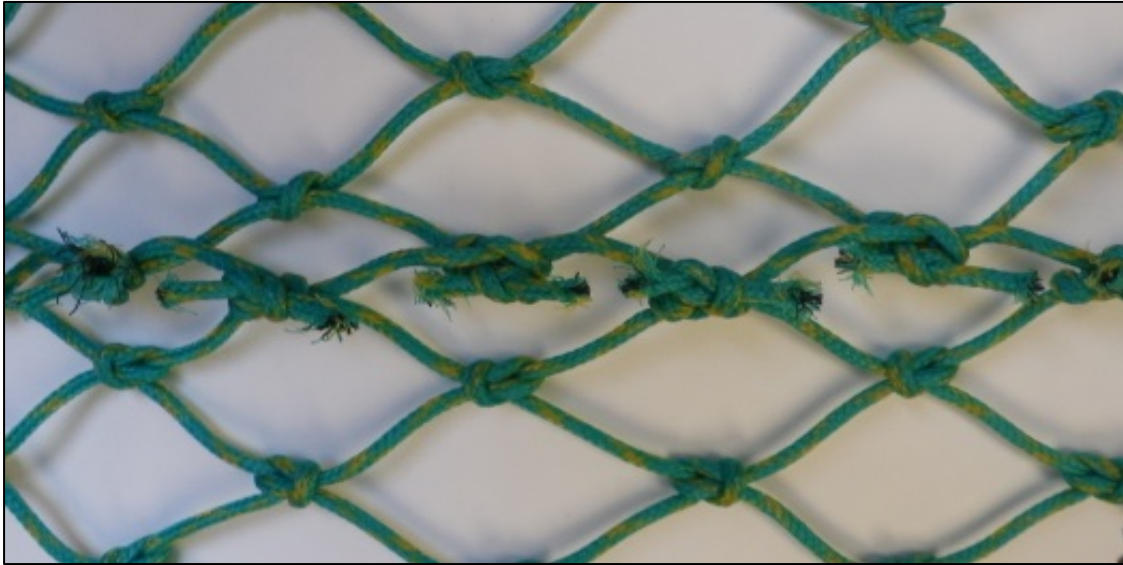
Start at the top of the webbing panel (Euroline<sup>®</sup> or similar) at the side that has the whole mesh in the corner. This is point A (Figure 1). Count down eight meshes from point A. From this mesh cut down 15 bars towards the bottom of the panel. At the end of this bar, count over six meshes along the bottom of the panel. From here cut up into the panel along the bar that runs upward and away from the starting side of the panel, up 15 bars. From this point continue in the direction away from the starting side but cut down the bar that runs in a downward diagonal. Repeat this step twice to remove three full, and two half wedges from the bottom of the webbing panel.



**Figure 1.** Layout of how the webbing is cut with highlighted references

## Sewing the Panel Together

1. Bring point A to point B. Be careful to keep the webbing flat and not introduce a twist to the panel. Using 3mm Euroline<sup>®</sup> (or similar) twine, start at the half mesh at point B. Sew in the seam that connects point B to point A then progress down the eight meshes toward point X, terminating the seam at point Y (Figure 2). The result should be a tube with 84 continuous meshes around the top, and four trailing trapezoidal tail with bar cuts down both sides and a six mesh termination each.



**Figure 2.** How the seam is sewn in from Point A and B down to point X and Y

2. The wedges removed from the original panel allow the tails to be brought together at a sharp taper. The edges of the neighboring tails will be sewn together by seizing the complementary bar tails (Figure 1) together. Start the first full mesh at the apex of wedge cut out. Using 3mm Euroline<sup>®</sup> twine to tie a double half hitch at the bottom of this mesh. Bring the sides of the two tails below this mesh together. Take the first cut leg from both sides and bring them together as the first pair of bar tails. From the apex starting point, run the twine down and lash a half hitch around this first pair of bar tails, first wrapping below the pair, then locking the half hitch above the pair. Continue tying half hitches down the bars until you reach the six bottom meshes (Figure 3).



**Figure 3.** How the bar cuts are sewn together between the tails of the tube

3. Repeat Step 2 to close up the spaces between each tail on the panel. The result is a tube of webbing with a strong taper from 84 meshes along the top down to 24 meshes around the bottom (Figure 4).



**Figure 4.** How the bottom cable hoop looks laced through the midline of the webbing tube

### Installing the Cable Hoops to the Webbing

1. Count down 8 meshes from point A to point X. Thread the 103" length of 3/8" 1 x 7 stainless steel cable through every mesh along the midline row of meshes in line with the mesh at point X (Figure 4). The cable should run through the mesh at the top of each of the tail seams (Figure 5).



**Figure 5.** The bar seam with the tails sewn together

2. Once the cable is run through the webbing and the ends come together at point X the end can be crimped together to make a continuous cable loop. To crimp a continuous cable loop you use a piece of steel pipe made of the same material with an inner diameter slightly larger than the diameter of the cable being used (Figure 6). The cable is inserted into the pipe and the pipe is crimped down onto the cable using a hydraulic press. It is important to center the pipe on the cable ends to insure a strong and secure crimp. A good way to center the crimp is (when using a 4" pipe) to mark the cable 2" from either end. Insert both ends of the cable into the pipe and center the pipe between the marks on the cable. The cable ends should be touching inside the pipe and the compressions should be made at both ends of the pipe (Figure 7).
3. Starting at point A, thread the 109" length of stainless cable through every mesh along the top of the 84 mesh tube. Once the cable is run through all the way around and the ends are brought together at point A crimp the ends together using the process described in Step 2 (Figure 8).

### Seizing the Webbing to the Top Hoop, Splicing Bottom Ring and Bridle

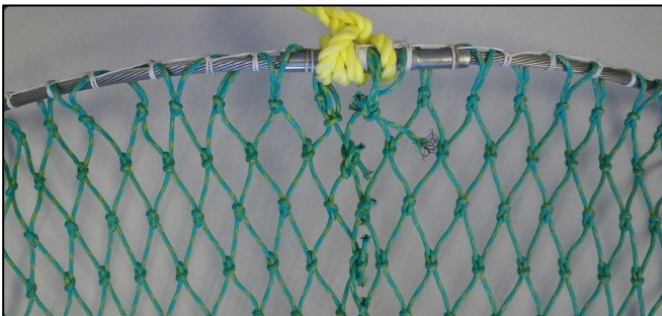
1. The bottom hoop does not need to be seized in, but the top hoop should be locked in place for a consistent mesh opening and to minimize chafing out the top row of meshes. This is done by seizing each mesh at the top of the tube to the top hoop with #15 nylon twine. The seizings and each respective mesh are made 1.5" apart. Additional chafing gear can be added to the top hoop by wrapping it with 3/8" three-strand poly line to protect the seizings and meshes (Figure 9).



**Figure 6.** 4" pipe used to crimp the cable into a loop



**Figure 7.** Finished crimp



**Figure 8.** Completed crimp and bridle at point A/B



**Figure 9.** Hanging placement around the top hoop

2. To close up the 24 meshes at the bottom of the tube, an 18" length of 3/8" nylon three-strand line is used. The line is run through every mesh along the bottom and spliced end for end with a 6" overlap. The resulting loop of nylon should have roughly a 12" perimeter or a 6" stretched diameter (Figure 10).
3. The bridle is made of three matching legs of 3/8" three-strand poly that should be more than 6' long. Each leg is attached to the top hoop 36" apart with a double half hitch, the tail of which is spliced back into the leg, and the splice is then seized (Figure 11). At the opposite end of each leg is an eye that is spliced through a single 2.5" stainless steel ring and each splice is seized. It is important that each leg is the same length from the hoop to the ring (Figure 12).



**Figure 10.** The spliced 3/8" nylon closer ring at the tail of the net



**Figure 11.** The bridle anchored to the top hoop



**Figure 12.** The lifting point at the top of the bridle

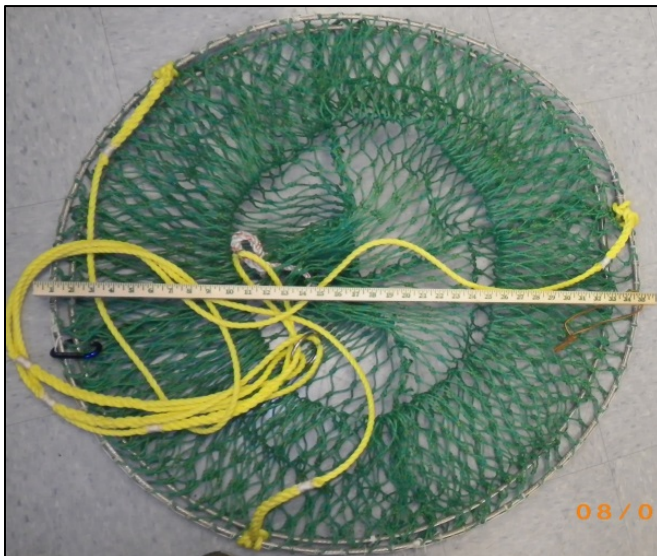




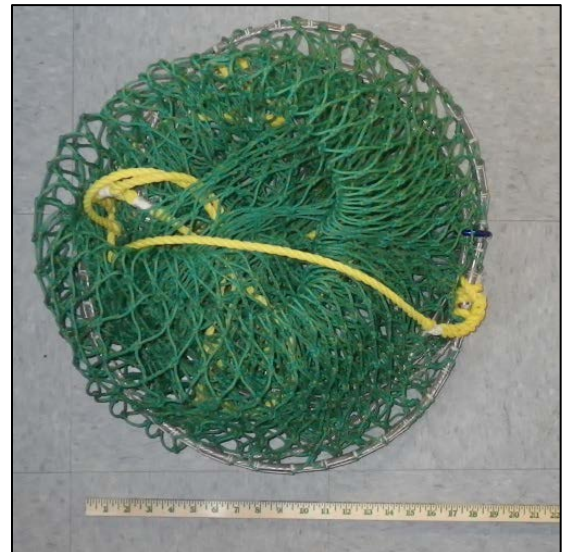
**Figure 13.** Finished collapsible net and bridle



**Figure 14.** Deployed net



**Figure 15.** Net is 36" wide when open

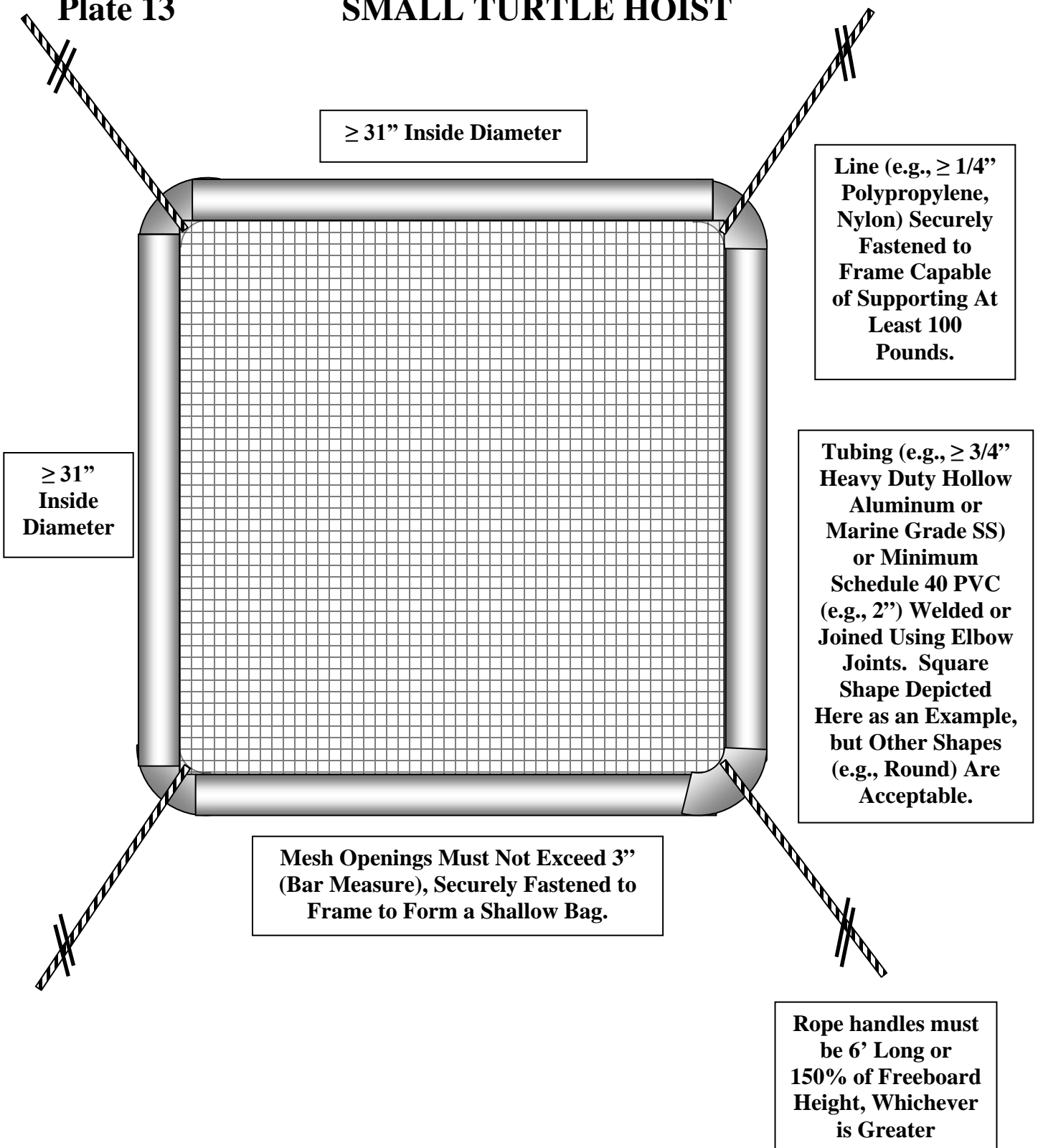


**Figure 16.** Net is 18" wide when folded for storage

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**Plate 13**

**SMALL TURTLE HOIST**



**≥ 31" Inside Diameter**

**Line (e.g., ≥ 1/4" Polypropylene, Nylon) Securely Fastened to Frame Capable of Supporting At Least 100 Pounds.**

**≥ 31" Inside Diameter**

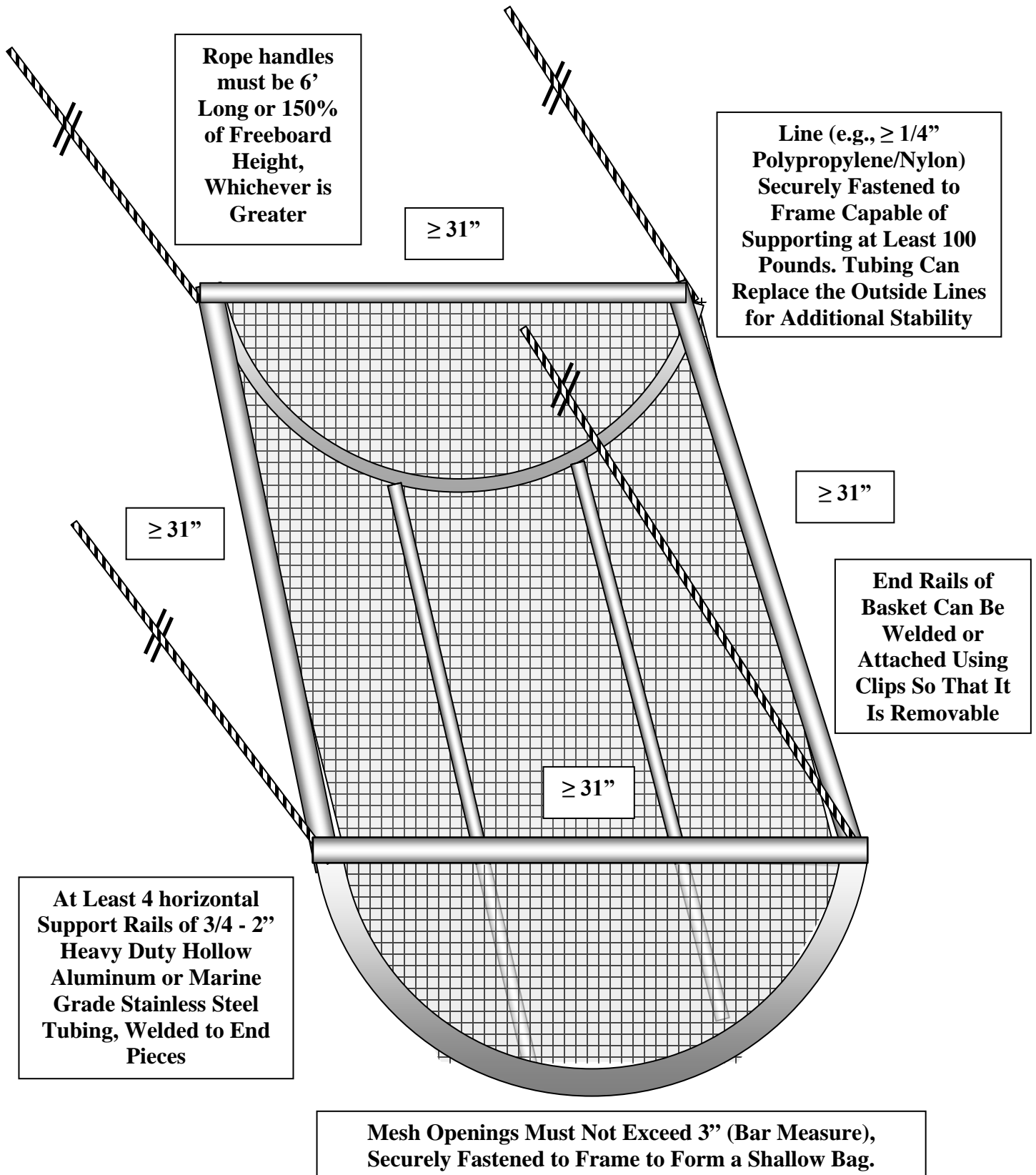
**Tubing (e.g., ≥ 3/4" Heavy Duty Hollow Aluminum or Marine Grade SS) or Minimum Schedule 40 PVC (e.g., 2") Welded or Joined Using Elbow Joints. Square Shape Depicted Here as an Example, but Other Shapes (e.g., Round) Are Acceptable.**

**Mesh Openings Must Not Exceed 3" (Bar Measure), Securely Fastened to Frame to Form a Shallow Bag.**

**Rope handles must be 6' Long or 150% of Freeboard Height, Whichever is Greater**

**Plate 13  
Continued**

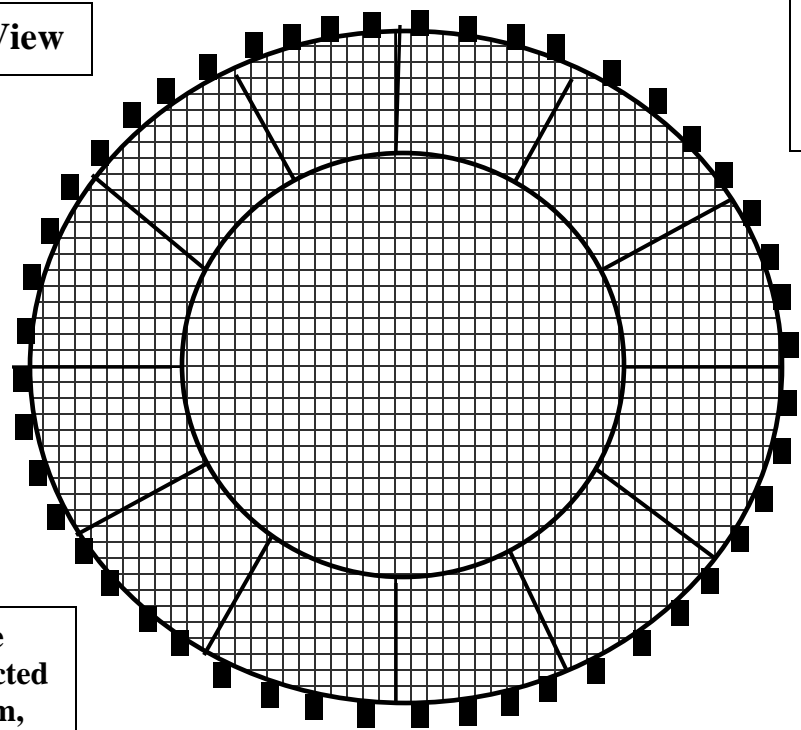
**BASKET STYLE  
SMALL TURTLE HOIST**



# Plate 14

# LARGE TURTLE HOIST

Top View



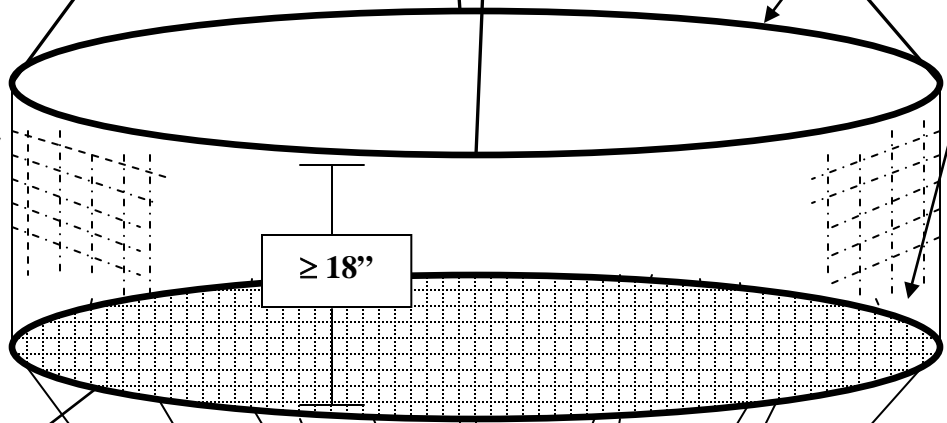
4 Round Rubber Cookies (8" x 2 1/2") per section (48 Total) on Top

Top/Fence Ring 7' 6" Diameter (1 3/4" Round 50 Series Aluminum Bar Wrapped in 1/2" Polypropylene Wrap Rope)

Fence Constructed of 3 mm, 4.7" Stretch Mesh Braided Polyethylene Webbing

3 or 4 Point Bridle Attached with Pairlinks and 3/4" Nylon 3-Strand Line

Middle Ring 7' 6" Diameter (1 3/4" Round 50 Series Aluminum Bar) Wrapped in 1/2" Polysteel Rope Around Circumference



≥ 18"

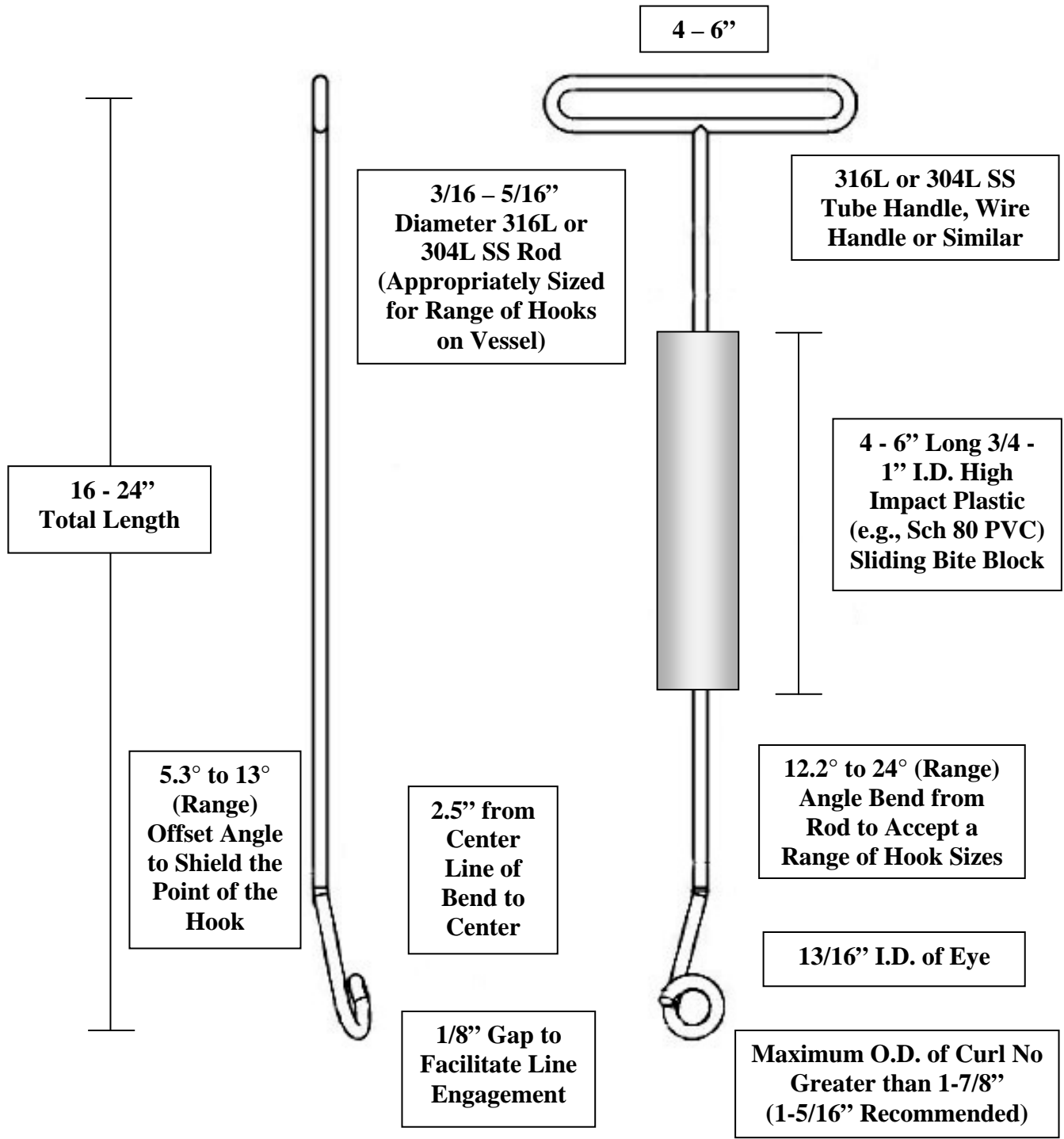
(12) Beveled Spokes ~23" (1" Round 50 Series Aluminum Bar or 6061 T6 Schedule 40 Pipe) Set at ~25°. Welded Using Appropriate Welding Wire (5052, 6061 or 3003).

8 mm, 6.5" Stretch Knotless 600 Ply Polyethylene Netting (e.g., Ultra Cross Netting by NET Systems, Inc.)

Bottom Ring 4' Diameter (1 1/2" Round 50 Series Aluminum Bar)

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**Plate 15 BITE-BLOCK PIGTAIL (ARC) DEHOOKER**

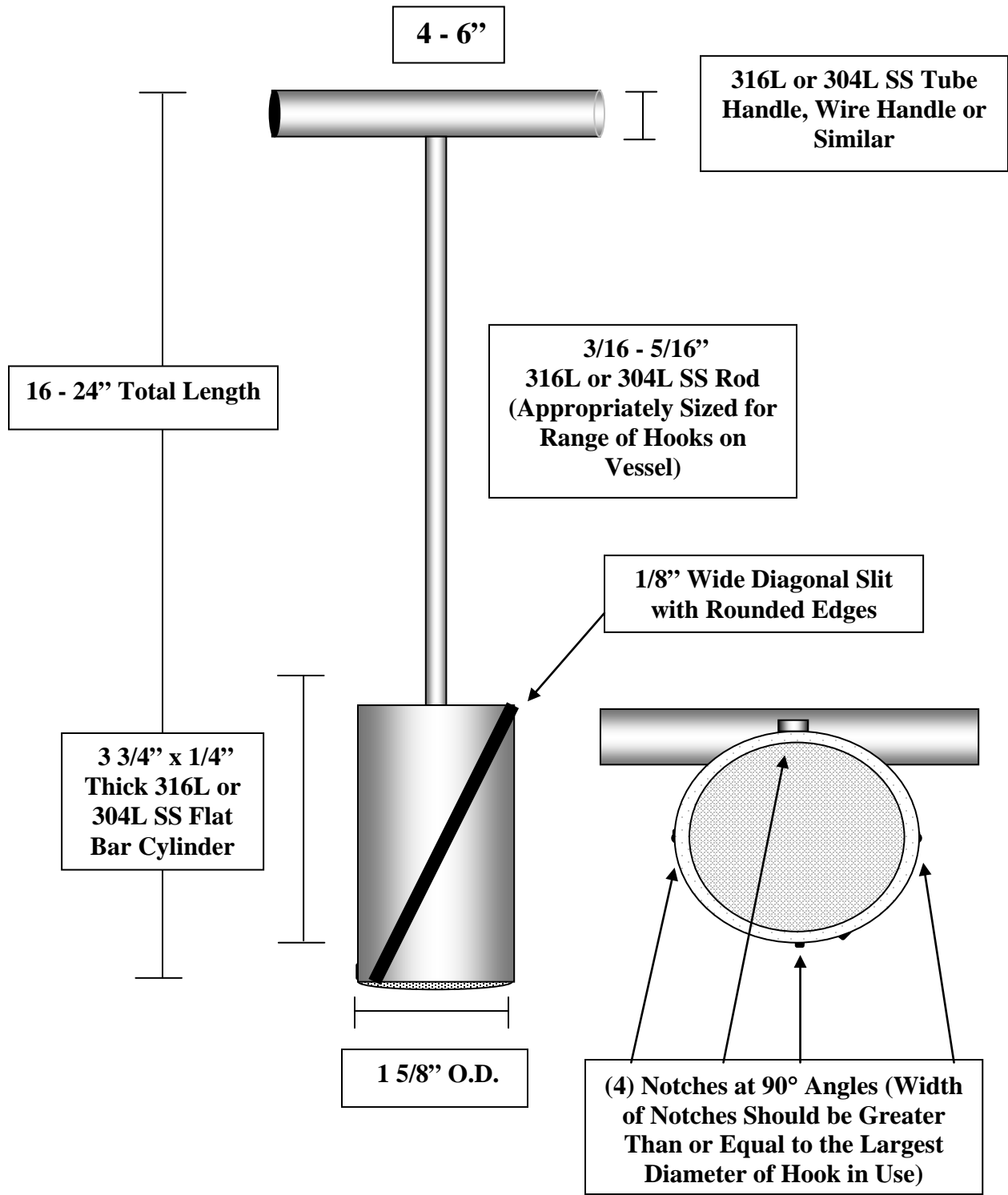


Modified Version of Diagram Provided by ARC; U.S. Patent # 4,914,853 and 6,840,002; U.S. Design Patent # 382,628; International Patent # WO/2005/055712

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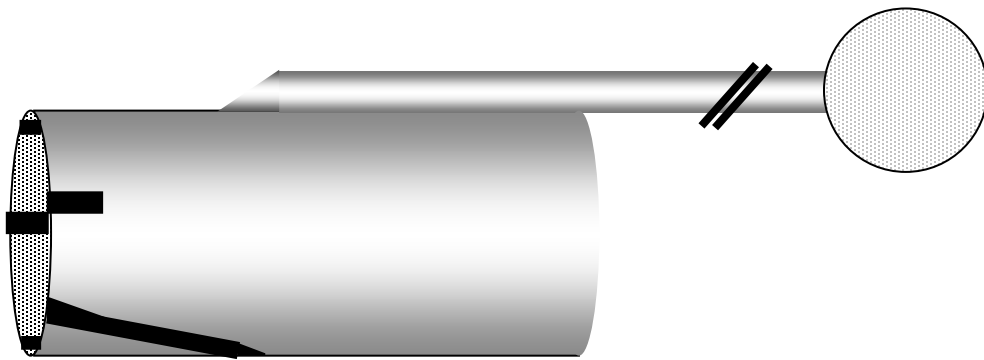
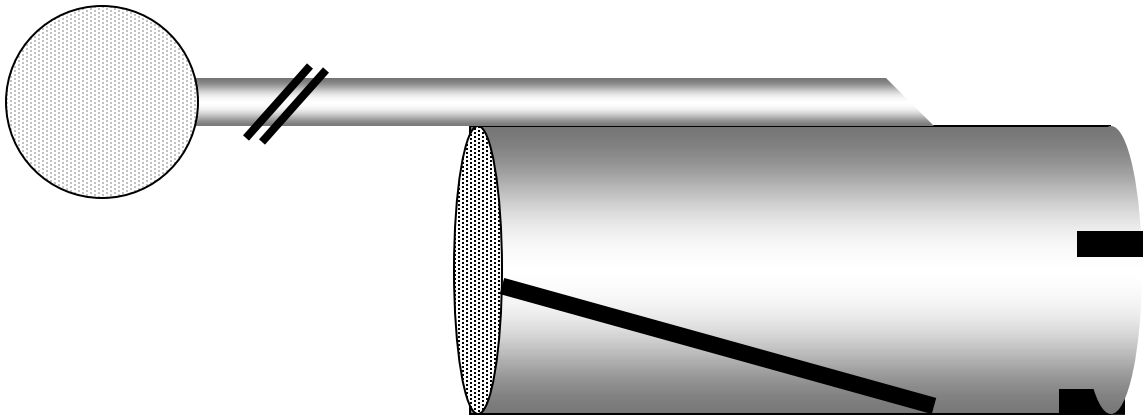
# Plate 16 SHORT-HANDLED CYLINDER DEHOOKER



All Edges Must be Rounded So That They Are Not Sharp

**Plate 16 Continued**

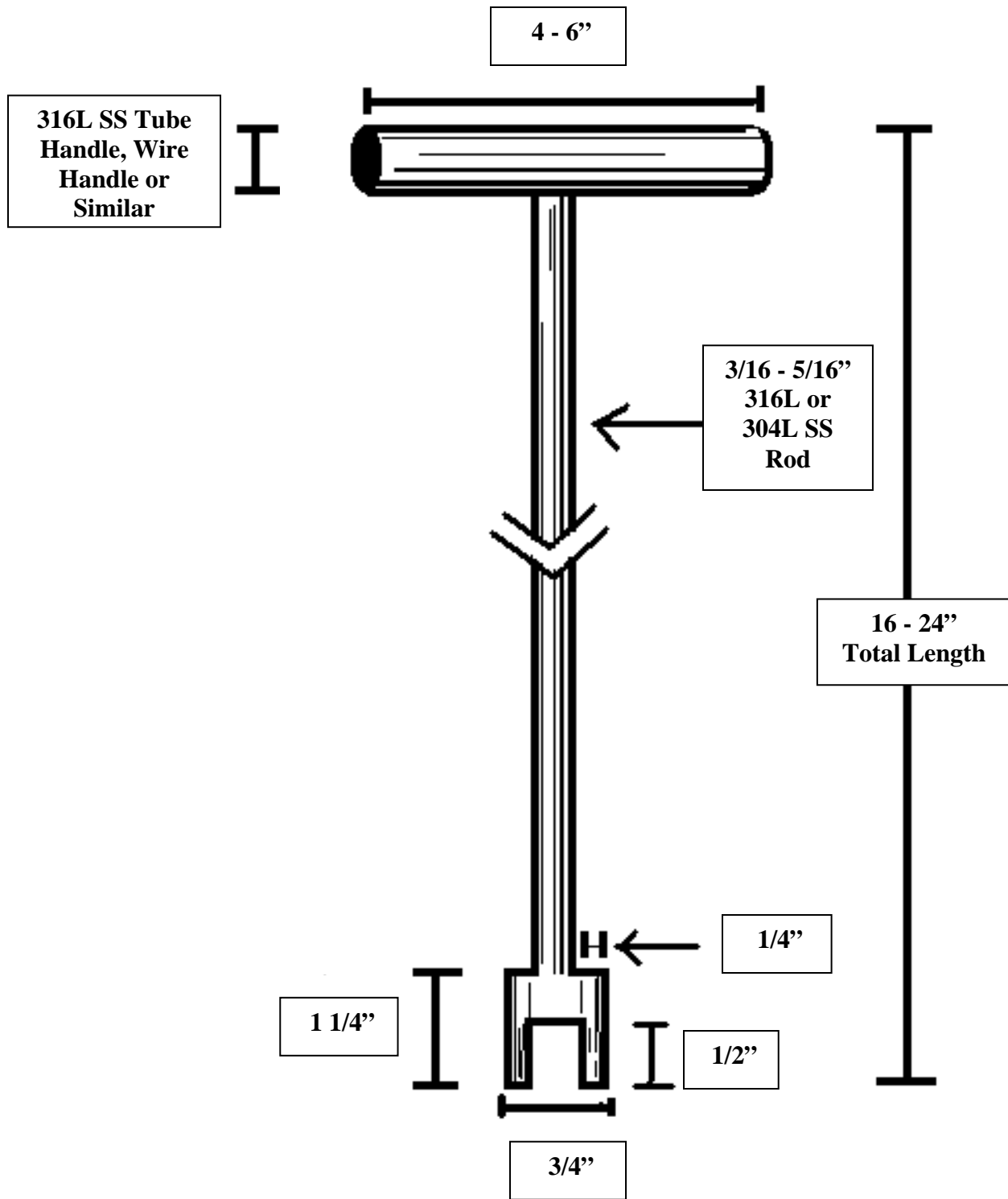
**Side Views**



**All Edges Must Be Rounded So That They Are Not Sharp**

**Plate 17**

**SCOTTY'S DEHOOKER**



Modified Version of Diagram Provided by ARC

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