

## NAVAL SHIPS' TECHNICAL MANUAL

# CHAPTER 582

# MOORING AND TOWING

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## **PART 2 — TOWING**

### **SECTION 9.**

#### **GENERAL TOWING INFORMATION**

##### **582-9.1 PLANNED VERSUS UNPLANNED OR EMERGENCY TOWS**

582-9.1.1 DEFINITION. Navy towing missions fall into one of two categories, planned or unplanned tows. Planned tows are scheduled in advance and they normally involve deactivated ships, or ships undergoing scheduled repairs. Unplanned tows normally occur in an emergency situation where a ship runs aground or loses propulsion/steering control. Towing of targets falls into planned tows.

582-9.1.2 NAVSEA RESPONSIBILITY FOR PLANNED TOWING. The Director of Ocean Engineering (OOC) of the Naval Sea Systems Command (NAVSEA) is responsible for planned towing. An example of a planned towing procedure can be found in NAVSEAINST 4740.9, Towing of Unmanned Defueled Nuclear Powered Submarines.

582-9.1.3 NAVSEA RESPONSIBILITY FOR EMERGENCY TOWING. The Deck and Underway Replenishment Systems Division (SEA 05P8) of the Naval Sea Systems Command (NAVSEA) and the Ship and Aircraft/Vehicle Handling Systems Engineering Section (SSES 9732) of the Naval Surface Warfare Center, Carderock Division provide the technical authority for emergency ship-to-ship towing.

##### **582-9.2 TOWING SYSTEMS**

582-9.2.1 EMERGENCY SHIP-TO-SHIP TOWING. Navy ships have provisions, in an emergency, for being towed and for towing another ship, except carriers and submarines, which are only outfitted to be towed. The subject of this chapter is emergency towing. Anticipated or planned tows are discussed in detail in the U.S. Navy Towing Manual (SL 740-AA-MAN-010) and are not covered here.

582-9.2.2 TOWING EQUIPMENT. Navy combatant surface ships have a towing pad and stern chock aft and a chain stopper pad (towing pad) and bow chock forward. Sometimes, because of equipment interference, the stern chock and towing pad at the stern are located on the quarter. In addition to these deck fittings, Navy surface ships carry a towing hawser, chafing chain, pelican hook, shackles and other appendages needed for emergency towing operations. Towing hawsers are designed to absorb energy during the tow by stretch in the synthetic hawsers or by vertical movement in the heavier wire rope hawsers.

##### **582-9.3 TOWING CAPABILITIES OF INDIVIDUAL SHIPS**

582-9.3.1 GENERAL INFORMATION. The requirement for towing disabled ships by other ships in an emergency is referred to as tow-and-be-towed or emergency ship-to-ship towing. The General Specifications for Ships of the United States Navy has provisions in section 582 for providing arrangements for being towed and for towing another ship. The specifications require that the arrangements be in accordance with applicable NAVSEA standard drawings. This requirement means that the ship is capable of towing another ship in an emergency, with each ship carrying half the tow line.

**582-9.3.2 NAVY TUGS AND SALVAGE SHIPS WITH A TOWING CAPABILITY.** The Navy has ocean tugs, which are capable of long-range tows and other missions. They are the ARS 50 Class of salvage ships, and the T-ATF 166 Class of fleet tugs. All are equipped with automatic towing machines/winches except for the T-ATF 166-168, which use a SMATCO Type 1 towing winch. For more information on the capabilities of these Navy ocean tugs, consult the U.S. Navy Towing Manual (SL 740-AA-MAN-010).

**582-9.3.3 SUBMARINE TOWING EQUIPMENT.** Submarines generally do not carry a towing hawser and associated gear. The towing ship shall provide this equipment. Submarines are built with the necessary towing pads, cleats and chocks for being towed. When not in use, the cleats and chocks are arranged to retract and house inside the faired lines of the hull. There are two basic types of emergency towing systems used in past US submarines. The bridle towing system, used on SSN 688 and SSN 637 submarines, is made up of a set of towing lines that are manually attached to two cleats located aft of the bow dome. An alternate system, the SSN 21 and SSN 774 towing pendant system, is operated remotely from the top of the sail via a line buried under the hull coating to the tow point.

**582-9.3.4 AIRCRAFT CARRIER TOWING EQUIPMENT.** Aircraft carriers are only equipped to be towed. They do not have a padeye or other towing equipment located aft for towing another ship. Carriers are equipped with 2 1/2-inch diameter 6 x 37 galvanized wire rope towing hawsers, 900 feet long. Some carriers are equipped with two 900-foot towing hawsers, while some have only one towing hawser. The towing hawsers are stored in the anchor handling compartment on a horizontal storage reel.

#### **582-9.4 TOWING INFORMATION ONBOARD NAVY SHIPS AND SUBMARINES**

Each ship in the Navy is provided with a towing drawing that shows how to rig the ship for being towed or for towing another ship. This drawing also shows such details as the size of the towing hawser, chafing chain and other appendages. For surface ships and some submarines, the Ship's Information Book (SIB) has details on the towing gear and also contains diagrams that illustrate how to rig for being towed or for towing another ship. For the later classes of submarines, the Ship System Manual (SSM) can be consulted for towing details. The SIB, SSM and towing drawing(s) should be consulted for the required towing gear and hookup for a particular ship. Figure 582-9-1 shows how to rig ships for emergency towing. It is provided to be used in the absence of ship's drawings and instructions. Figure 582-9-2 shows the towing hawser arrangement to be used for an emergency tow.

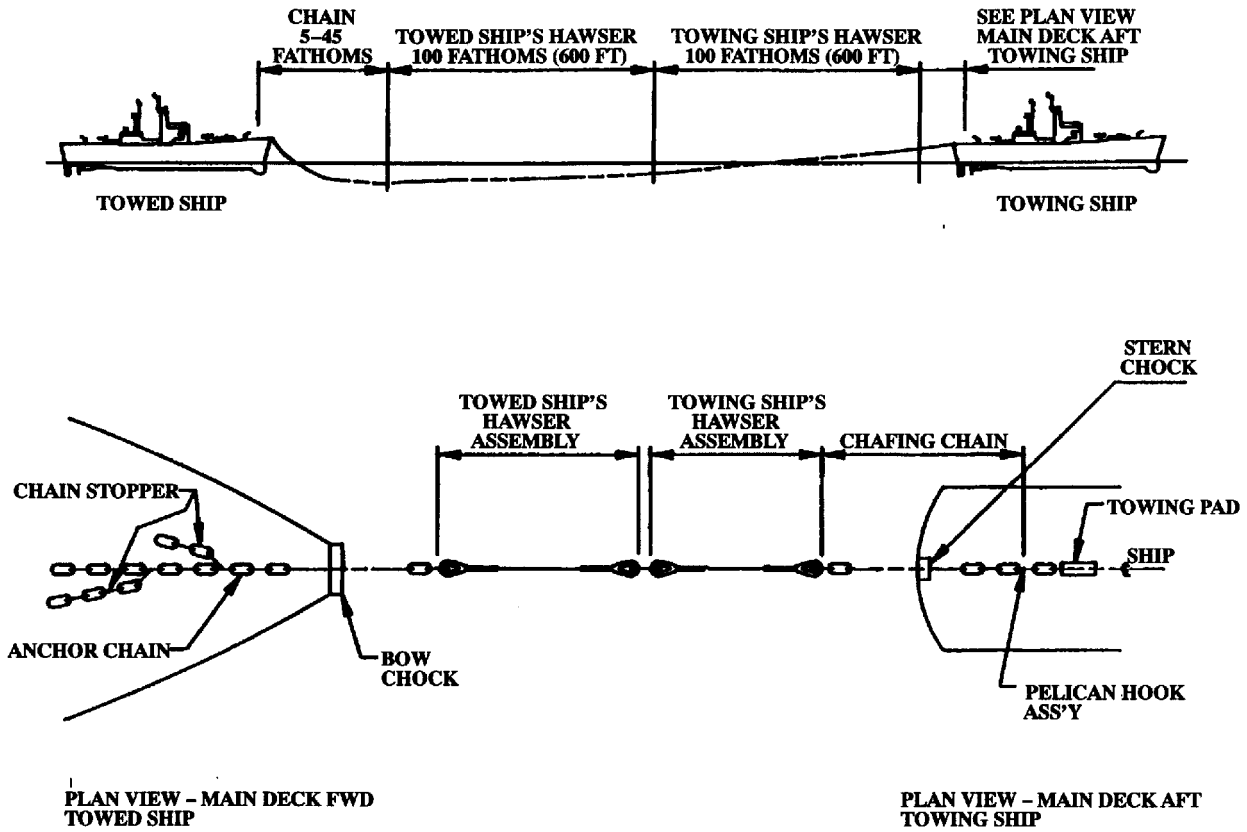
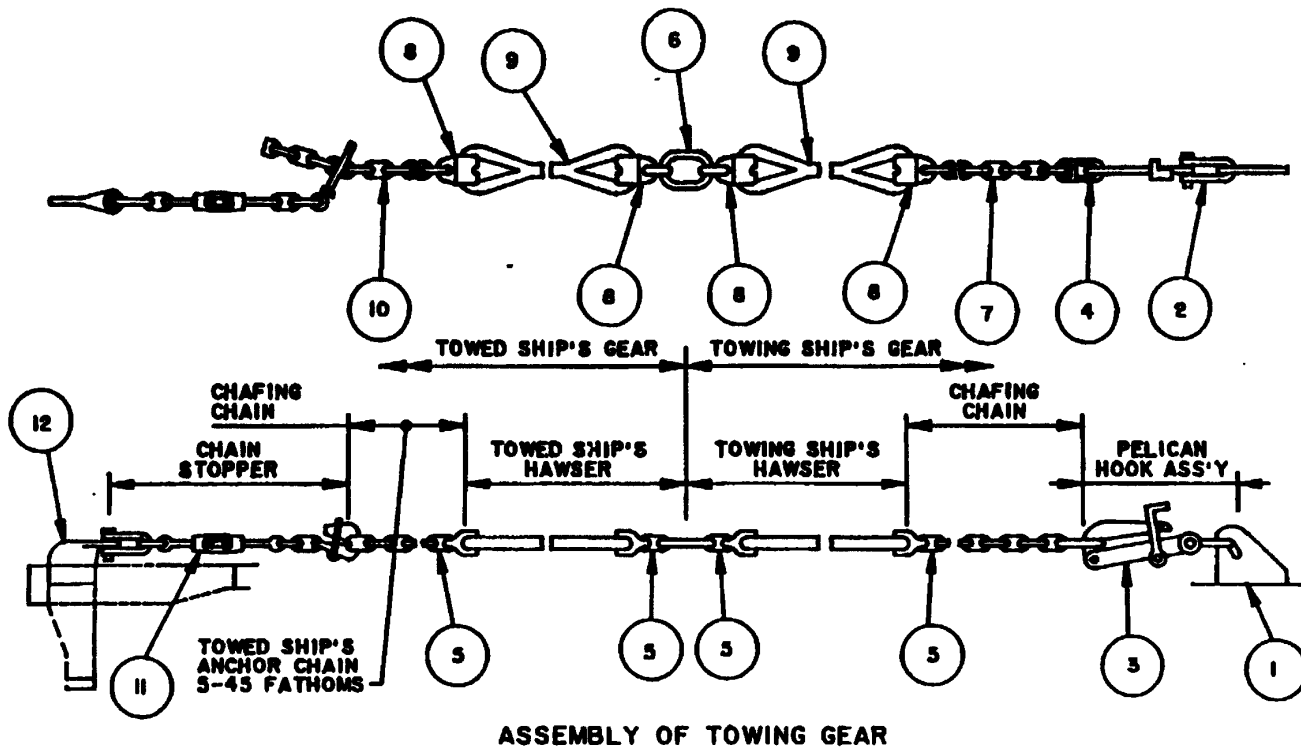


Figure 582-9-1 Emergency Towing Arrangement.



**ASSEMBLY OF TOWING GEAR**

PIECE	DESCRIPTION	PIECE	DESCRIPTION
1	TOWING PAD	7	CHAIN
2	SHACKLE	8	TOWING THIMBLE
3	PELICAN HOOK	9	TOWING HAWSER
4	END LINK	10	ANCHOR CHAIN
5	DETACHABLE LINK	11	CHAIN STOPPER
6	NATO LINK	12	CHAIN STOPPER DECK PADEYE

Figure 582-9-2 Towing Hawser Arrangement.

**NOTE**

Figure 582-9-1 and Figure 582-9-2 do not show the size and exact type of emergency towing gear used for the various ship classes. If the ship's towing drawings are not available for this information, consult NAVSEA standard Dwg. No. 803-4759441, which show emergency towing gear assemblies using the Navy standard towing thimble for use with 5-inch through 14-inch circumference synthetic rope towing hawsers. The actual configuration may be different from the type drawing if the thimble and link or rope connector fittings are used.

**SECTION 10.**  
**DESCRIPTION OF TOWING EQUIPMENT**

**582-10.1 TOWING COMPONENTS**

The following paragraphs provide a brief description and discussion about the equipment used for towing. Towing systems are comprised of three primary components; the towline or hawser; fittings; and machinery.

**582-10.1.1 TOWING HAWSER.** The towing hawser is the primary load-carrying element of the towline. It is usually made from galvanized wire rope or synthetic fiber rope such as nylon or polyester. Twelve strand, plaited or double-braided polyester, in accordance with MIL-R-24750, MIL-R-24730 or MIL-R-24677, listed here in order of preference, are currently the recommended types of rope to be used for new construction ships equipped with synthetic fiber rope towing hawsers. The synthetic fiber rope hawsers are usually 100 fathoms (600' feet) long with eye splices at each end. The final length of new, assembled towing hawsers, bearing point to bearing point (relaxed), is dependent on the length ordered minus the lengths required for the eye splices on each end. The wire rope towing hawsers found on aircraft carriers are 150 fathoms (900 feet) long and are made from 6 x 37 galvanized wire rope cable with eye splices and solid thimbles at each end. There are various types of end fittings. The types that are normally used as part of the synthetic fiber rope towing hawser are discussed below. Observing the catenary is the most practical way to determine when the tension in a synthetic hawser is approaching the danger point. Optionally, a tattletale may be used. Refer to 582-5.3.1 for a description of how to rig a tattletale.

**582-10.1.2 END FITTINGS FOR TOWING HAWSERS.** Synthetic lines are all terminated with hand spliced eyes and a variety of end fittings are used on them to protect the line from chafing. The recommended end fittings for towing hawsers made of synthetic rope (nylon and polyester) given here in order of preference are:

- a. Towing Thimble (NAVSEA Dwg. No. 803-6397321) shown in figure [582-10-3](#).
- b. Rope Connector is shown in figure [582-10-2](#) (commercially available). Commercially referred to as a Nylite Spool, Shield and Shackle. Also referred to as a Towing Connector (NAVSEA Dwg. No. 803-6397406)
- c. Thimble and link (NAVSEA sketch No. 56W41-14A with manufacturing requirements) is shown in figure [582-10-4](#).
- d. Rope Coupling (NAVSEA Dwg. No. 803-5000916) is shown in figure [582-10-1](#). Rope couplings are fitted in the eye splices at each end for attaching the hawser to the towed ship's towing hawser or anchor chain at one end and the chafing chain of the towing ship at the other end.

The manufacturing requirements for the thimble and link assembly are shown on NAVSEA sketch No. 56W41-14A. Newco thimbles (figure [582-10-5](#)) should be replaced with the above approved fittings at the earliest availability. Boston thimbles are similar to towing thimbles (figure [582-10-3](#)) except they are made of aluminum bronze alloy. The Boston thimbles should also be replaced with the recommended fittings whenever convenient.

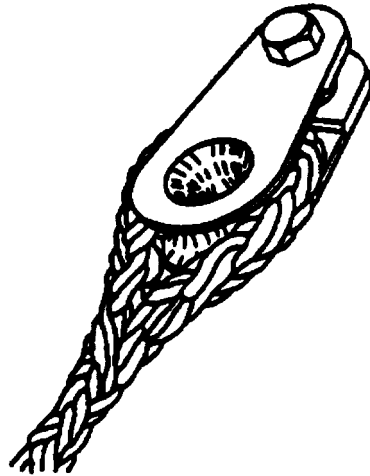


Figure 582-10-1 NAVSEA Rope Coupling.

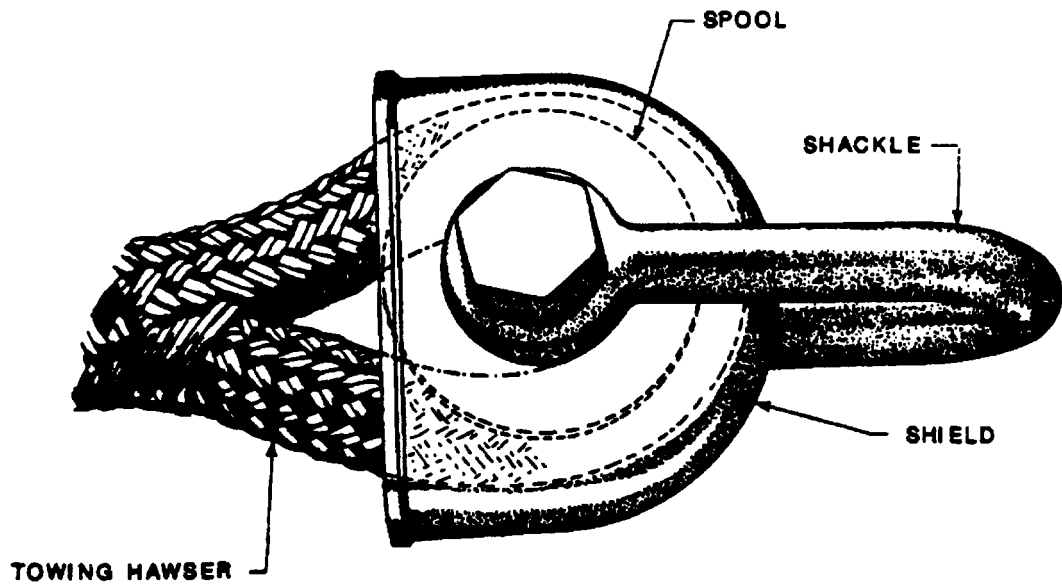


Figure 582-10-2 Rope Connector.  
(Nylite Spool, Shield and Shackle)  
Also referred to as a NAVSEA  
Towing Connector



Figure 582-10-3 NAVSEA Towing Thimble

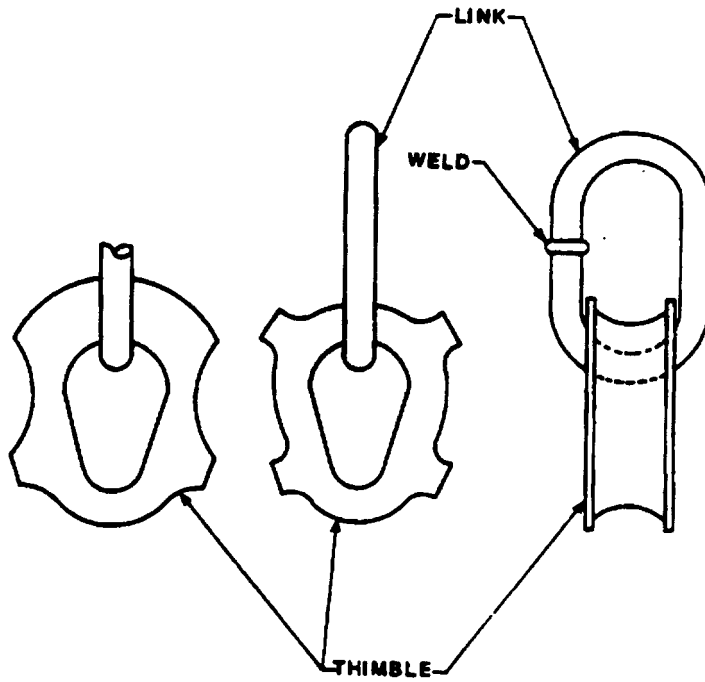


Figure 582-10-4 Thimble and Link.



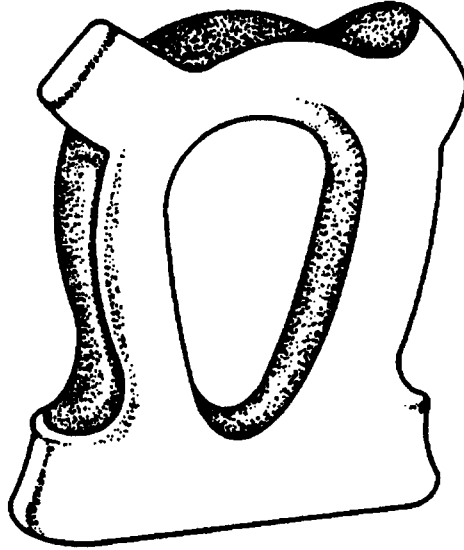


Figure 582-10-5 Newco Thimble.

**582-10.1.3 TOWING MACHINERY.** As mentioned in paragraph [582-9.3.2](#), Navy tugs and salvage ships have towing machinery. Although wire rope is somewhat easier to handle than wet manila line of equal strength, it cannot be faked out on the deck when hauled in. Powered winches and towing machines were a natural evolution, providing the in-haul and storage features for wire rope hawsers and eliminating the use of bits and hooks. As synthetic fiber line towing hawsers were being introduced in Navy towing, the multi-sheave traction winch was developed. In addition to providing a hard point for attachment, the winch has payout and heave-in features for adjusting the towline scope. Because reel-type storage is not practical for synthetic line, the hawser is fairled into a stowage bin located below decks as it comes off the traction winch.

The principle functions of towing machines are:

- a. Acts as a hard point or attachment point for securing the towline to the tug.
- b. Pays out and heaves in the towline during towing operations.
- c. Transports or stows the towline as it is heaved in.
- d. Acts as a quick-release device for disconnecting a towline if necessary during an emergency.
- e. Acts as an automatic tension control device to limit or relieve peak dynamic loads in a towline system, thereby enhancing life and utility of the equipment, increasing maximum speed, and increasing safety.
- f. Monitors and displays tow hawser conditions such as tension and scope.

## **582-10.2 RECOMMENDED TOWING HAWSER MATERIAL AND CONSTRUCTION**

**582-10.2.1 GENERAL INFORMATION.** The present recommendation for towing hawser material and construction is to use 12-strand polyester rope made to MIL-R-24750, plaited polyester rope made to MIL-R-24730, or double-braided polyester rope made to MIL-R-24677. Current towing hawsers on board need not be replaced unless they are no longer usable.

**NOTE**

Towing fittings (all appendages) for mine sweepers shall be non-magnetic.

582-10.2.2 HAWSER MATERIAL. Synthetic fiber and wire ropes are used to make towing hawsers. The primary synthetic fiber ropes used by the Navy for towing hawsers are nylon and polyester. The demands of the situation determine which type of construction and fiber will be used. Tables showing comparative minimum breaking strengths for plaited and double braided nylon and polyester ropes are found in NSTM Chapter 613, Wire and Fiber Rope and Rigging.

582-10.2.2.1 Nylon rope. Nylon rope has good strength, elasticity, and resistance to weather and is available in braided and plaited construction for towing applications. Nylon loses 15 percent of its strength when wet but regains that strength after drying out.

582-10.2.2.2 Polyester rope. Polyester rope can be as strong as nylon rope depending on the type of construction, but does not have the stretch and elasticity of nylon rope. Polyester rope does not have the wet strength loss that nylon does. Polyester rope is also available in braided and plaited construction for towing applications.

582-10.2.2.3 Wire rope towing hawsers. Wire rope is also used for towing hawsers. However, for emergency towing, its use is limited mostly to aircraft carriers and older submarines. The wire rope hawsers used for emergency towing are the 6 X 37 class type, Improved Plow Steel (IPS) galvanized.

582-10.2.2.4 Spring lay rope 6 x 3 x 19. This type of rope is used in harbor towing by service craft. This type of wire rope is more flexible than wire rope, but not as strong. It is stronger than fiber rope of the same diameter. It is made of six (3 X 19) main strands laid around a fiber core. Each main strand consists of three fiber strands and three preformed steel wire strands of 19 wires each, laid alternately around a fiber center. The fiber portion provides a cushion for the wire strands and results in a rope having good flexibility and elasticity.

582-10.2.3 HAWSER CONSTRUCTION. A non-rotating rope is best suited for towing; hence the following three construction types are commonly used. Figure 582-10-6 shows the three types of rope construction used by the Navy for towing. Their construction types and characteristics are, in preferred order:

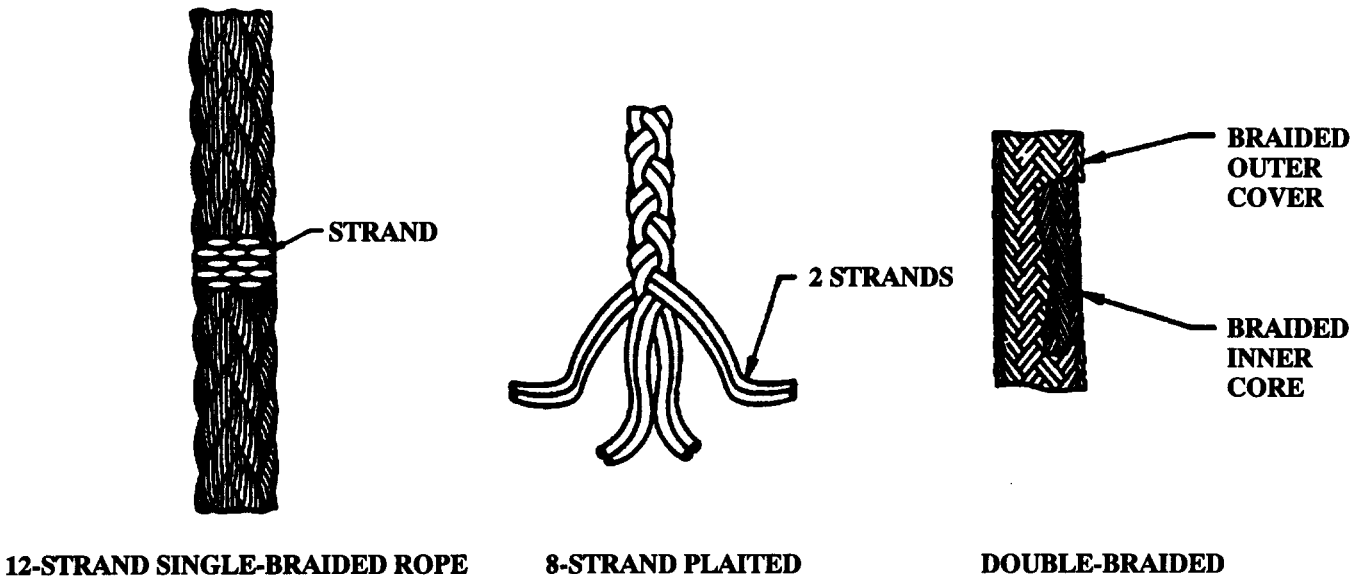


Figure 582-10-6 Rope Construction

582-10.2.3.1 Twelve strand plaited rope. Twelve strand, single braided rope provides ease in inspecting and splicing, is non-rotating, and has maximum bearing surface.

582-10.2.3.2 Eight strand plaited rope. Eight strand plaited rope provides ease in inspecting and splicing and does not rotate.

582-10.2.3.3 Double braided rope. Double braided rope is acceptable but less desirable because it is more difficult to splice. This line is non-rotational. Double braided ropes also have a firm, round cross section that provides a maximum bearing area. This results in more gripping surface and an ability to disperse heat and abrasion over a larger area to reduce wear.

#### NOTE

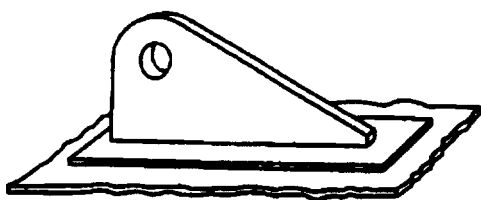
Three-strand twisted rope has high-stretch characteristics and good abrasion resistance and splicing characteristics. However, since it rotates under load, a number of instances of cockling (line kinking when the load is released, see figure 582-10-7 Cockle) during towing operations have been produced. Three stranded twisted lines are not recommended for use as towing hawsers.



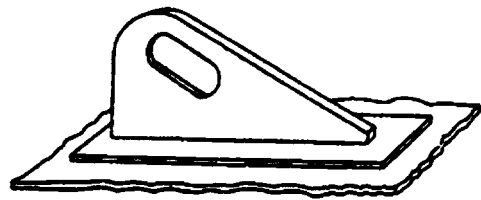
Figure 582-10-7 Cockle

### 582-10.3 TOWING HARDWARE

582-10.3.1 PADEYE. A towing padeye is securely welded to the ship's main deck structure at the stern and serves as the attachment point for the towing hawser when the ship is towing. There are three types of towing padeyes commonly found on naval combatants: two vertical types (see figure 582-10-8) and a horizontal type (see figure 582-10-9).



**SHACKLE-PIN TYPE**



**DIPPED-SHACKLE TYPE**

Figure 582-10-8 Vertical Towing Padeyes

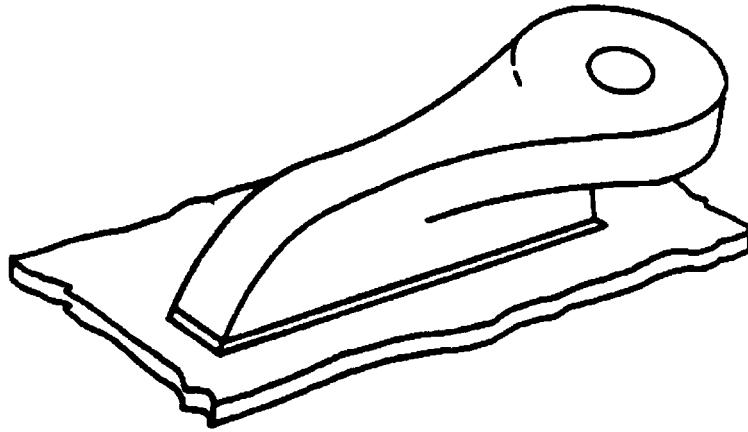


Figure 582-10-9 Horizontal Towing Padeye

582-10.3.2 CHOCK. A stern chock, usually located on the centerline, is used when towing another ship. When the ship is being towed, a bow chock sometimes called a bullnose, is used for the lead of the towing gear.

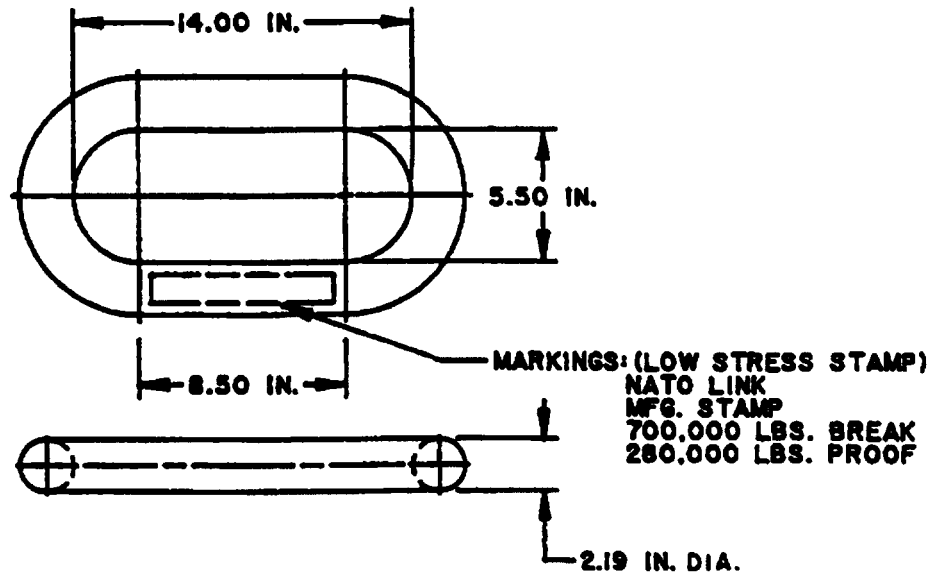
582-10.3.3 CHAFING CHAIN. A chafing chain is a length of chain lead from the towing hawser to the attachment point (padeye) on the towing ship. For a towed ship, the anchor chain serves as the chafing chain and is usually lead out through the bow chock and attached to the towing hawser. The length of chain lead out from the bow ranges from five to 45 fathoms (30 to 270 feet). Chain is used primarily to provide a catenary to the towing hawser for keeping the ships in step and to withstand chafing.

582-10.3.4 CONNECTING APPENDAGES. Connecting appendage items include shackles, detachable links, end links, as well as specially sized and arranged lengths of chain. This hardware is used to connect the various long, flexible portions of the tow line system to each other and to the tow. Figure 9-2 shows a chafing chain and some of the connecting appendages.

582-10.3.5 NATO TOWING LINK. A NATO towing link is a special link to facilitate connection of the towing rig with ships of other nations. Figure 582-10-10 shows a NATO towing link. The details of the NATO towing link are shown on NAVSEA standard Dwg No. 803-5959315. The towing ship passes its NATO link to the towed ship. The NATO towing link is available from SPCC Mechanicsburg, PA. NICN 4010-LL-HAL-6707 applies when ordering the NATO link.

### CAUTION

**The U.S. Navy NATO standard towing link has a breaking strength of 700,000 pounds. The breaking strength of the towing links provided by other member nations is their responsibility and may be of greater or lesser strength than the U.S. Navy NATO towing link.**



### NATO LINK

Figure 582-10-10 NATO Towing Link.

582-10.3.5.1 NATO Towing Link Exceptions. The minesweepers (MCM's and MHC's) do not carry NATO towing links because of their requirement to carry no ferrous material. Also, the only submarines to carry the NATO towing link are the SSN 21 and SSN 774 Classes.

582-10.3.6 CHAIN STOPPERS. Chain stoppers are used in groups of two or more to secure the ship's anchor chain. They eliminate the strain on a windlass, which would otherwise be caused by towing loads. The Navy uses the pelican hook chain stopper as shown in figure 582-10-11. The pelican hook has a strong back and bill that is passed on a link of chain and held in place with a bail and pin. Typically the pelican hook is connected to a turnbuckle by a detachable link. The pelican hook is used if the tow must be dropped in an emergency. Another detachable link connects the other end of the turnbuckle to a shackle that attaches to a padeye welded to the deck. Towing chain stoppers are the same as housing chain stoppers, except that they have modified eyebolts that accept a locking plate and cotter pin. These locking plates prevent the chain stopper turnbuckle from backing off when subjected to the shock loading of the towing hawser. No turnbuckle is used on the pelican hook aft.

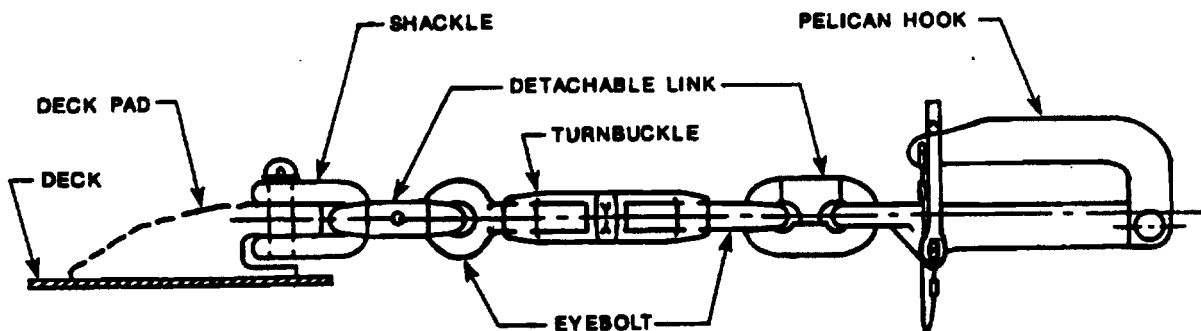


Figure 582-10-11 Pelican Hook Chain Stopper