CHAPTER 10

PONTOONS

When the United States entered World War II, our Navy was faced for the first time with the problem of landing and supplying large forces in areas where traditional harbor facilities were controlled by the enemy. Navy Lightered (N.L.) pontoons were developed in 1942 to meet this difficult situation. They were designed for erection by naval personnel and shipment aboard Navy vessels. These pontoons pro-veal to be an invaluable asset and were used extensively in operations during World War II, the Korean conflict, and again in Vietnam.

P-SERIES PONTOONS

P-series pontoons were used throughout the Republic of Vietnam in combat conditions. Although originally designed to meet the requirements of the Advanced Base Functional Component (ABFC) System, they have been used successfully in many other fields due to their inherent versatility and ease of erection. Large structures are easily and quickly disassembled then made into smaller structures, and then the smaller structures can be quickly and easily reassembled into larger structures. The light draft, structural strength, mobility, and adaptability of pontoon structures made them extremely useful for shallow water passage and tactical deployment in the Mekong Delta. They allowed movement of heavy weapons and shifting of firepower throughout otherwise remote areas. Many structures not discussed in this manual, such as armored barges, helicopter pads, mortar barges, and barracks barges, were constructed in the field for use in special situations throughout the waterways of South Vietnam.

TYPES OF P-SERIES PONTOONS

Five basic types of P-series pontoons are in use today, designated Pl, P2, P3, P4, and P5. These pontoons are specially designed, internally reinforced, welded steel cubes. They are tested to withstand an internal pressure of 20 pounds per square inch (psi). All pontoons have plain deck plates covered with a nonskid coating, and all are, fitted with a 2" plugged hole for air, drain, or siphon connections at the top and bottom of one of the end plates.

The P1 pontoon is cubicle in shape. (See fig. 10-1.) The deck of the P1 is 5'3/8" x 7', and the sides are 5'3/8" high. The side, end, deck, and bottom plating is 3/16" thick. The P1 is the most common and widely used pontoon in the P-series. Its usage is required in every structure of the pontoon system.

The P2 pontoon has the same depth (5'3/8") as the PI, but it has a 7' square deck and a straight-line sloping bow. (See fig. 10-2.) The side, end, and deck plates are 3/16" thick. The sloping bow plate is 3/8" thick. P2 pontoons are used on the bow and stern of various pontoon structures.

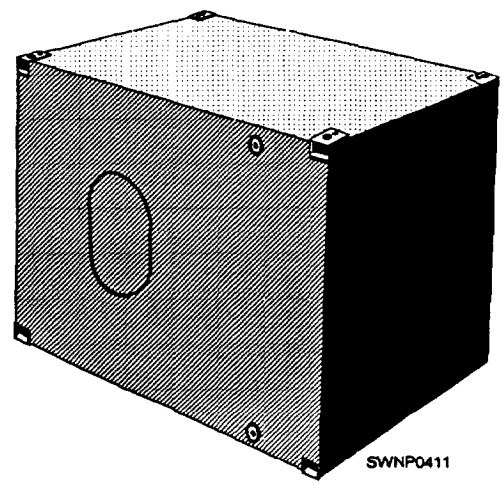


Figure 10-1.—P1 pontoon.

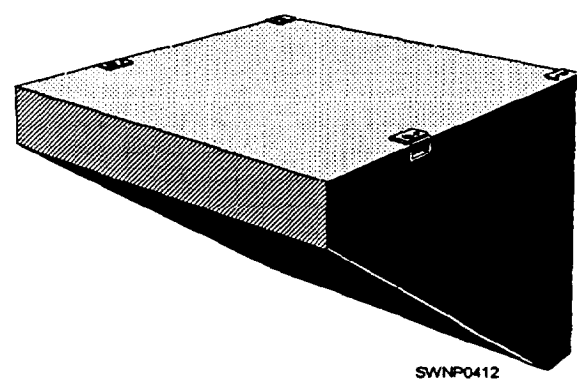


Figure 10-2.—P2 straight-line sloping bow pontoon.

The P3 pontoon has an inclined deck5'1 3/4" long and 7' wide. (See fig. 103.) The deck slopes from 4' 11 3/8"to3'8 1/4" high. The bottom is horizontal. All plating is 3/16" thick The sloping deck is fitted with five 1" square ribs 5/6" long, evenly spaced and secured by welding, with a covering of nonskid paint applied between the cleats. The P3 is used in conjunction with the P4 to form a gradually sloped ramp for causeway ends and ramp barge bows.

The P4 pontoon has a deck 5'1 3/4" long and 7' wide inclined at the same angle as that of the P3 pontoon. (See fig. 10-4.) The after end is 3'6" high; the forward end, 1'. The bottom is horizontal for 8" on the after end, then slopes upward. The deck, side, and back plates are 3/16" thick; the bottom, or bilge, plate is 3/8" thick. Five evenly spaced, 1" square ribs are welded to the sloped deck, and a coat of nonskid paint is applied between the cleats. Used in conjunction with the P3 pontoon, the P4 forms a continuous ramp for causeway ends and ramp barge bows.

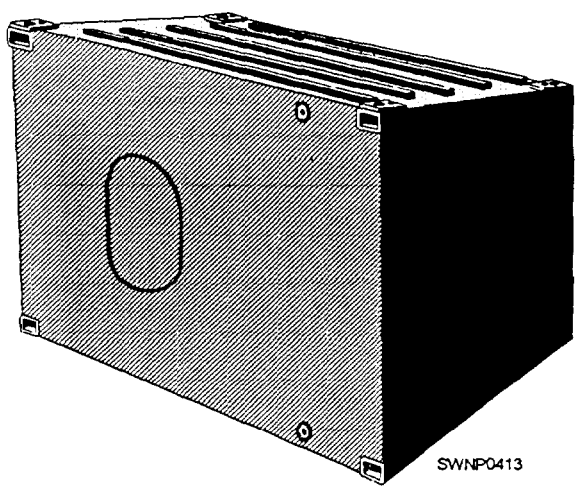


Figure 10-3.—P3 sloped deck pontoon,

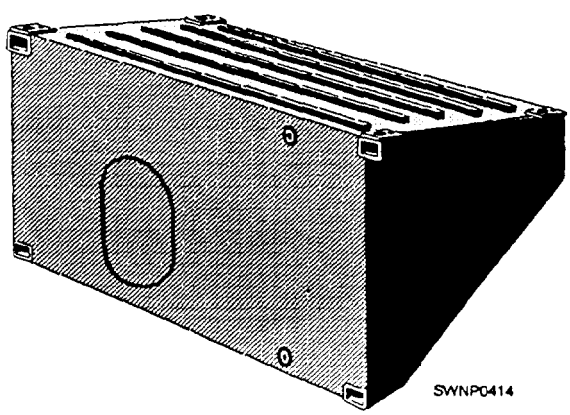


Figure 10-4.—P4 ramp-end pontoon.

P5 pontoons consist of P2 pontoons with quick-lock hinge connectors fixed to the bow. The P5M is a P5 with a male connector; the P5F is a P5 with a female connector. (See fig. 10-5.) P-series 3 x 15 pontoon causeways are connected end-to-end by alternate P5M and P5F pontoons; so are barge sections that are used as wharves where end-to-end connection is required. These pontoons are constructed by welding hinge connectors to P2 pontoons that are then assembled in male and female sequence, forming causeways of any required length. These pontoons are also used for enlarging or extending wharf structures. The center section of the P5F hinge is made from a section of extra strong pipe. When joined, these two parts resist the torsion, compression, and vertical shear forces in the joint.

Making end-to-end connections with P5M and P5F pontoons is not a difficult task (fig. 10-5). When the mating ends of two causeway or wharf sections are brought together, the male pipe connection is simply guided into the female and held in place by pad eyes and links. The resulting pipe joint then prevents vertical movement of either section. A short chain-locking device completes the connection and secures the links in the pad eyes. Each set of hinges is capable of withstanding 300,000 pounds of pull. Closure plates are welded on either side of each connection to bridge open spaces between pontoons.

A wide variety of structures-wharves, barges, causeways, and so on-can be assembled from pontoons. In the assembly of pontoon structures, the pontoons are first joined into strings and the strings are launched; the floating strings are then attached to each other. Structures of not over three strings in width can be entirely assembled on land and then launched as a unit. The number of pontoons in each string and the number of strings attached to each other depends upon the size and type of structure being assembled. The manner of assembly is similar in each case with variations depending largely on the intended use of the completed structure. The size of each pontoon structure is designed by indicating the number of strings in the assembly and the number of pontoons in each string, Thus a 3 x 15 causeway section is three strings wide and fifteen pontoons long. Pontoon gear is usuaIIy shipped with the parts required to complete a specific structure.

PONTOON ATTACHMENTS

Pontoon attachments, used in the basic assembly of pontoon structures, include assembly angles, bolts, nuts, keepers, assembly plates, and closures.

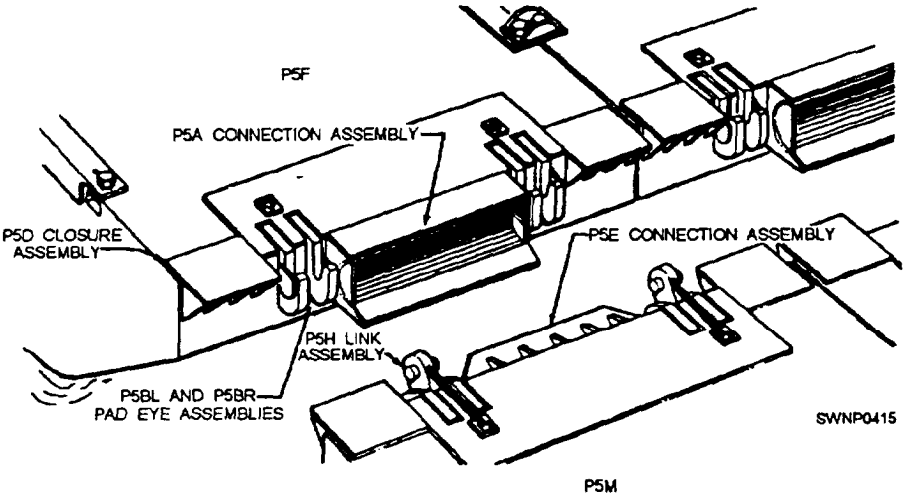


Figure 10-5.—End-to-end connections for P5M and P5F pontoons.

Structural steel ASSEMBLY ANGLES in varying lengths are used to connect the P-series pontoons into stings. Each is suitable for assembling a definite number of pontoons and designated as E-series angles. The angles are positioned to each of the four edges of a row of pontoons. Various types of assembly angles are available. Figure 10-6 shows an ES 16 assembly angle. Figure 10-7 shows assembly angles E 16L and E 26L.

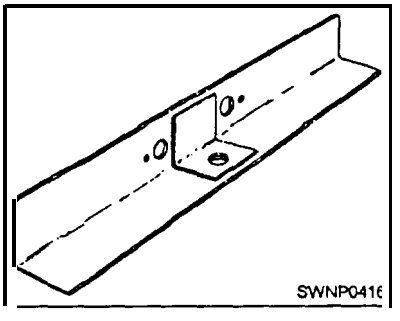


Figure 10-6.—AII E516 assembly angle.

Angles are supplied in several lengths, so strings can be made up with a minimum number of welded joints, and they are designed so these welds fall midway along the edges of each pontoon, rather than between pontoons where stress is greatest. Each angle has one or two cross-sectional sizes, 6" x 6" x 1/2" thick or 8" x 8" x 1/2" thick. Angles with 8" legs are used to replace 6 x6 's at the center of strings 18 to 24 pontoons long, and strings of 30 pontoons have 8" angles throughout to resist the extra stress that their weight imposes. Regardless of dimensions, however, each P-series angle falls into one of two types: basic or end-condition angles. Basic angles are those angles used throughout the body of a structure. Their application is not restricted to top, bottom, left, or right

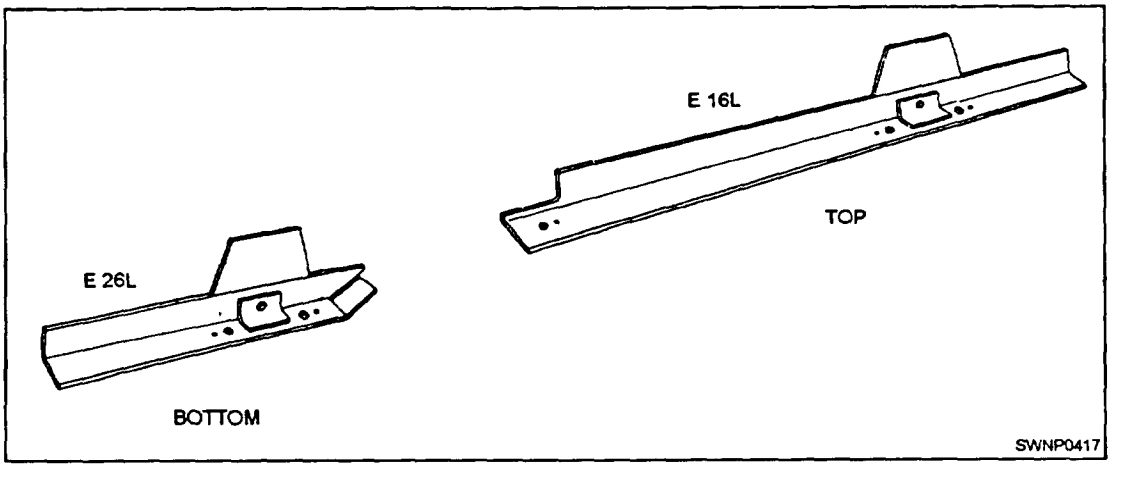


Figure 10-7.—Assembly angles E 16L and E 26L.

angles of the strings. On the other hand, end-condition angles connect P2, P3, or P4 pontoons to the ends of strings, and each is designed for a specific orientation-top or bottom and right or left. Basic angles can be shortened or lengthened to make up modified configurations, and end-condition angles can be cut and formed from basic angles to meet abnormal operating requirements.

The A6B ASSEMBLY BOLT is a 1 1/2" diameter x 3 3/8" long, hexagonal head, steel bolt (fig. 10-8). Three radial grooves on the head, spaced 120 degrees apart, are the code for grade 5 steel rated at a tensile strength of 105,000 psi. In addition to its use in securing assembly angles to pontoons ate each comer, the A6B bolt is also used to connect strings into structures, to secure deck fittings and accessories, and to pin hinges on dry dock stabilizer towers.

The forged FNl FLANGED NUT (fig. 10-9) is designed to fit into a pontoon pocket with sufficient clearance to allow positioning on the A6B assembly bolt. The flange of the nut is large enough to prevent the nut from turning in the pocket when the bolt is tightened; it is formed near the midline of the nut to clear welds in the pocket and allow positive se sting of the nut boss when the A6B bolt is tight.

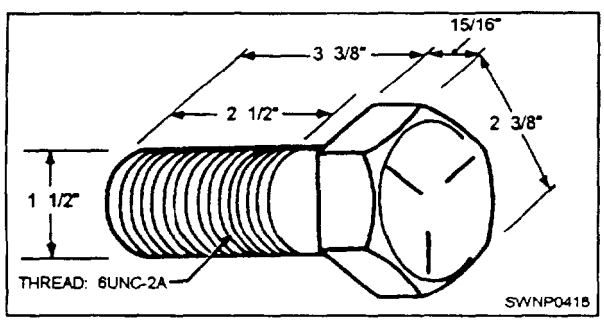


Figure 10-8.—An A6B assembly bolt.

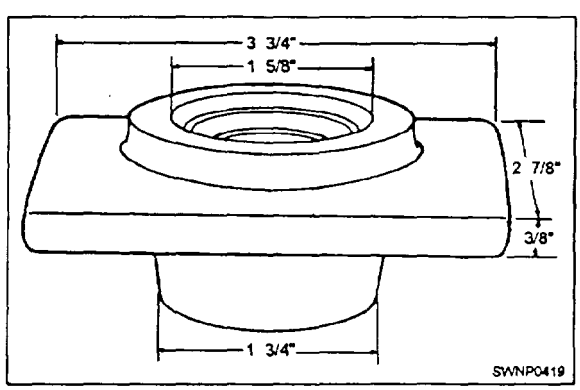


Figure 10-9.—AII FNl flanged nut.

The KPl KEEPER PLATE (fig. 10-10) is made from a plate 3 3/4" long, 2 1/8" wide, and 3/16" thick. The plate is cut out to fit over four of the hexagonal flats on the A6B bolt head. After final tightening of a bolt in a pontoon structure, the keeper plate is positioned around the bolt head and skip-welded to the underlying assembly plate or angle. This prevents the bolt from working loose during operations. To reduce maintenance problems, you should use the keeper plate on the bottom of pontoon structures where daily inspection is impractical. Keeper plates should not be welded to the bolt head.

Steel PLATES of various shapes are used in the assembly of pontoon structures mostly to reinforce those areas that are subjected to maximum stress and shear. A number of different types of assembly plates are shown in figure 10-11. Each of the plates shown is designed for a specific application, as indicated below.

APl CONNECTING PLATE: The AP1 is a steel plate with four drilled holes for A6B assembly bolts. It reinforces the A6B bolts that hold pontoon strings to each other in completed structures that use either 6" or 8" angles.

AP3 LAUNCHING ANGLE PLATE: When pontoon structures are to be side-loaded on an LST, an accessory known as an LA1 launching angle is attached. The AP3 is a steel plate that is used to attach the LA1 to the structure. The AP3 has four drilled holes for A6B bolts, and a curved plate is attached to form a semicylindrical pad. The pad serves as a fender to protect the hull of the LST on which the pontoon structure is side-loaded.

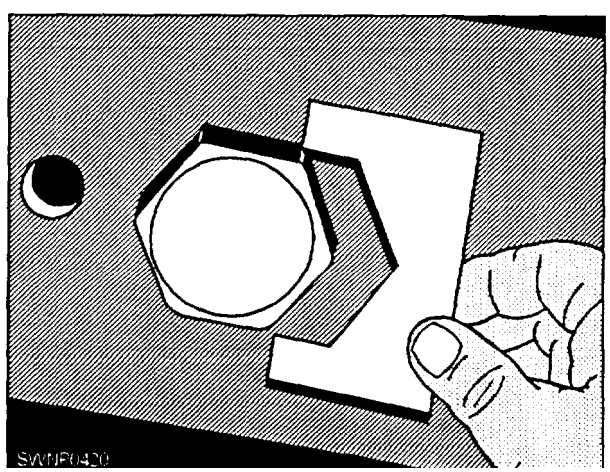


Figure 10-10.—A KPl keeper plate being installed on an A6B bolt.

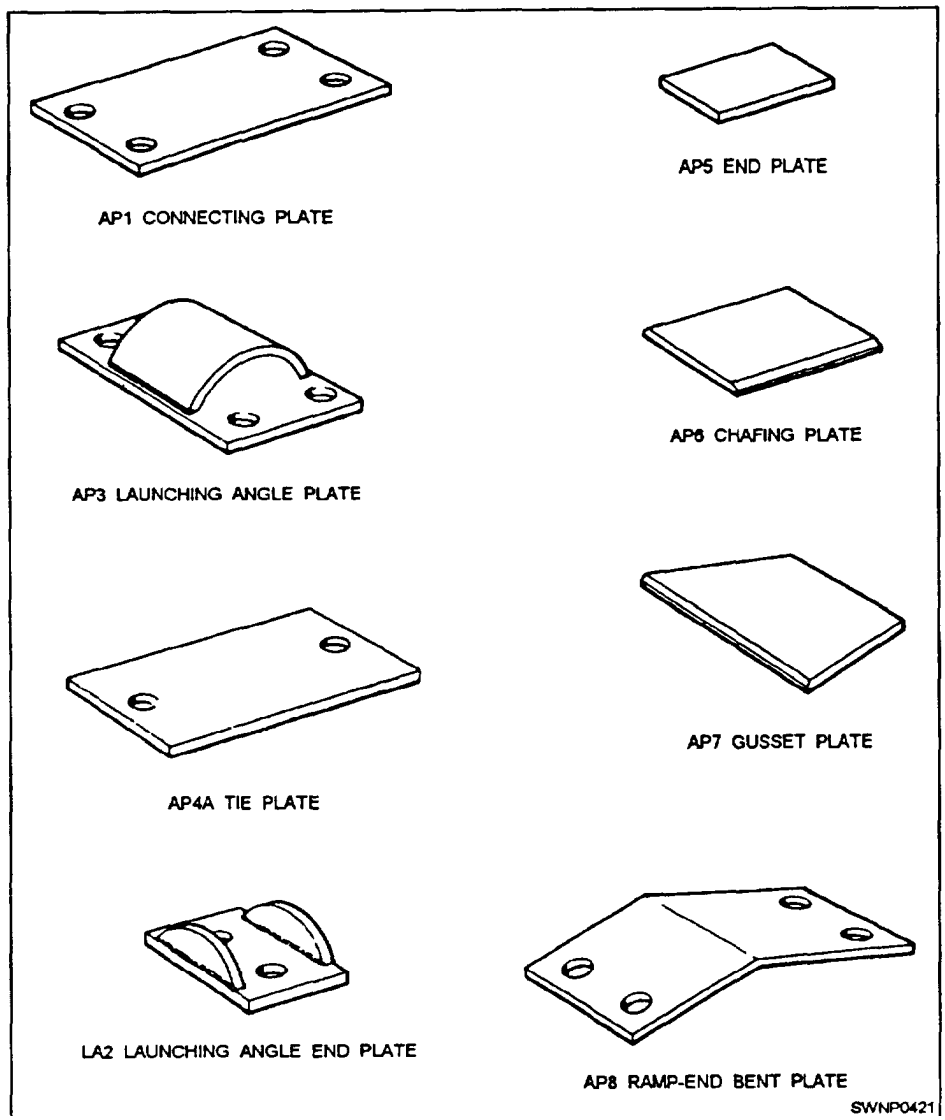


Figure 10-11.—Assembly plates.

NOTE: As of this printing LSTs are being decommissioned and it is undecided what platform will transport causeways. The information on LSTs is given because the Reserve Fleet will retain two and the next platform used could require the same hardware for loading and launching.

AP4A TIE PLATE: The AP4A is a steel plate with two drilled holes for A6B bolts. It is used for connecting pontoon strings to each other at their bow and stem ends. If necessary, an acceptable substitute for the AP4A can be obtained by cutting an API connecting plate in half across the narrower dimension; two plates are produced, both of which can be used.

LA2 LAUNCHING ANGLE END PLATE: The LA1 launching angle used when side-loading a pontoon structure on an LST is attached to the structure at the bow and stem ends with a two-hole assembly plate, just as pontoon strings are connecteed within the structure by the two-holed AP4A at the bow and stem. The two drilled holes in the LA2 are for A6B bolts. Two half-ovals are welded perpendicularly to the upper face of the plate, on either side of the bolt holes. These half+oval lugs serve as fenders to protect the hull of the LST in the same way as the pad on the AP3.

AP5 END PLATE: The AP5 is a steel plate that is welded across the gap between pontoons at the bow and stem of adjacent strings. It is used only in certain special cases where structures require extra reinforcement; for example, where end connectors are used or where the structure will be side-launched. An

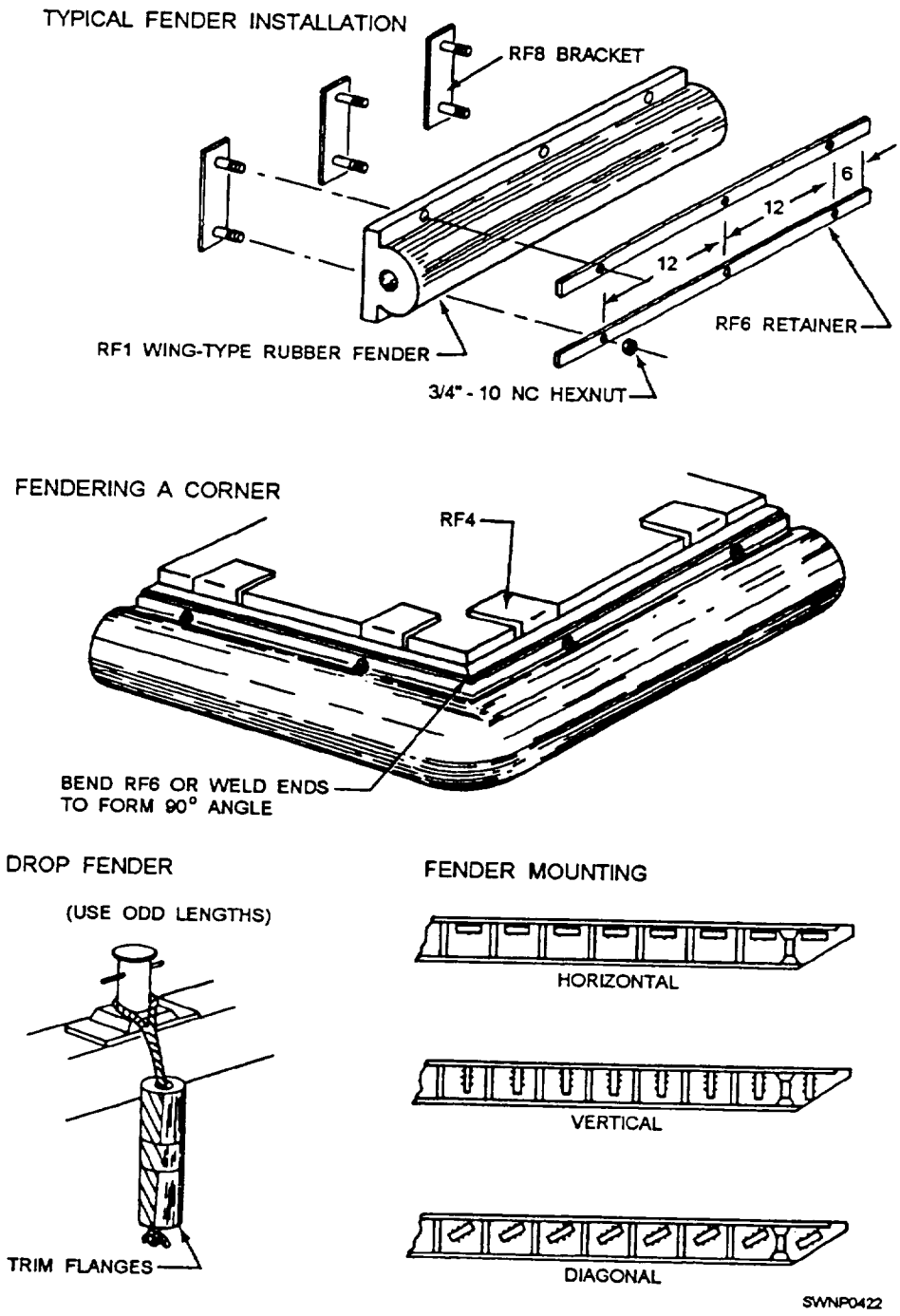


Figure 10-12.—Typical fender installations.

acceptable substitute for the AP5 can be field-fabricated, if necessary, from an API. To do so, remove the holes from the APl by cutting 3“ inside the two edges measuring 18 1/4”, and halve the resulting 18 1/4" x 5" plate to produce two 9 1/8" x 5" plates; both can be used as end plates.

AP6 CHAFING PLATE: The AP6 is a steel plate. 10” square, with two opposite edges beveled. Welded to the sides of causeway sections, the AP6 protects the causeway from damage due to sliding contact. It is frequently used between side-lapped causeway sections. Because the AP6 is a nonstock item, it should be fabricated in the field when it is required. Dimensions are not critical; halves of an APl or an AP7 plate will serve as chafing plates when properly beveled.

AP7 GUSSET PLATE: The AP7 is a steel plate cut in the form of a 9“ high trapezoid. The parallel

edges are 18" and 12" long, and the 18" edge has a 1/4" bevel. The AP7 reinforces the end-condition angles used at the fore and aft ends of larger structures. The 18“ edge is positioned against a tip or bottom assembly angle so the plate bridges the gap between the pontoons to which the angle is bolted. The 18" edge is welded to the angle, and the two vertical edges are welded to the adjacent pontoons. APl connecting plates can also be used for reinforcing, welded to end-condition angles in the same way as the AP7.

AP8 RAMP-END BENT PLATE: The AP8 is fabricated from steel plate. An 11“ x 20 1/4” rectangle is bent to form two legs, one 8 5/8” and the other 11 5/8” long; each leg has two drilled holes for A6B bolts. The AP8 is used for connecting pontoon strings at the point where each string has a P3 sloped-deck ramp pontoon connected to a P1 pontoon.

RUBBER FENDERS

Anew rubber fendering system for use on pontoon structures has replaced oak timber fenders. Rubber fendering is wing-type, extrusion-shaped, styrene butadiene composition; it is supplied in random lengths to be cut, formed, and fitted in the field for specific structures and operating conditions. For each structure, the fenders, brackets, retainers, and fasteners are furnished in the quantities required. The new fenders absorb enough impact, upon contact with the dock or other structure, to transfer shock from dynamic to static load, thereby protecting both of the impacting structures.

To install rubber fenders, lay out fendering on the deck over the position to be installed. Cut it to the required length, bolt on the retainers and the brackets, and ease it into position, using lines attached. Tack-weld the brackets in place temporarily, remove the lines, and when the entire fender is properly positioned, weld all the brackets as shown on the drawings. Damaged portions can be cut out and repaired with a rubber portion of the same length. Use odd pieces for drop fenders or bumpers. Use a fine-tooth oil-lubricated saw, manually operated or power-operated, for cutting wood or steel bits for drilling holes. Various fendering arrangements and details are shown in figure 10-12. These are subject to change to meet local fendering needs.

H6 HATCH COVER AND FLOOR PANEL ASSEMBLY

Various pontoon structures require a stowage space for tools, chaining, fittings, and miscellaneous gear when not in use. The H6 hatch cover and floor panel assembly (fig. 10- 13) was designed to be installed on any designated pontoon structure and consists of a mounting frame, grating panels, hanger rings, and a 21” diameter, quick-acting, waterproof, flush-mounting, shipboard type of scuttle, together with the parts required to convert a P1 pontoon into a stowage compartment. Making the necessary cutout in the pontoon deck and installing the hatch cover and the other components are done in the field When installed, the hatch cover is a string as the pontoon deck. However, on structures normally traversed by heavy loads, such as causeways and ramp barges, it is advisable to locate the hatch cover away from the regular line of travel-preferably to one side and as far forward or aft as possible—to protect the watertight sealing gasket under the hatch rim.

DECK CLOSURES

Deck closures are used to bridge the openings, or slots, between pontoons while meeting the

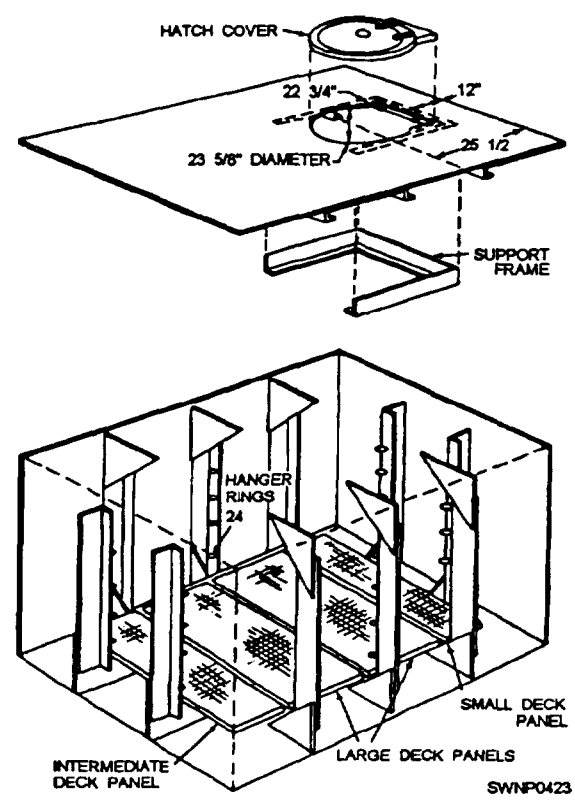


Figure 10-13.—H6 hatch cover and floor panel assembly.

requirements for fitting around plates and lift pads. They also can be configured to provide access to assembly angles between structures for wrapping chains and wire rope during causeway beaching and LST side-carry operations. Formerly, five types of closures were needed to perform the necessary functions. These were identified as DC1 through DC5. The DC6 deck closure (fig. 10-14), with certain field alterations, was designed to fulfill all closure requirements and will replace the five closures entirely when stocks of these have been depleted.

The H22 and H23 closure plates are used for joining pontoons and for making bridge-to-wharf or barge-to-wharf connections. The H17AF and H17AM heavy-duty hinges are used to close the deck openings formed by the hinges between the pontoon sections. The closures (fig. 10-15), which are 20" wide and 24 1/4" long, are made from 1/2" steel plate and are used in combinations to fit over and enclose the heavy-duty hinges. Nonskid coating is applied on the top of the closures to prevent slippage. The H22 and H23 closures are not included in the heavy-duty hinge set. They are to be fabricated in the field as required.

BITTS AND CLEATS

Bitts and cleats are steel posts, or arms, to which lines are secured. Structures to be side-carried should have bitts and cleats, as well as all other deck fittings, bolted down on the launching angle side. A typical cleat is shown in figure 10-16. The B1 all-purpose bitt (fig. 10-17) consists of a single 4" diameter post that is 13" long with a 6" diameter cap welded to a base that has two drilled holes for A6B assembly bolts. A 1 1/2" diameter crossarm, 16 1/2" long, runs through the post approximately 10" above the deck. The B1 can be used on all structures requiring a single bitt and can be welded to the deck angles opposite the launching angle side.

The B4 bitt (fig. 10-18) is the same as the B1 bitt except for the base that has been designed for quick positioning in the CP1 chain plate.

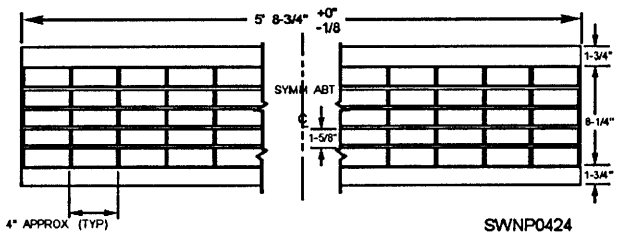


Figure 10-14.—DC6 deck closure.

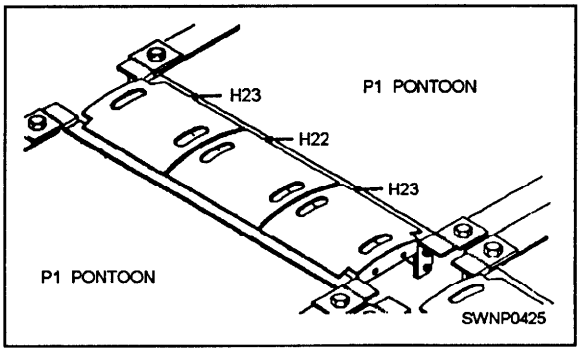


Figure 10-15.—Closure plates H22 and H23.

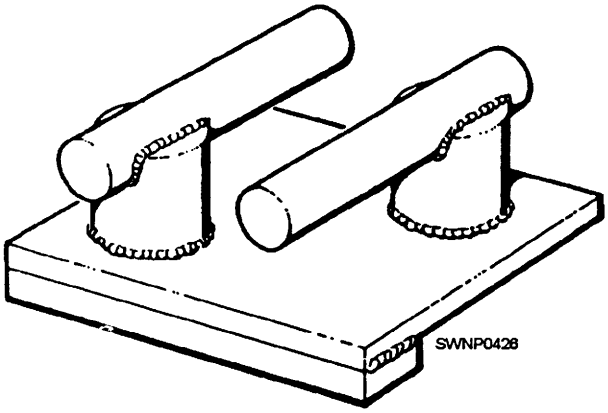


Figure 10-16.—Cleat.

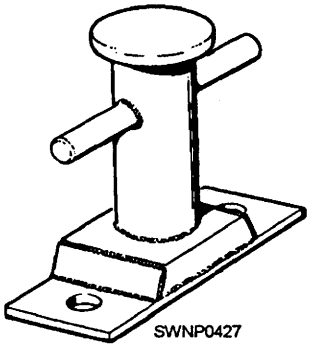


Figure 10-17.—B1 all-purpose bitt.

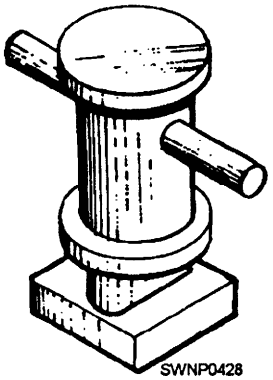


Figure 10-18.—B4 retractile bitt.

The M147 double bitt (fig. 10-19) consists of two 8" steel pipe posts, 20" long, welded to a 13" x 40" base and capped on the upper ends.

PROPULSION UNITS

Self-propelled pontoon barges and tugs are powered by outboard propulsion units. These units have been specially designed for this purpose and readily installed on tugs or barges of any size. The propulsion unit shown in figure 10-20 is essentially a heavy-duty outboard motor, consisting of a propulsion mechanism and a marine diesel engine mounted on a heavy structural base. Propulsion power is carried from the engine through a right-angle housing and a vertical-drive housing to the propeller. Steering is affected by shifting the propulsion-force direction; the propeller can be turned around a vertical axis in either direction through a complete circle. Each unit has a steering wheel and an indicator that show direction of travel. The tail section, with the propeller, is mounted on the vertical housing assembly that can be elevated outward and backward to raise it out of the water for inspection or repairs. As new equipment and techniques for amphibious operations developed, performance requirements for all components increased accordingly. As a result, propulsion units have increased in power and thrust capability.

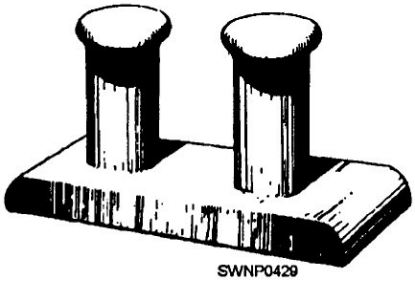


Figure 10-19.—M147 double bitt.

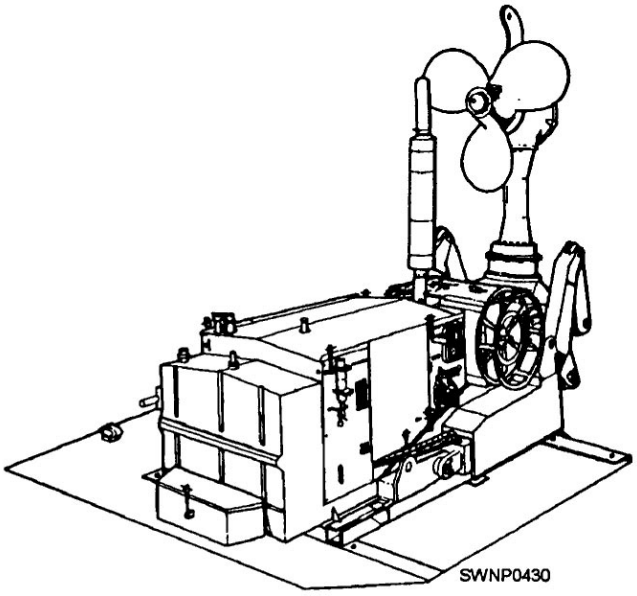


Figure 10-20.—Model L-295 diesel outboard propulsion unit.

PONTOON STRING ASSEMBLY

After the first two assembly angles have been placed on the ways, the pontoons are placed in the angles (figs. 10-21 and 10-22). The pontoons are positioned on their sides with all deck surfaces on the same side. The first pontoon will ordinarily be placed in the center of the angles with the assembly bolt holes aligned; placement of the remaining pontoons from the center toward each end can be accomplished without difficulty.

Bolting Lower Angles

As each pontoon is placed in the assembly angles, the A6B assembly bolt holes in the pontoon nut receptacles are aligned with those in the angles, using spud wrenches or driftpins as necessary. The A6B bolts are then inserted through the assembly angles

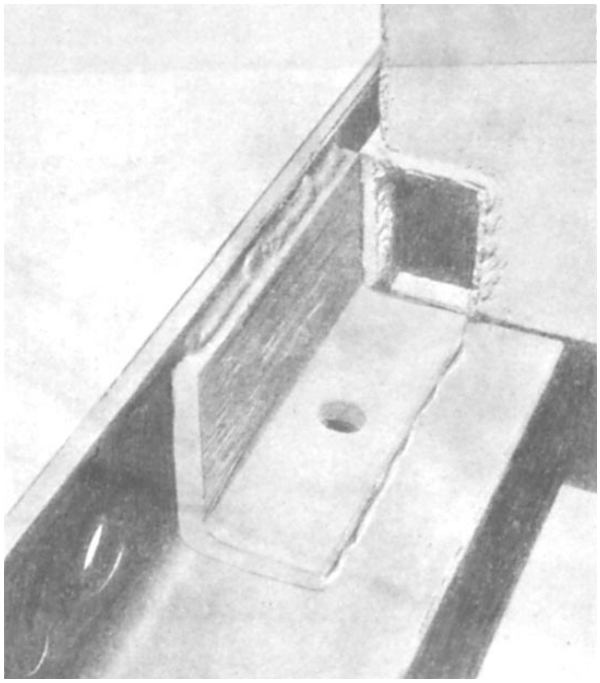


Figure 10-21.—Pontoon positioned on assembly angle.

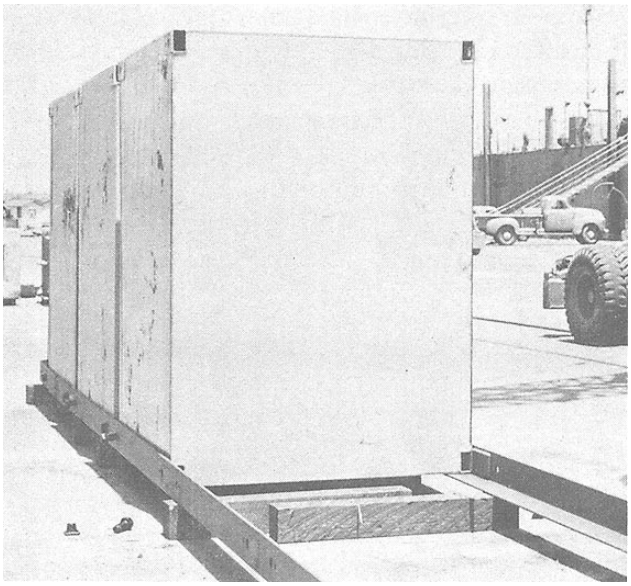


Figure 10-22.—P1 pontoons on assembly angles

and started by hand to thread the FN1 nut (fig. 10-23). The bolts should be snugly tightened, then backed off about one turn.

Positioning Upper Angles

The second pair of assembly angles is placed on the top of the pontoons and positioned and bolted in the same manner as the bottom pair of angles. Spreader jacks, come-alongs, or heavy-duty pinch bars can be used to align holes for the top angles.

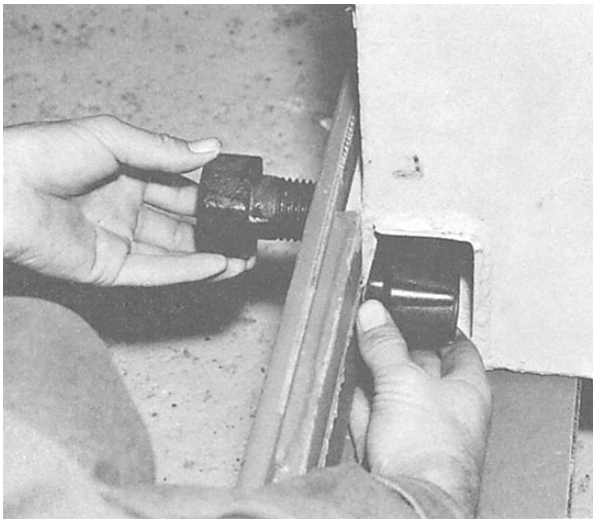


Figure 10-23.—Positioning of A6B bolt and FN1 nut to connect pontoon to assembly angle.

Tightening Bolts

After all of the A6B assembly bolts have been installed, final tightening is accomplished with an impact wrench or 48" ratchet wrench in those locations where accessories or assembly plates are not bolted to the structure.

NOTE: The proper setting of A6B bolts requires tightening to a 2,400-foot-pound torque. (The applicable rule is to draw the bolt or nut up tight and then add another half turn.)

FINAL ASSEMBLY OF STRING

CP1 chain plates, LA1 launching angles, or other accessories that attach to the outer edge of the particular structure under construction can be installed on the string at this time, if desired. Strings, requiring the addition of a launching angle, should be so assembled on the way that the launching angle can be installed on the top of the string. After installation of the chain plates, the A6B assembly bolts that attach the parts are tightened, and the chain plates or other accessory items are welded, as required. KPl keeper plates can be installed at this time in all locations for which they are specified for the one string of the structure being built. After all fittings are in place and the assembly bolts tightened, the assembly should be inspected for security of bolts and fittings. After the first string has been launched, the same assembly procedures are followed for assembly of the second and additional strings, as applicable.

LAUNCHING A STRING

If the pontoon string has been assembled along the edge of a dock, it can be tilted into the water by means of jacks or a crane. If it has been assembled on a way, the anchorage is released and the string is allowed to glide head-on into the water. Note that adequate freeboard will be required for this method of launching. End launchings can be accomplished from flat or nearly flat ways by pushing the string with a bulldozier or pulling it with a tug or M-boats. Strings also have been assembled inland and pulled to the shoreline by a bulldozer. A line, secured to the string before launching, should be made fast ashore to keep the string from drifting away in either side launching

or end launching and can be used to assure that the string rights itself when launched.

ASSEMBLY OF LAUNCHED STRINGS INTO STRUCTURES

A new method for securing pontoon strings together, referred to as the bolt and nut attachment, has been implemented throughout the pontoon system and completely replaces the heavy tie rod assemblies formerly used. It consists of an A6B bolt and heavy nut connection through holes in the vertical legs of adjoining assembly angles between strings. Special wrenches have been designed to facilitate bilge angle connections while working from the deck, and a two-piece aligning tool is used when hole alignment restricts passage of the bolt. Detailed instructions for using the bolt and nut method of connection to assemble a pontoon structure are presented below.

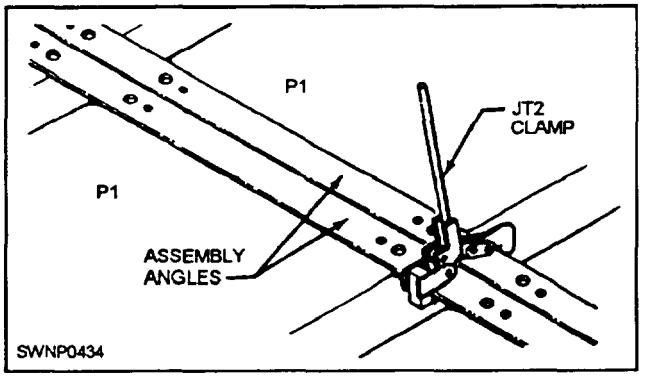


Figure 10-24.—Angle clamp for assembly of pontoon strings

As each pontoon string is launched, it is brought up alongside the other string(s), lined up, and clamped together with JT2 top angle clamps (fig. 10-24). Insert the A6B bolts by hand through the holes in the vertical legs of the top assembly angles located in spaces between the pontoons, and secure them with the heavy nuts. This is done at every space, starting in the middle and working toward each end. Connections are threaded snug only, at this time, to be tightened later.

After the top bolts and nuts are in place, the bottom angle connections are started. The hole locations and bolting pattern are the same as for the top angles, except that here the special wrenches are used for inserting the bolt, holding nut, and tightening, which is accomplished from the deck side.

Using the JT7 drive wrench, insert the A6B bolt in the holes through the adjoining bottom angles and make contact with the nut being held in position with the JT8 backup wrench. When thread contact has been made, draw up snug but do not tighten until all the bottom bolts have been installed. Again, work from the center out to both ends. (If only one special wrench set is used, start in the center and work each side alternately toward the ends.) When all the bolts have been installed, reverse the wrenches so that JT8 holds the bolt while JT7 drives the nut, and tighten all the nuts to the bolts, top and bottom, to the required torque of 2,400 foot-pounds. Note that the applicable rule is to draw the nut up tight, then turn it about another half turn. (See fig. 10-25.)

The JT13, a two-piece aligning tool, should be used when differences in the hole alignment between angles restrict easy passage of the A6B bolts. The

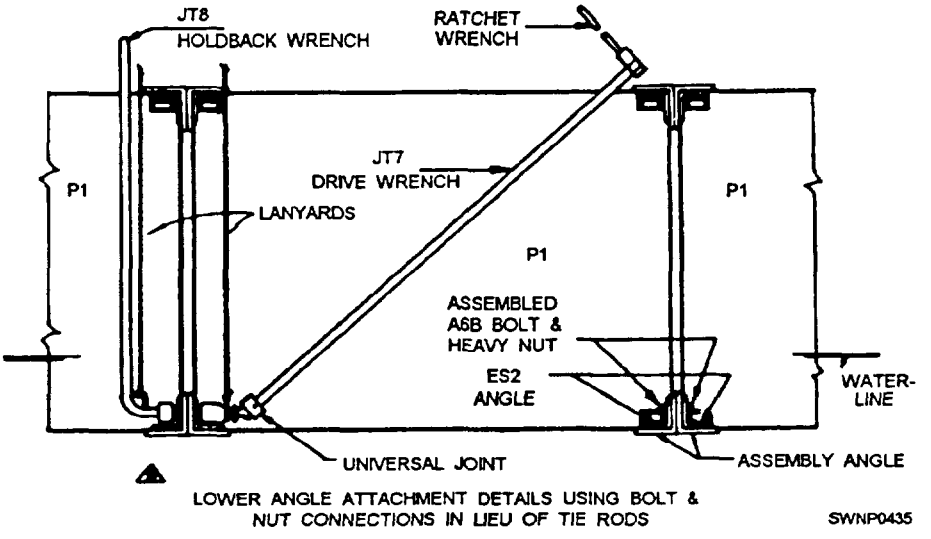


Figure 10-25.—Lower angle attachment details using bolt and nut connections instead of tie rods.

JT13 is inserted anywhere along the strings (preferably in the center) and drawn together tightly, using the JT7 and JT8 drive and backup wrenches. Leave the aligning tool installed, remove the JT7 and JT8 wrenches, and complete connections of the bolts and the nuts, after which remove the aligning tool and replace it with a bolt and nut. Lanyard rings, provided on wrenches and two-piece aligning tools, must always be used to safeguard against loss.

As each string is secured with the bolt and the nut to the preceding string(s), installation of AP4A plates, pad eyes, chocks, cleats, and other accessories required for the structure and not previously installed on the strings are welded or bolted in position as specified in the detailed drawing. To complete the assembly, skip-weld the deck closures in the slots of the deck.

ASSEMBLY OF COMPLETE STRUCTURE ON LAND

Assembly of a complete structure on land is begun in the same manner as construction of strings, except that the structure is assembled parallel to the shoreline on rails perpendicular to the shoreline. Structures up to three strings wide can be built in this manner by assembling the second and third strings on top of the first. When built this way, the bolt and nut attachment previously described and the assembly plates are installed as the work progresses. KPl keeper plates are welded on the bottom A6B assembly bolts and accessories. They will not interfere with launching and can be attached to the assembly. Portable scaffolding, fabricated in the field and similar to that shown in figure 10-26, is attached to the pontoon assembly angles and can be moved to other locations on the structure to meet construction progress. The completed structure can be side-launched by sliding it out to the ends of the rails and tipping it into the water.

USES OF PONTOON ASSEMBLIES

A barge is any of several pontoon string assemblies connected together to form a complete unit used for transporting cargo, including vehicles and personnel, and used primarily in their transfer from landing craft to amphibious vehicles or for lighterage duties in ship-to-shore movement of cargo. Barges, designed for lighterage operations, either self-propelled or towed, can be built in various sizes and, with modifications as required, can be used as a diving platform for salvage operations, as a tugboat, as a gate vessel, for fuel storage, or for mounting cranes.

The intended use of the barge determines the length of the strings, the number of strings needed, and the pontoon configuration of each string. Seven standard-size barges in the P-series equipment include

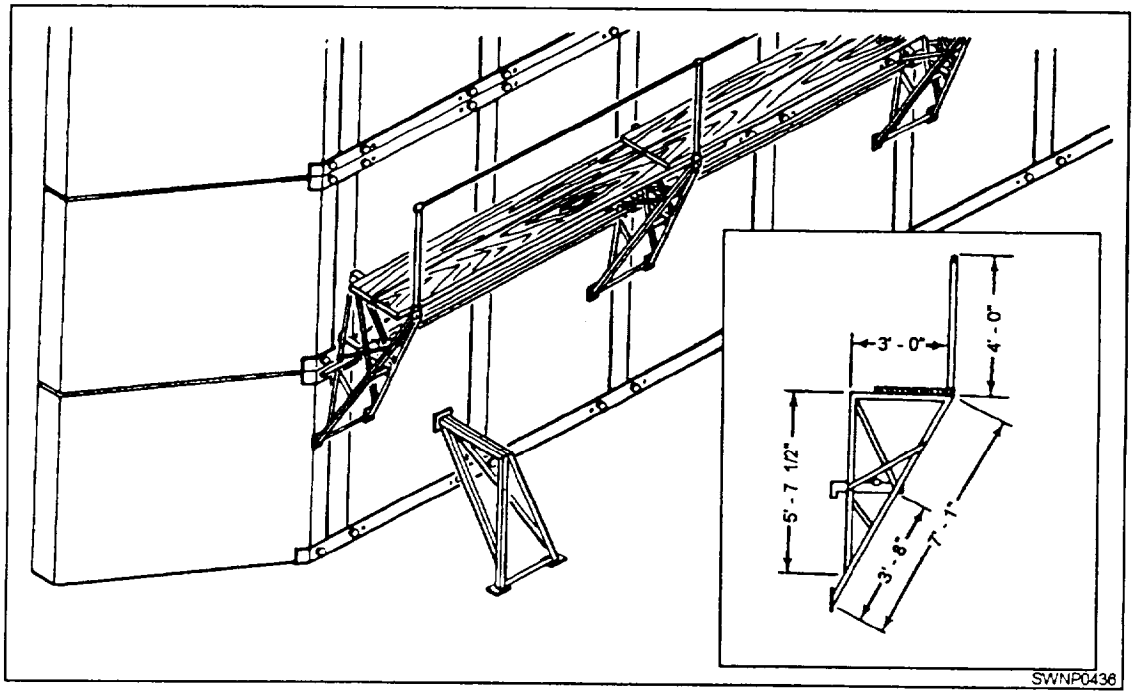


Figure 10-26.—Portable scaffolding used in assembly of structures on a pier.

the following: 3x7, 3x12, 4x7, 4x12, 5x12, 6x18, and 10x30 barges. The conventional pontoon barge, in sizes up to and including the 6x18 barge, is designed to carry its rated load with 1' of freeboard or a load concentrated at the center point that is heavy enough to bring the deck awash.

The 3x7 pontoon barge is a general-purpose structure that can be used as necessary in lighterage and ferrying operations. Cargo transport can be accomplished by tow, or the barge can be self-propelled by mounting a propulsion unit on the end without fenders. A 3x7 barge with a propulsion unit is shown in figure 10-27.

The 3x12 pontoon ramp barge is ordinarily used for transporting cargo and equipment and has proved suitable for general use in amphibious operation. The sloping bow end with ramps attached permits beaching the barge under its own power. And also it helps to unload tractors and equipment that will be used to assist in forming a causeway pier. Four 3x12 barges can be side-loaded on an LST for side-carry to the assault area, or the barges can be loaded in the well deck of an LSD or deck-loaded on an LST.

The 4x7 pontoon barge is similar in all respects to the 3x7 barge, except it is one string wider. Although this is a general-purpose barge used principally for lighterage operations, it is suitable for any transportation task within its capacity.

The 4x12 pontoon barge is a general-purpose structure that can be used in lighterage operations either by towing or as a self-propelled structure by the addition of propulsion.

The 5x12 pontoon barge is one string wider than the 4x12 barge but similar in all other respects. It is particularly suitable for mounting a crawler crane with a lifting capacity ranging from 20 tons at a 12' radius to 7 tons at 55'. This barge can also be used as a general-purpose structure and can be used in lighterage operations as a self-propelled structure by the addition of propulsion units.

The 6x18 pontoon barge is the second largest barge in the P-series pontoon system. Installation of propulsion units permits its use in lighterage operations for transporting loads (cargo, vehicles, and personnel) up to 250 tons. By the addition of accessories and equipment, the barge can be converted into a 1,500-barrel fuel storage barge (fig. 10-28). Also, by installing heavy-duty hinges, the barge can be converted into a wharf or used for outfitting and repair of smaller structures when placed on its deck.

The 10x30 pontoon barge is the largest barge in the pontoon system. It was developed primarily for mounting a 100-ton derrick (See fig. 10-29.) The barge, however, is adaptable to other uses. With propulsion units attached, it can serve as a lighterage barge in transporting over 800 tons of cargo at one time from ship to shore or dock. The barge can also be

Figure 10-27.—A 3x7 pontoon barge with a propulsion unit.

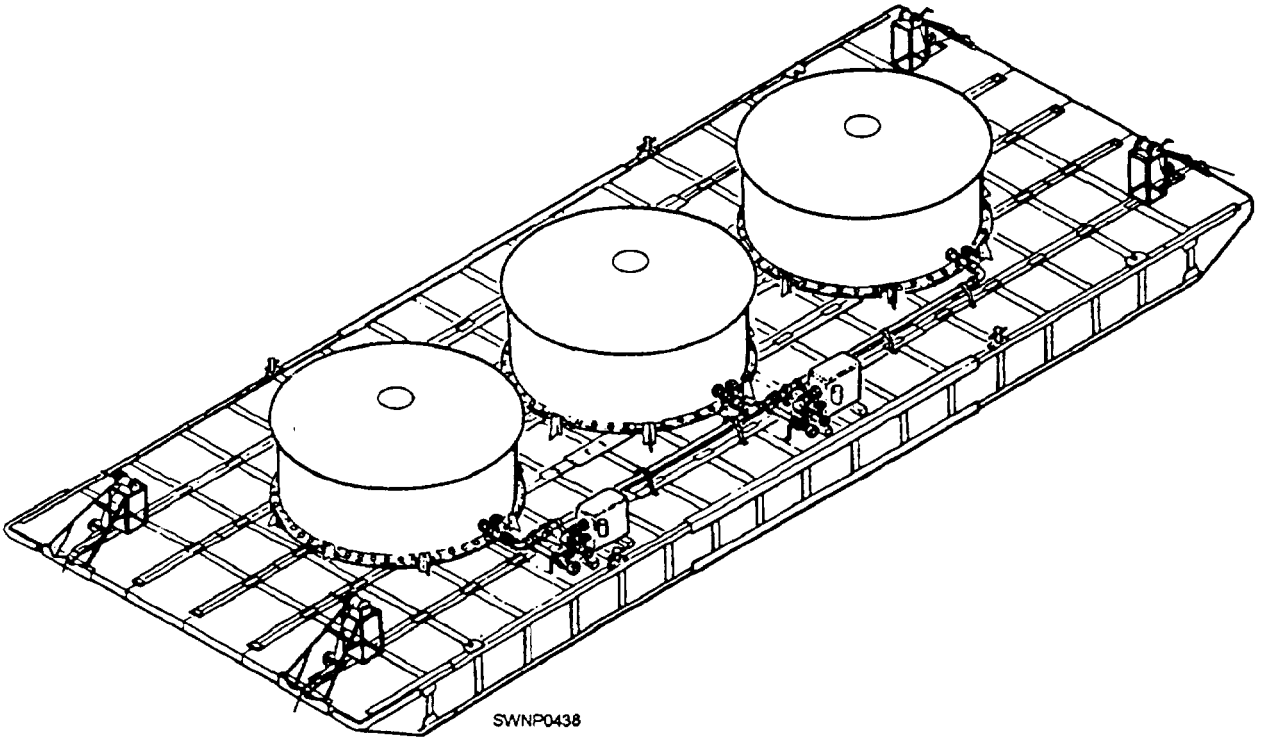


Figure 10-28.—A 1500 barrel , 6x18 fuel storage barge.

used as a pier or wharf or, by installing heavy hinges, could be connected to any existing pontoon wharf to enlarge or extend that structure.

Essentially, tugs are barges equipped with outboard propulsion units and the accessories required for the operations to be performed. The P-series equipment tugs are widely adaptable and can be used for towing, causeway tending, placing and retrieving anchors, salvage operations, assisting in the installation and recovery of fuel systems, and other services.

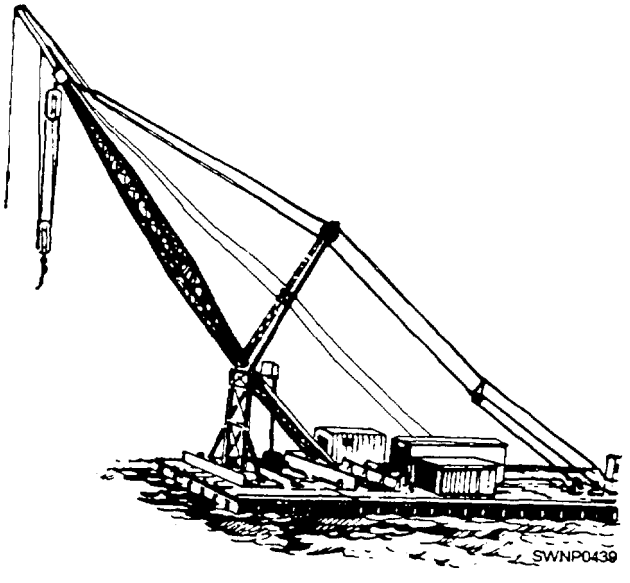


Figure 10-29.—100-ton derrick mounted on a 10 x 30 barge.

The 3x14 warping tug shown in figure 10-30 is equipped with two outboard propulsion units. The after end of the center string incorporates an anchor housing to accommodate the 2,500-pound mooring anchor and also holds the anchor wire away from the propulsion screws. An A-frame, mounted on the bow of the tug, stands approximately 13' above the deck of the barge. A double-drum winch is mounted near the center of the barge. A line from the after drum is fairlead to the deck and back to the anchor astern, while the line from the forward drum is run over a sheave in the top of the A-frame and is used for lifting over the bow or pulling from the bow of the warping tug. The winch is mounted on a welded steel cross-braced frame. Standard equipment for the tug also includes M147 double bitts and navigation lights. The warping tug is approximately 90' long and 21' wide, has a stem draft of 48", a bow draft of 18", and a speed of 6 1/2 knots. The 3x14 warping tug replaces the 3x12 tug throughout the pontoon system. The only difference in these two is that the 3x14 tug is longer by two P1 pontoons and incorporates new style winches with lines feeding off horizontally laid drums.

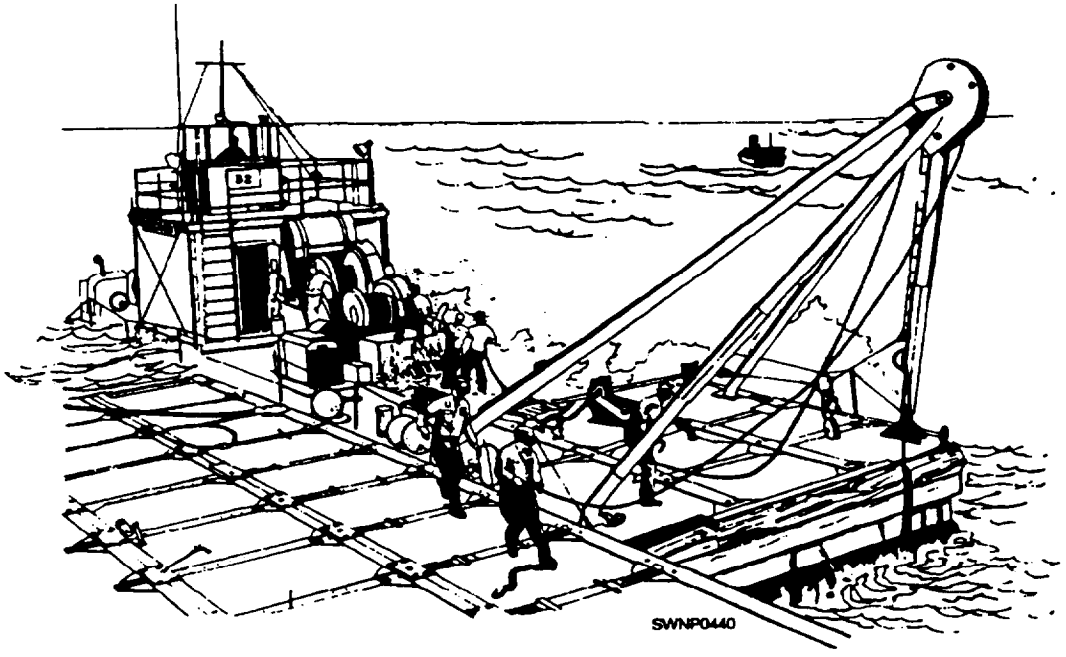


Figure 10-30.—3x14 warping tug.

A PONTOON CAUSEWAY consists of an inshore section, an offshore section, and as many intermediate sections as necessary to make up the desired length. Lengths up to 1 mile are considered possible. Each section is a 3x15 structure designed to support a load of 105 tons with a freeboard of 12".

Each string of the offshore (fig. 10-31) and inshore sections (fig. 10-32) is made up of 12 P1 pontoons with a P3 sloped deck pontoon and a P4 ramp-end pontoon at one end At the other end is an end-to-end connection pontoona—a P5F (female) end connection pontoon on the offshore section and a P5M (male) end connection pontoon on the inshore section. Strings of the intermediate sections (fig. 10-33) are made up of 13 P1 pontoons with a P5F at one end and a P5M at the other.

SIDE-LOADED CAUSEWAYS

Causeways, as well as binges, normally are transported to the combat area side-loaded on an LST. To facilitate this, you should weld a hinge rail or shelf bracket on each side of the LST. An LA1 launching angle is bolted to one of the outboard strings of the barge or causeway (fig. 10-34).

The LST is listed far enough to the side being loaded to permit the hinge bar of the pontoon structure to be hoisted onto the shelf bracket. Then the structure is hoisted upright, either by a crane or by the winch(es) on the LST. The hoisting sequence can vary, depending on the gear used and the LST involved.

Regardless of the method use&personnel from an amphibious construction battalion, usually with a SWC or BMC in charge, bring the required gear aboard and do the job. The ship's company make necessary preparations aboard ship and provide whatever assistance is required of them.

FLOATING DRY DOCKS

Floating pontoon dry docks are structures consisting principally of a main wharf-like deck and vertical side towers constructed of P-series pontoon units. Pontoon dry docks are submerged by admitting a controlled amount of water into the deck pontoons and raised by expelling the water with compressed air. The tower pontoons act as stabilizers to keep the dry dock level when the deck is under waler. Dry docks require 18' of water in which to submerge the decks 12", the maximum safe submergence, and should be moored in sheltered, quiet water 18' to 20' deep, in an area with a smooth bottom, devoid of large rocks or other obstacles. Two sizes of pontoon dry docks are presently in the ABFC System. This is identified as the 4 x 15 (l00-ton capacity) dry dock. Figure 10-35 shows a 6 **x** 30 pontoon dry dock installation.

The assembly method of erecting pontoon strings for the dry docks is the same as those used for other pontoons structures. Only P1 pontoons are used and

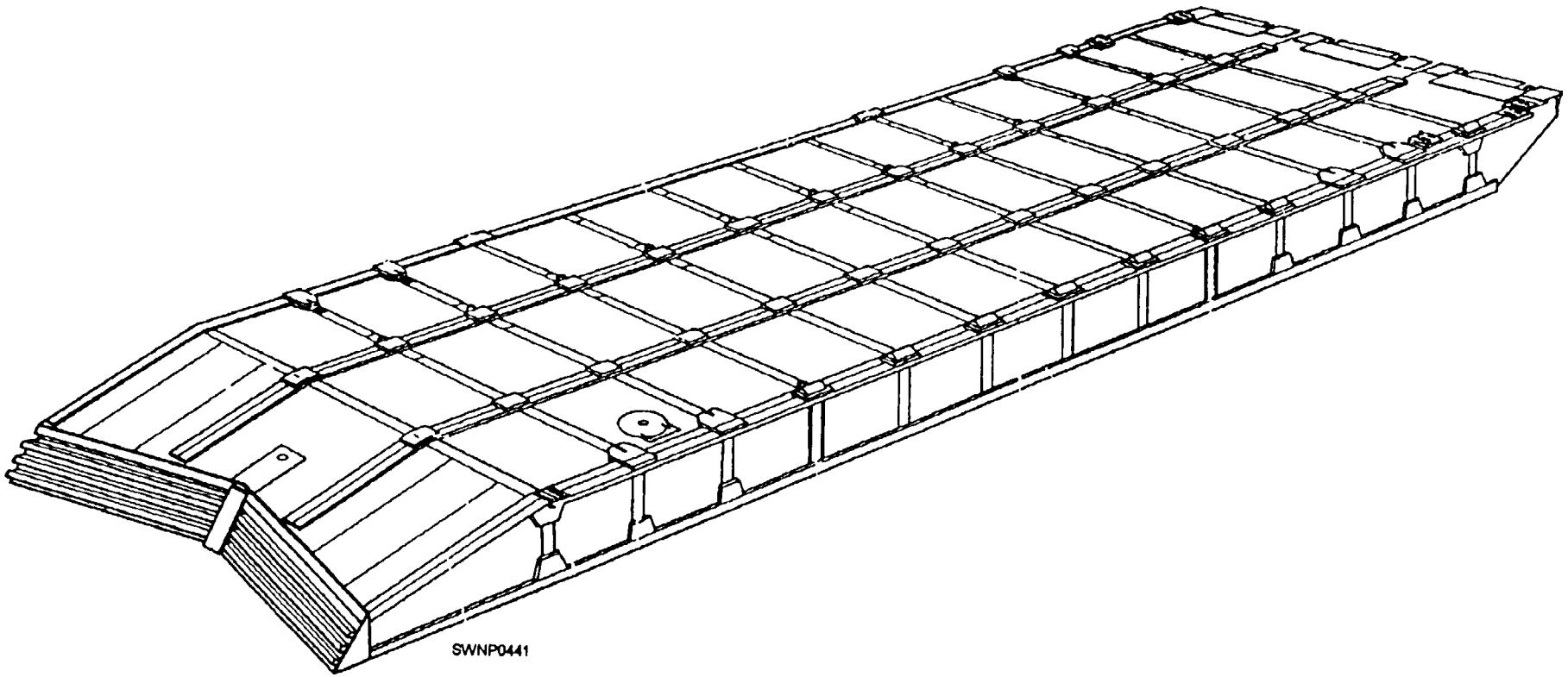


Figure 10-31.—Offshore causeway section.

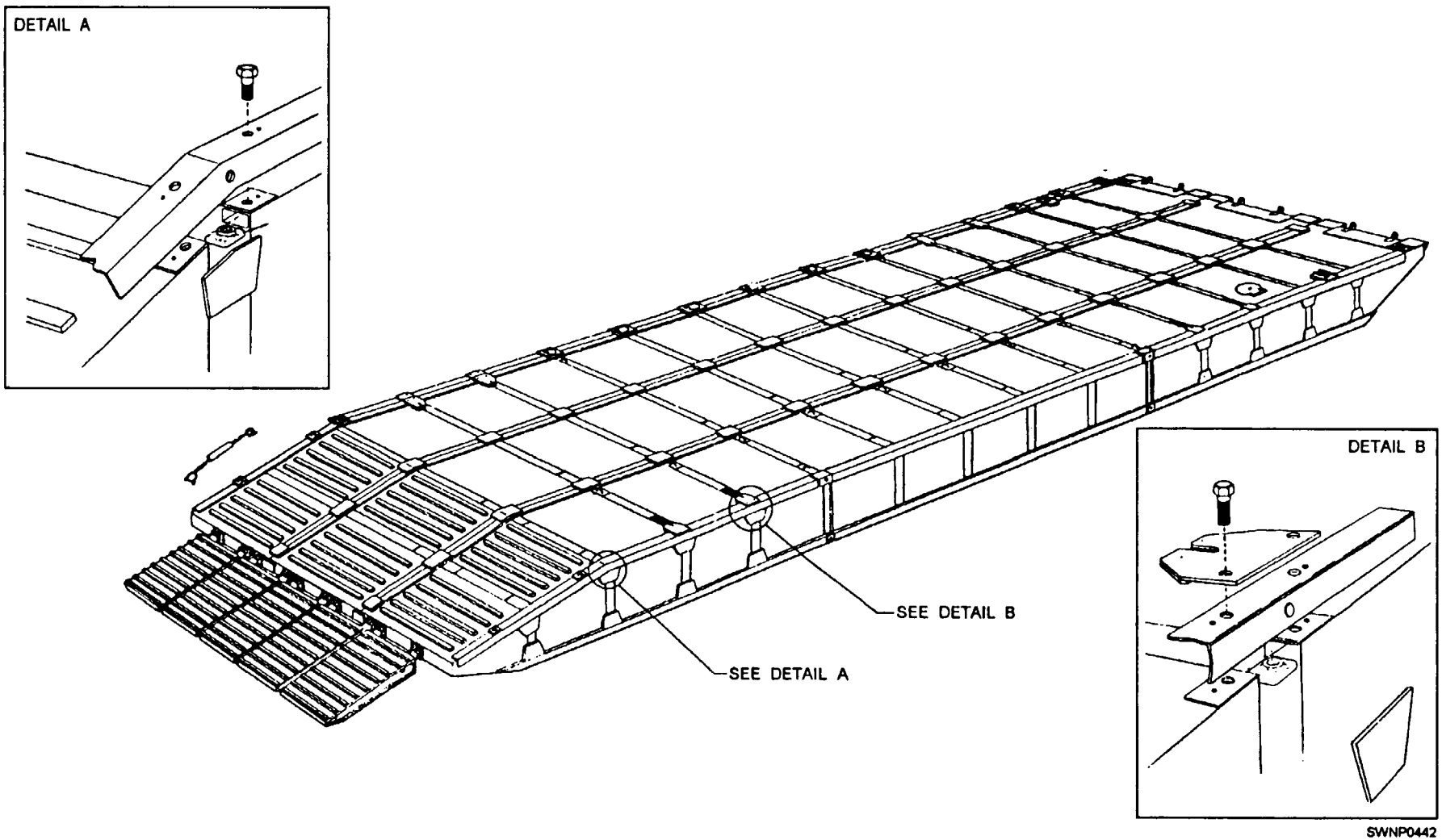
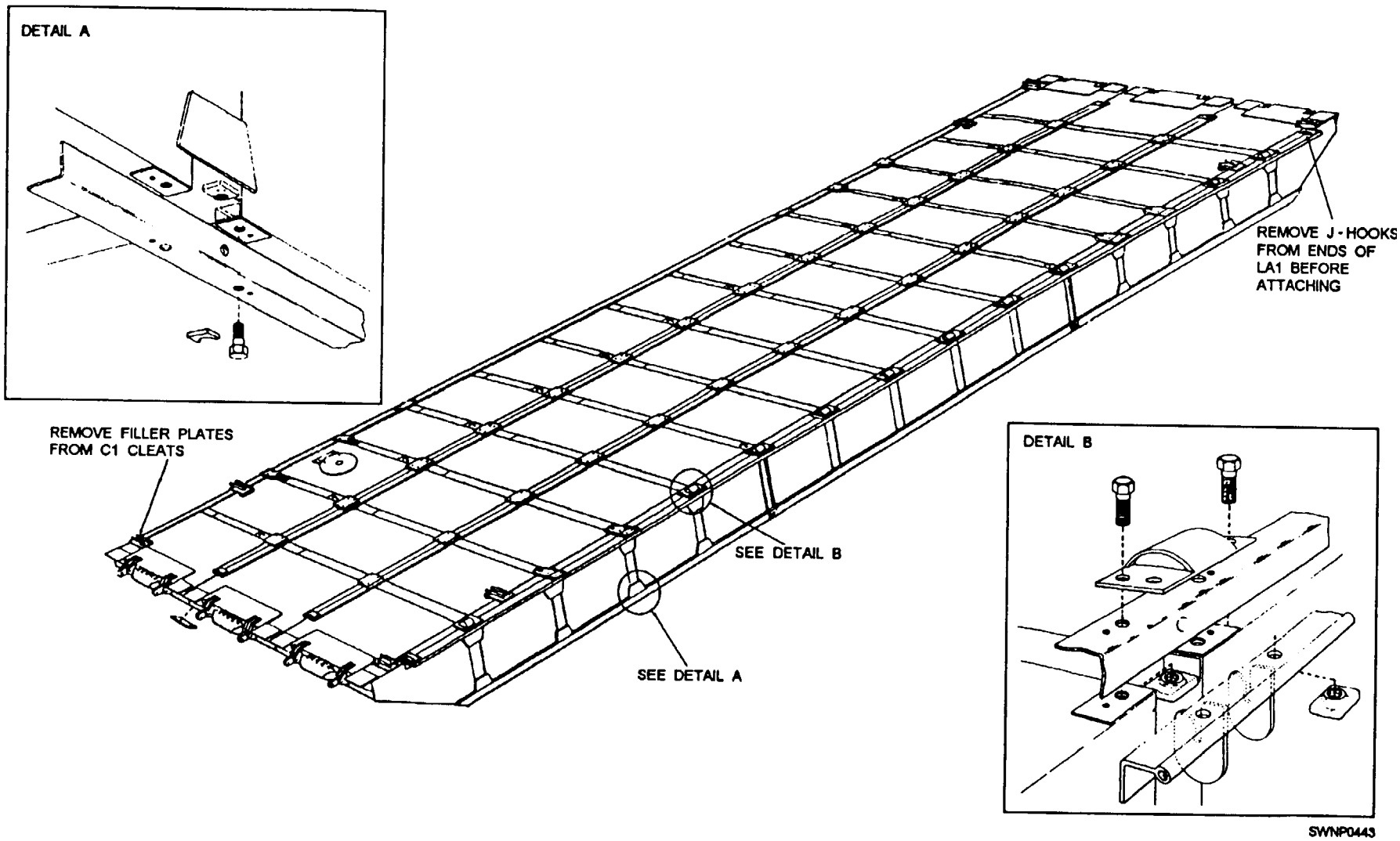


Figure 10-32.—Inshore causeway section.



FFigure 10-33.—Intermediate causeway section.

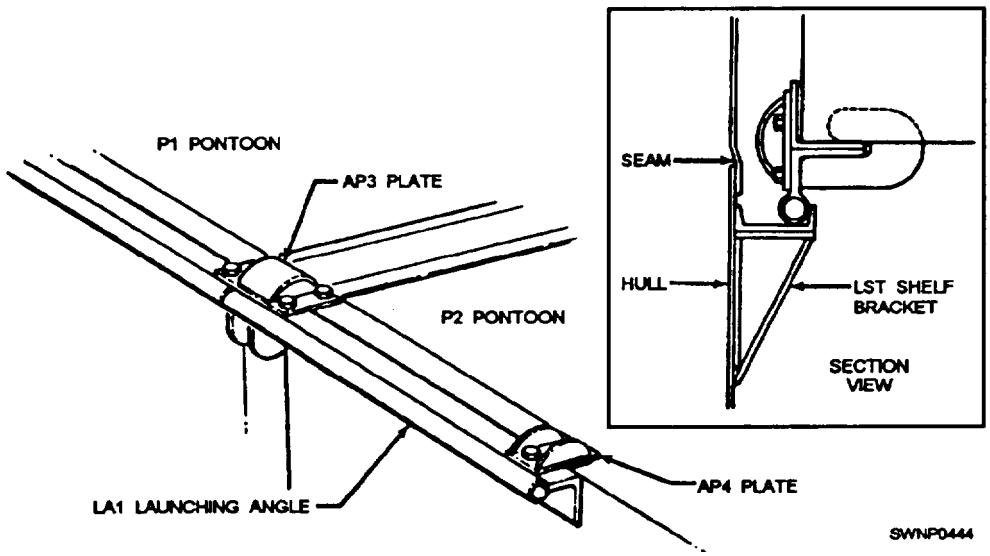


Figure 10-34.—An LA1 launching angle.

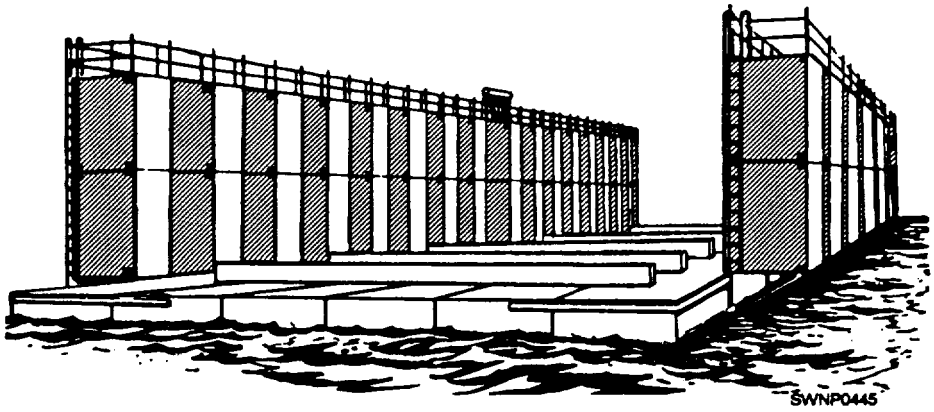


Figure 10-35.—6 x30, 400-ton pontoon dry dock.

are made up into strings, launched, and joined in the water the same as with other structures. However, before pontoon string construction, dry dock drawings should be prepared in detail to show the type and the location of parts, together with field erection information. It is important to make available the applicable drawings of the dry dock to be erected at all times during the initial construction stage. This will ensure that parts are properly located, positioned, and secured and will facilitate erection during the final stage.

ELEVATED CAUSEWAY SECTIONS

The elevated causeway pier facility (ELCAS) provides a link between lighterage and the beach by bridging the surf zone. The standard ELCAS consists of six 3x15 approach or roadway sections and six 3x15 pierhead sections (fig. 10-36). The pierhead is two sections wide by three sections long. Since the facility is modular, it may be expanded by enlarging the pierhead and/or adding approach sections. The basic component of the ELCAS is the 3 x 15 intermediate causeway section that is converted to the elevating mode by the addition of spudwells. Spudwells provide the attachment between the causeway deck and the supporting piling. Internal spudwells (fig. 10-37) are used where the full width of the causeway section is required for traffic and to support the fender piles along the fender side of the pierhead. The internal spudwell incorporates four grooved connection pins that are inserted into four receiver boxes attached to the side of the causeway. Two guillotines are lowered into the pin grooves behind the receiver boxes to secure the spudwell to the section. A steel-angled locking key is used to lock the guillotine into place. External spudwells (fig. 10-38)

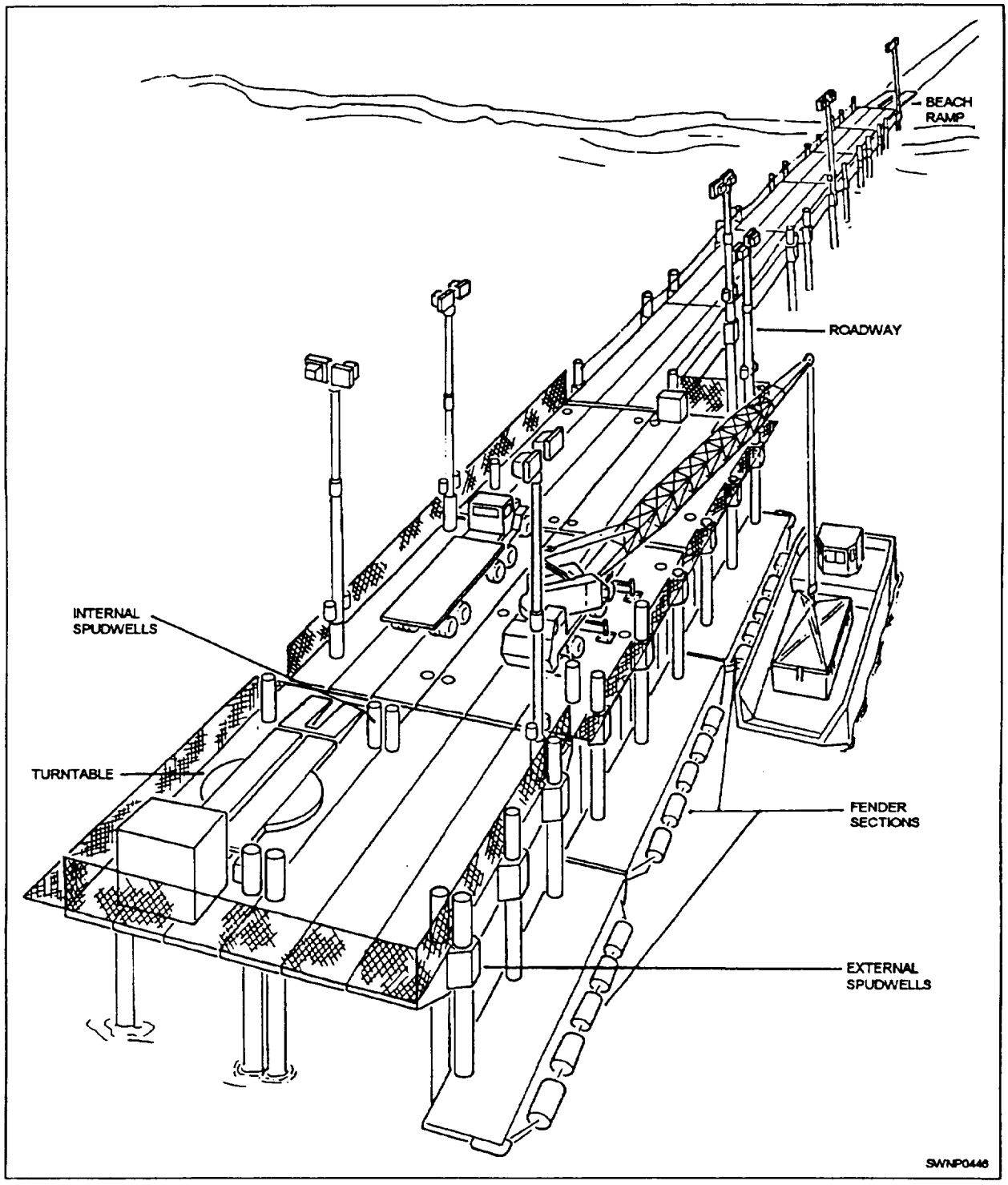


Figure 10-36.—Twelve section elevated causeway.

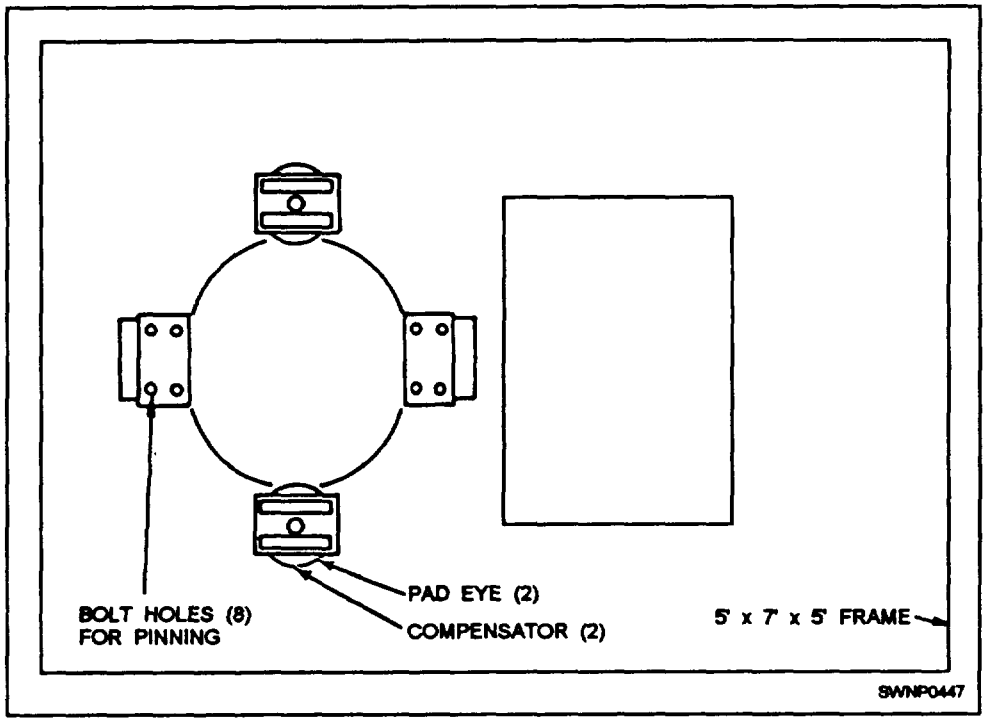


Figure 10-37—Internal spudwell.

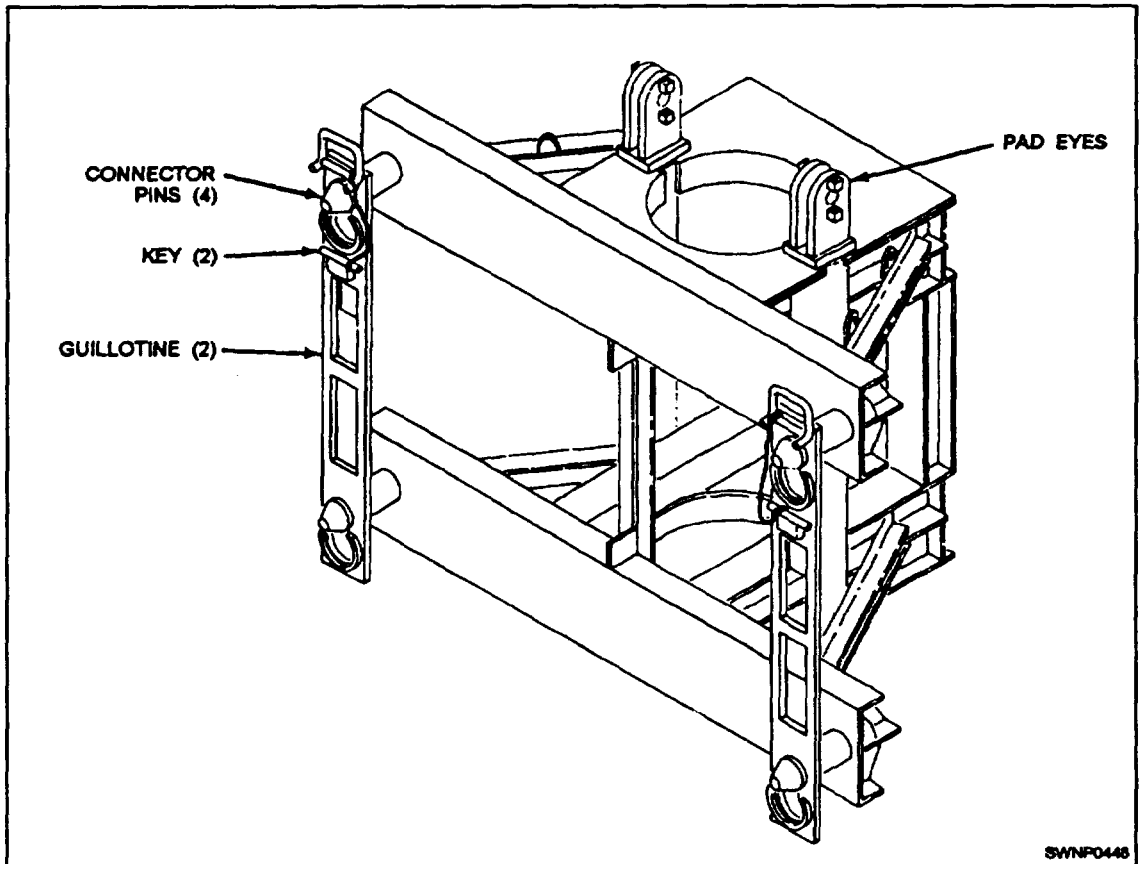


Figure 10-38.—External Spudwell.

are used in the outboard strings of pierhead sections, where side to aide connection with another section is required, and at load-bearing points, such as under the container handling crane. The external spudwell is fabricated into a frame having the same overall dimensions as a PI pontoon. It is interchangeable with

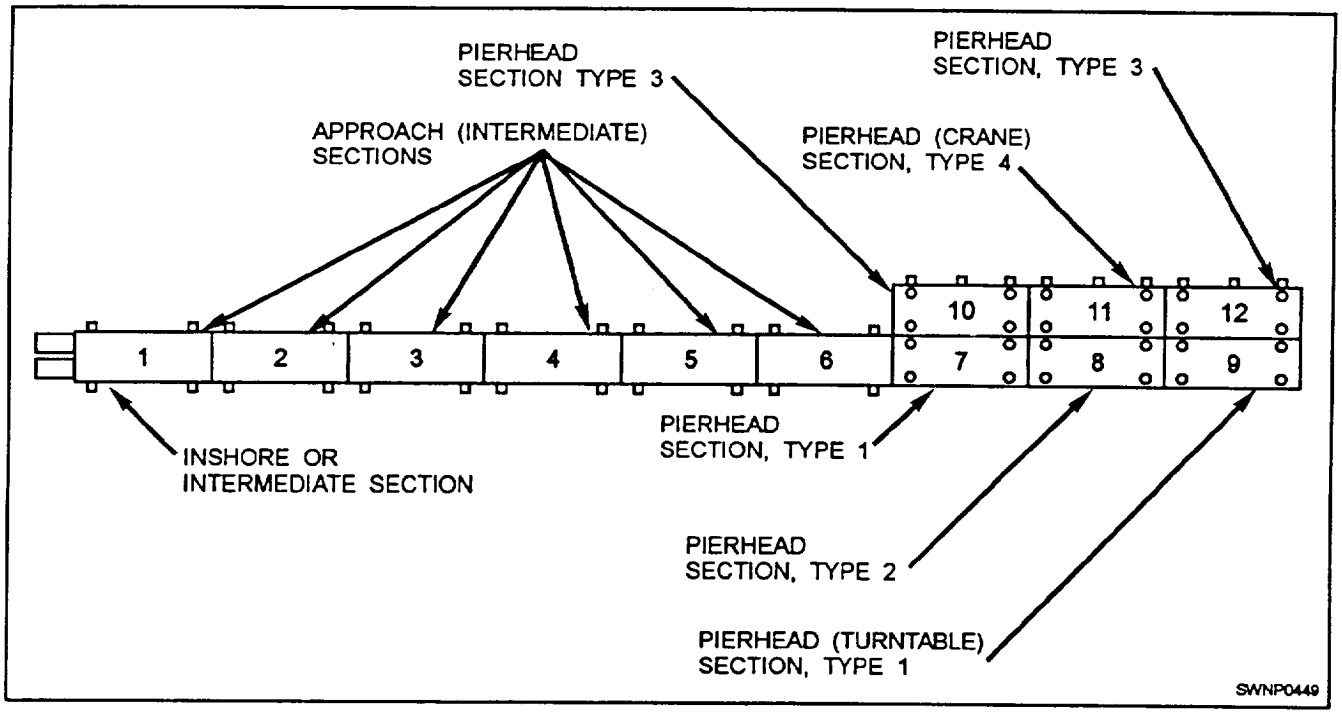


Figure 10-39.—Types and positions of causeway sections in the ELCAS.

the PI pontoon and uses the same attaching hardware. The ELCAS consists of four distinct parts as follows:

Ž **The PIERHEAD** is made up of four types of sections. It is the offshore section of the ELCAS and supports cargo unloading functions. The pierhead includes a crane installation for off-loading lighterage and a turntable for turning trucks around on the causeway.

Ž **The FENDER SECTIONS** provide an interface between the pierhead and the lighterage.

Ž **The ROADWAY** provides for two-way traffic between the pierhead and the beach.

Ž **The BEACH RAMP** provides access from the beach to the ELCAS.

The types of sections used and their locations are shown in figure 10-39.

CONSTRUCTION OF PIERHEAD SECTIONS

The type 1 pierhead section makes use of four internal spudwells. This section is also equipped with support brackets to receive the side connectors used to join these sections side to side with type 3 pierhead sections.

The type 2 pierhead section contains six internal spudwells. Support brackets for side connectors are also used in this type. Additionally, the type 2 section contains six reinforced PI pontoons.

The type 3 pierhead section uses four internal and three external spudwells. Support brackets must be also added to support the side connectors.

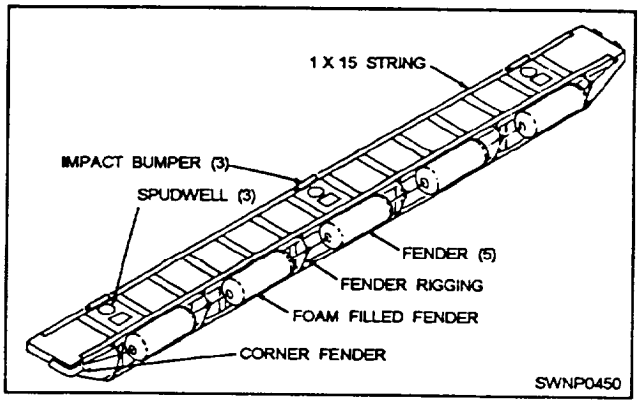


Figure 10-40.—ELCAS fender system details

The type 4 pierhead section, which supports the container handling crane, contains seven internal and three external spudwells. Six reinforced PI pontoons are also included.

CONSTRUCTION OF FENDER SECTIONS

A fender section is a 1'x15' structure incorporating three fender spudwells (fig. 10-40). Fender piles are driven through the fender spudwells after the causeway is elevated (fig. 10-41). The fender section can then rise and fall on' the piling. A series of foam-filled fenders are strung on the outboard side of the fender system to absorb impact from lighterage. Since it is only one pontoon wide, the fender system uses P5 pontoons as end-to-end connections instead of the P8.

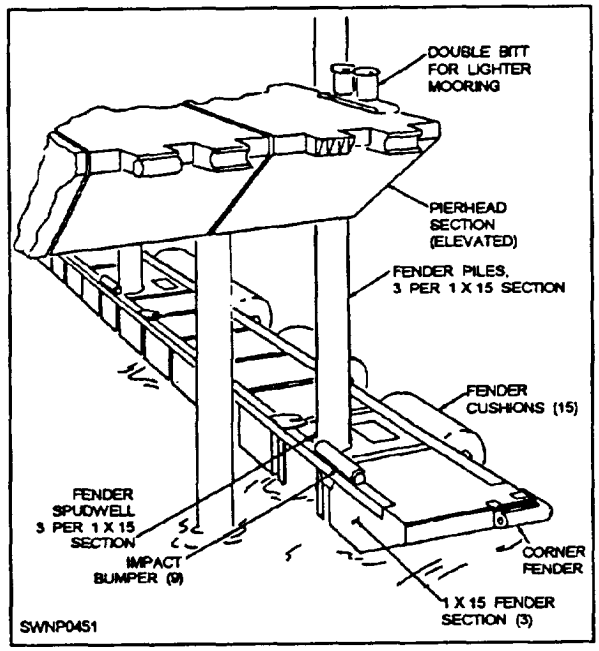


Figure 10-41.—ELCAS fender system.