
5. Lifting and Towing

5.1. Salvage Equipment

Table 5-1 at the end of this chapter is a complete list of equipment stored at Submarine Salvage Material Bases for operation with the submersible structural pontoons. Following Tables 5-1 and 5-2, are drawings A through I, showing various components used in pontoon operations.

5.2. Submersible Structural Pontoons

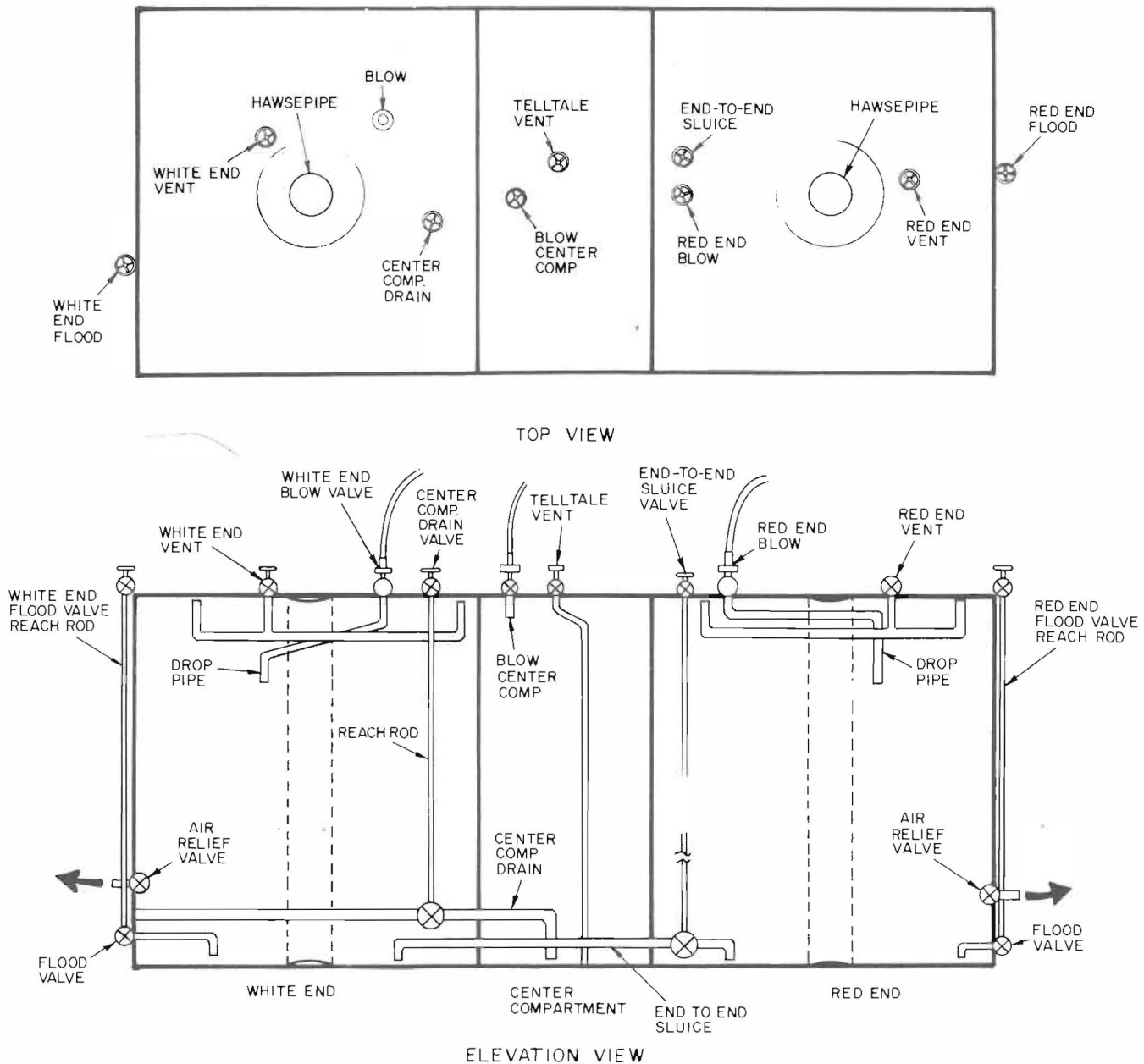
5.2.1. General Description

The submarine structural pontoons are cylindrical in shape and of steel construction. This steel shell is covered by 3-inch planking and the ends of the pontoons have timbers mounted to act as fenders, thereby protecting the flood and relief valves. Each pontoon is subdivided into three watertight compartments. The two end compartments have the same capacity, and, together, provide the main lifting force. The center compartment is of such size that when dry and with the end compartments flooded, it will support most of the weight of the pontoon which is from 35 to 40 tons. In this condition, the pontoon has about 3.5 tons in negative buoyancy, and is positioned for attachment to the slings by the 5-inch lowering lines. When all compartments are blown dry, the pontoons will furnish lifts of 80, 85, and 90 tons, depending upon the type (see Table 5-2).

There are three older types (Figures 5-1, 5-2 and 5-3) of pontoons in existence (structural numbers YSP 1, 2, and 3) that have a lifting capacity of 60 tons, and some newer type III pontoons with a 90-ton lift (Figure 5-4).

Each end compartment has blow, vent, flood, and relief valves. The center compartment has blow and telltale vent valves and the type I pontoons also have a center compartment drain valve.

The end compartment vent valves are used only for completely filling the end compartments so as to destroy all free surface and make the pontoon negatively buoyant. Thus, the pontoon may be lowered into position, or the cable clamps or chain stoppers (see Chapter 7) may be freed should it be necessary to remove the pontoon from the slings.



MAXIMUM INTERNAL PRESSURE - 30 P.S.I., RELIEF VALVES CAN BE GAGGED CLOSED BY SCREW ON EACH VALVE.

STRUCTURAL NO'S 3, 5, 6, 7, 9 & 10:

- LENGTH OVERALL - 34'-0 $\frac{7}{8}$ "
- DIA. OVERALL - 13'-1 $\frac{3}{4}$ "
- LIFTING CAPACITY - 85 TONS
- WEIGHT, DRY - 38.4 TONS
- NEGATIVE BUOYANCY WITH END COMP'TS FLOODED AND CENTER COMP'T. DRY - 3.64 TONS
- BALLASTED WITH CONCRETE IN BOTTOM

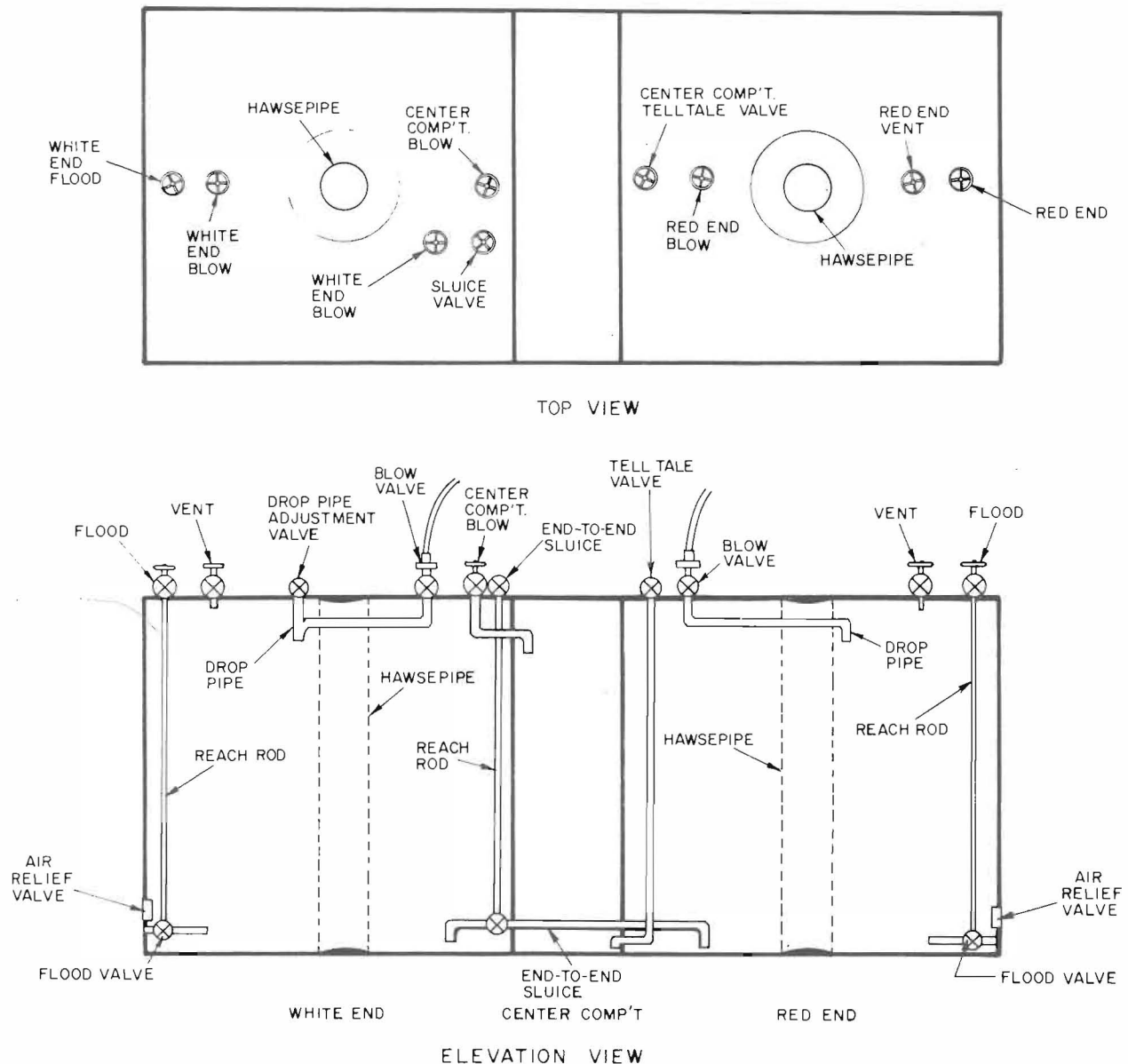
STRUCTURAL NO'S 1 & 2 - SAME GENERAL FEATURES AS OTHER PONTOONS BUT WITH THE FOLLOWING DIMENSIONS:

- LENGTH - 32'-0"
- DIAMETER - 11'-0"
- LIFTING CAPACITY - 60 TONS
- WEIGHT, DRY - 35 TONS

VALVE HANDWHEELS ARE SAME AS TYPE II & III.

TYPE I SALVAGE PONTOON.

FIGURE 5-1



MAXIMUM PRESSURE, END COMPARTMENTS - 30 P.S.I., MAXIMUM PRESSURE, CENTER COMPARTMENT - 75 P.S.I.

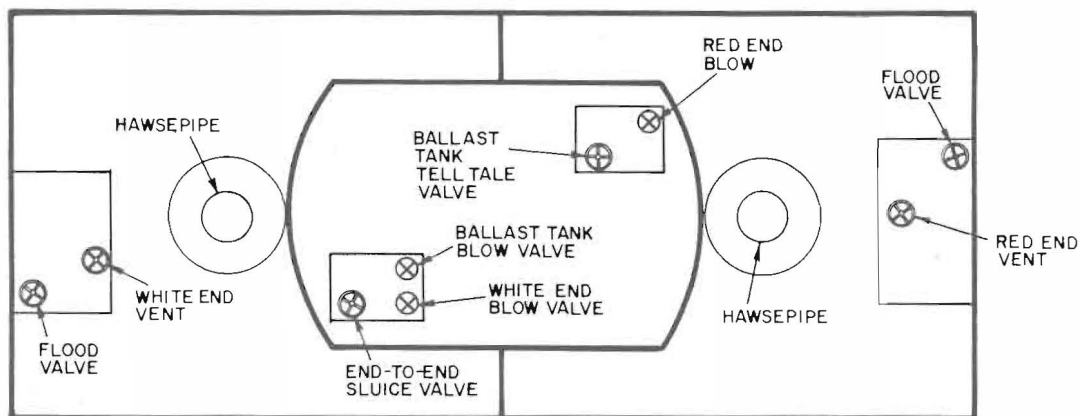
- STRUCTURAL NOS. 11-60
- LENGTH - 32'-0"
- DIAMETER - 12'-6"
- LIFTING CAPACITY - 80 TONS
- WEIGHT, DRY - 35-40 TONS
- NEGATIVE BUOYANCY, WITH END COMPARTMENTS FLOODED TO END OF BLOW PIPES - ABOUT 3.5 TONS

VALVE HANDWHEELS

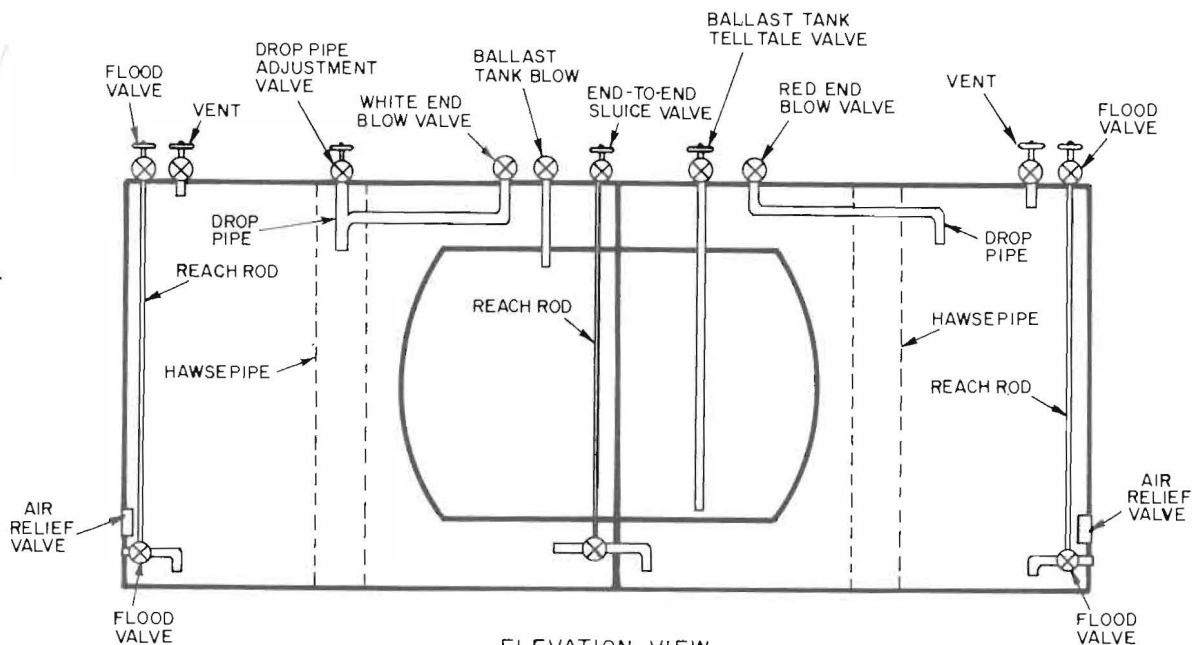
- ROUND - TELLTALE AIR VENT, CENTER COMP'T. - AIR VENT, END COMP'TS.
- SQUARE - BLOW VALVES, END COMP'TS.
- TRIANGULAR - BLOW, CENTER COMP'T.
- T-WRENCH, PORTABLE - OPERATING RODS TO: SLUICE VALVE, FLOOD VALVES, END COMP'T.

TYPE II SALVAGE PONTON.

FIGURE 5-2



TOP VIEW



ELEVATION VIEW

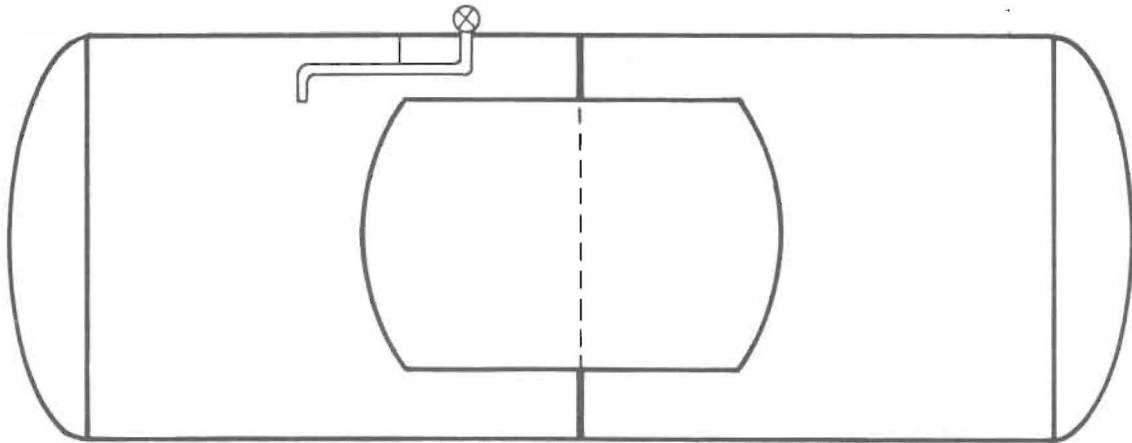
MAXIMUM PRESSURE, END COMPARTMENTS - 30 P.S.I., MAXIMUM PRESSURE, CENTER COMPARTMENT - 75 P.S.I.

- STRUCTURAL NOS. 61-75
- LENGTH - 32'-0"
- DIAMETER - 12'-6"
- LIFTING CAPACITY - 80 TONS
- WEIGHT, DRY - 35-40 TONS
- NEGATIVE BUOYANCY, WITH END COMPARTMENTS FLOODED TO END OF BLOW PIPES - ABOUT 3.5 TONS

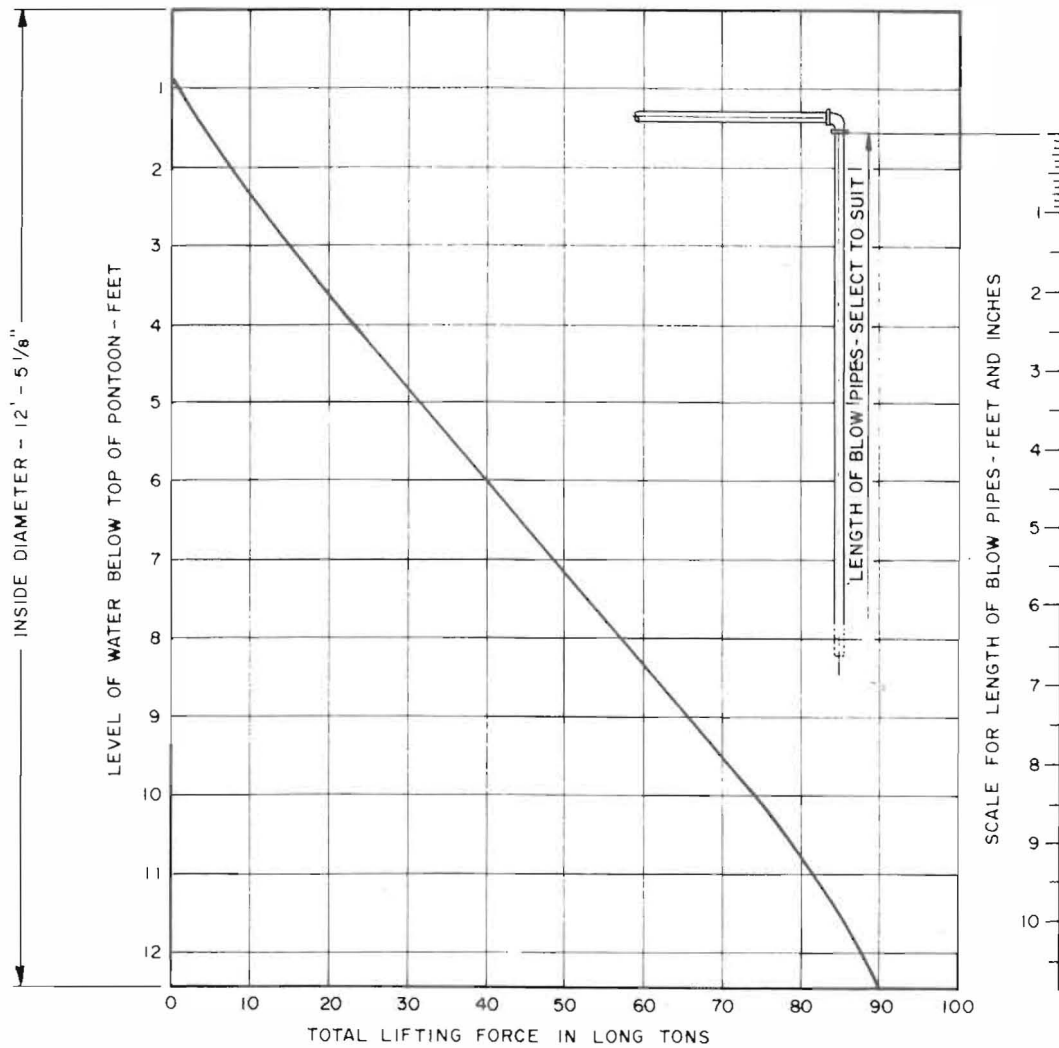
VALVE HANDWHEELS

- ROUND - TELLTALE AIR VENT, CENTER COMP'T.
- AIR VENT, END COMP'TS.
- SQUARE - BLOW VALVES, END COMP'TS.
- TRIANGULAR - BLOW, CENTER COMP'T.
- T-WRENCH, PORTABLE - OPERATING RODS TO:
SLUICE VALVE
FLOOD VALVES, END COMP'T.

TYPE III SALVAGE PONTON.
FIGURE 5-3



TYPE III-A 90 TON PONTOON WITH DROP PIPE EXTENSION



USE OF ADJUSTABLE BLOW PIPE

FROM CURVE OF TOTAL LIFTING FORCE VS. LENGTH OF BLOW PIPE, SELECT LENGTH OF PIPES FOR THE LIFT DESIRED, AND SCREW THESE LENGTHS OF PIPE INTO ELBOW AT END OF HORIZONTAL SECTIONS OF BLOW (AIR SUPPLY) PIPES.

TYPE III-A PONTOON DROP PIPE

EXTENSION CURVE.

FIGURE 5-4

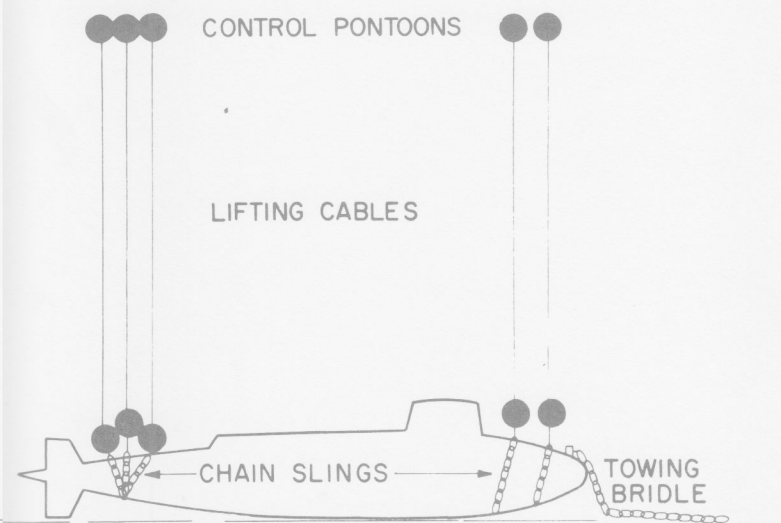
The end compartment blow valves are used for dewatering the pontoon and venting to a predetermined level of positive buoyancy. End compartment flood valves admit sea water or discharge it when blown with high pressure air. The relief valves permit the expanding air to escape as the pontoon rises. The end compartments contain hawsepipes through which the lifting chains or the heavy wire slings are passed. These chains or cables form a cradle by which the sunken submarine is lifted. (Figure 5-5(A) through (E) illustrates various lifts, i.e., initial lift, breakout, under tow, intermediate lift, and final lift.

The center compartment blow valve is used for pressurizing the center compartment. A telltale vent pipe leads to the bottom of this space and is used to determine if the center compartment is free of water. Any residual water can thus be blown up through the vent pipe.

Drop pipes extend from the blow valves of the red and white compartments in various lengths, depending upon the adjustment or type of pontoon. The height of the ends of the drop pipes will determine the amount of air space or lift when the compartment is vented back through it. The purpose of this is to provide various positive buoyancies so that the pontoon can be positioned over the submarine and hold the slings taut. These drop pipes are adjusted prior to pontoon lowering operations and must take into account the length of chain and wire rope slings so as to determine the weight that will be supported. In operation, the pontoons are blown below the ends of the drop pipes, then vented back, as described in Paragraph 5.2.8.

There are three types of drop pipes installed on the pontoons. The type I pontoon (Figure 5-1) has a fixed drop pipe that is essentially an extension of the blow line into the compartment and cannot be adjusted. This drop pipe will give 9-1/2 to 10 tons of positive buoyancy. The type II and III pontoons (Figures 5-2 and 5-3) have adjustable drop pipes that range from 3-1/2 to 5 tons lift. The adjustment for these drop pipes is a small handwheel on top of the pontoon. The post-war type III (90-ton) pontoons have sets of pipe extensions that can be screwed into place prior to employment at sea. These drop pipe extensions will provide lift increments from approximately 1 to 55 tons, or the maximum of 90 tons (see Figure 5-4).

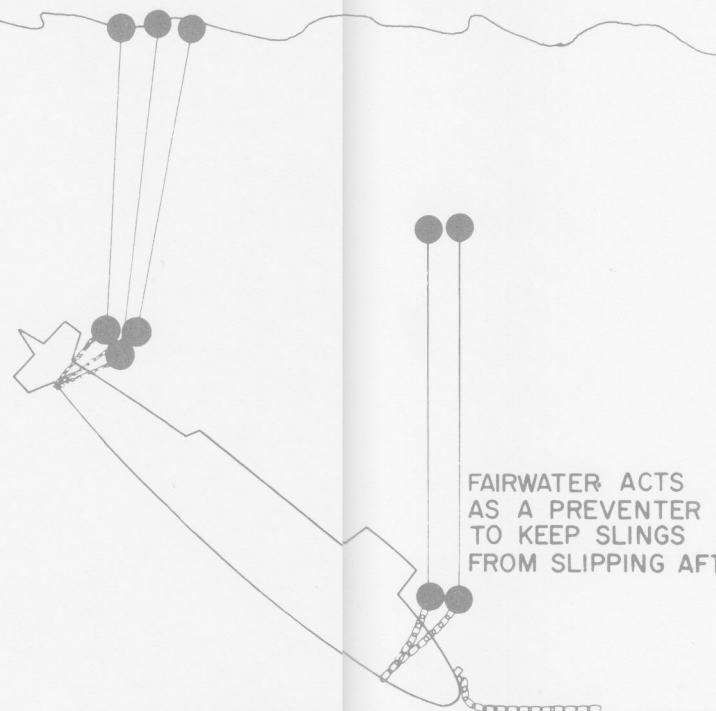
Prior to deployment, the Salvage Officer should inspect each pontoon drop pipe configuration and have the adjustment made to suit his requirements. Once set, the drop pipe adjustment must not be altered without the authorization of the Salvage Officer.



SUBMARINE RIGGED FOR INITIAL LIFT

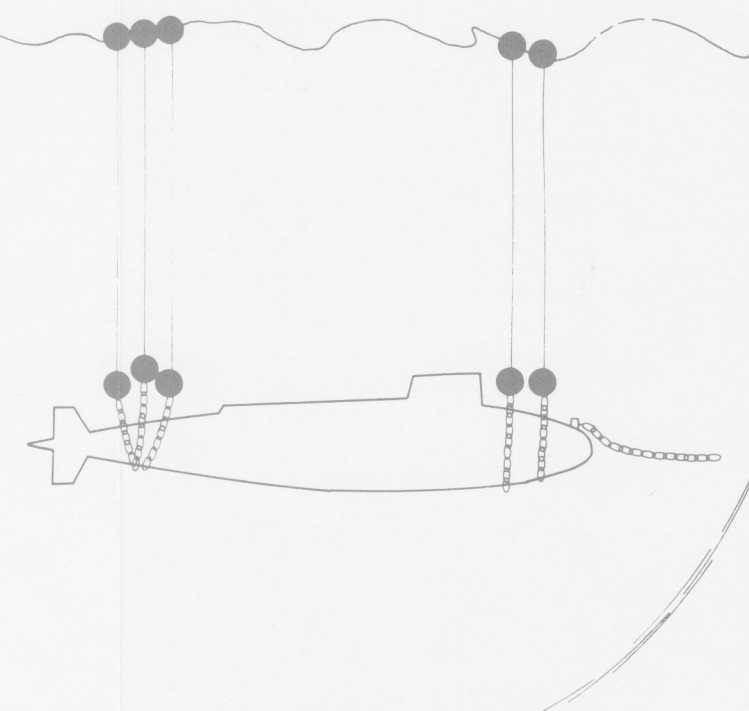
(A)

STERN PLANES
ACT AS
PREVENTER



STERN BREAKOUT

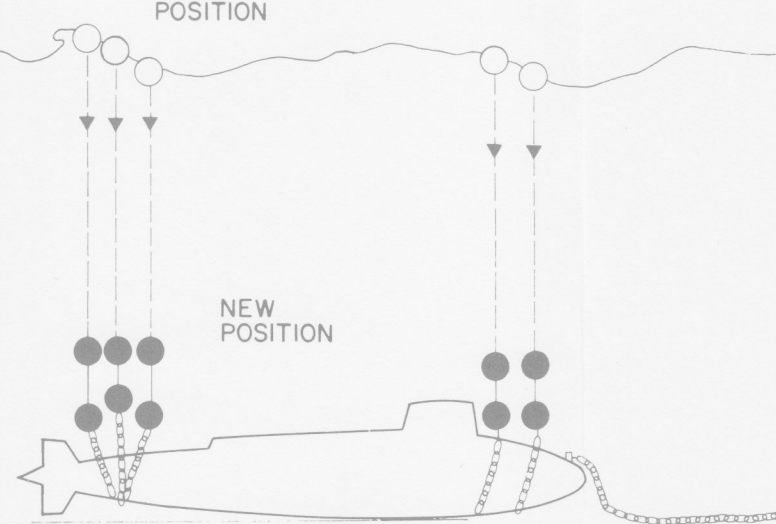
(B)



SUBMARINE OFF OF BOTTOM AND UNDER TOW

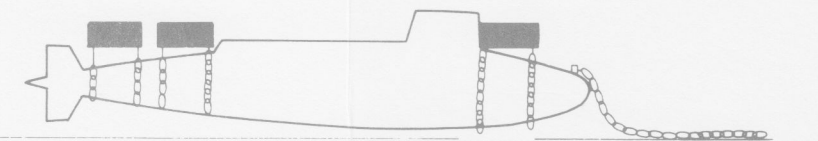
(C)

FORMER
POSITION



SUBMARINE RIGGED FOR INTERMEDIATE LIFT

(D)



SUBMARINE RIGGED FOR FINAL LIFT

(E)

SUBMARINE LIFTING SEQUENCE.

FIGURE 5-5

The positive buoyancy for which the drop pipes are set may be checked by venting down the end compartments through the blow valves while the pontoon is afloat on the surface and observing accurately the external water line.

The flood and sluice valves are operated from the top of the pontoon by means of reach rods. The pontoon is made to apply its lift to the sling by displacing the water from the end compartments using compressed air supplied through hoses which are connected to the pontoon blow valves.

5.2.2. Tests

Every two years, the pontoons are to be inspected to ensure that all parts function properly. At the same time, each compartment shall be air tested at 10 or 25 psi, held for 10 minutes without leakage. When air-testing pontoons 61 through 75 (type III), the end compartments must be tested simultaneously by leaving the sluice valve open. Reports of these tests are to be submitted to the Naval Ship Systems Command in the tabular form as shown in Figure 5-6.

The following is applicable to these tests:

1. Accurate, properly tested gages should be used. Full pressure shall be maintained for at least 10 minutes. No compartment is to be considered satisfactory until it has met this requirement. If a drop in pressure is indicated by the gages, leaks should be located and permanently corrected.

2. When tests are completed, all valves should be shut and wired, and compartments thoroughly dried. A suitable dessicant, such as Silica Gel, should be placed in the compartments and the manhole gaskets coated with white lead before replacing and securing the cover. A 10 psi air test should again be conducted to ensure tightness of the manhole cover.

3. Pontoons should be stored on an angle to prevent an accumulation of water in manhole and valve recesses.

4. Caution should be exercised in entering pontoons that have been sealed for long periods of time, as with any confined space. Noxious gasses or oxygen levels too low to support life are common in such void spaces.

TESTED BY _____ AT _____ DATE _____

PONTOON NO.	:	AIR PRESSURE - 10 PSI	:	HELD FOR 10 MINUTES WITH NO PRESSURE DROP
WHITE END	:	RED END	:	CENTER COMPT. OR CENTER BUOYANCY TANK
RESULT	:	STEPS	:	RESULT
	:	TO	:	STEPS
	:	COR-	:	RESULTS
	:	RECT	:	STEPS
	:		:	TO
	:		:	COR-
	:		:	RECT
	:		:	REMARKS

REPORT FORM FOR SUBMARINE
SALVAGE PONTOON TEST.

FIGURE 5-6

5.2.3. Use of Submersible Structural Pontoons

Control Pontoons

Unless a submarine is to be raised in one step, as would be the case in shallow water, control pontoons will most likely be utilized. Control is achieved by setting the pontoons below the surface an amount that is equal to the distance it is desired to raise each end of the submarine. When the control pontoons reach the surface, they will arrive at drafts which will automatically establish a condition of equilibrium with the total moment of all list forces required to counterbalance the weight and moment of the lift. For this equilibrium to be established, it is necessary that at the time the end leaves the bottom, the total lifting moment of the control pontoons at each end of the ship be greater than the moment required for breakout. This can be accomplished by blowing down those compartments and tanks on the submarine which will provide self-lift first. Second, the control pontoons would be blown completely to obtain their total lift before the lift pontoons rigged nearer the submarine are blown (see Figure 5-5). The axis of the control pontoons should be set athwartships to simplify resetting each between intermediate lifts.

Lift Pontoons

Lift pontoons are those whose external lift is needed to make up the positive buoyancy not available through self-lift or lift control. Lift pontoons are set at depths which will require the least adjustment after attachment to the slings, and, thus, will minimize work of the divers. Pontoons that can be set in positions which remain suitable for all lifts, including the final lift to the surface, should be set with the axis parallel to the submarine, otherwise it is more convenient to set them with the axis at right angles to the centerline of the submarine.

5.2.4. Rigging Pontoons for Tow to Salvage Area

The following steps should be taken to prepare the pontoons for tow to the salvage area:

1. Remove dessicant from each compartment and replace manhole covers.
2. Check operation of all valves and valve mechanisms; lubricate liberally. Verify dimension of drop pipe from top of tank and record.

3. Check relief valve setting and adjust to relieve at 8 psi.

4. Test each compartment as specified in Paragraph 5.2.2. Leave pressure in compartments.

5. Close all valves; leave relief valves gagged.

6. Tow as shown in Table 5-1, Drawing A.

NOTE: Drawings A to I are found at the end of Table 5-2 in this chapter.

5.2.5. Delivery and Responsibility

Transportation of the submersible pontoons to the salvage site is normally accomplished by towing, but if the distance is great, they may be placed on the main deck of a ship, such as a tanker, an LST, or a barge, in such a manner that they can be unloaded by rolling them over the side. Pontoons should be delivered to the salvage vessel with the white end forward. This provides a uniform arrangement, allows quick orientation of handling gear, and speeds up the operation.

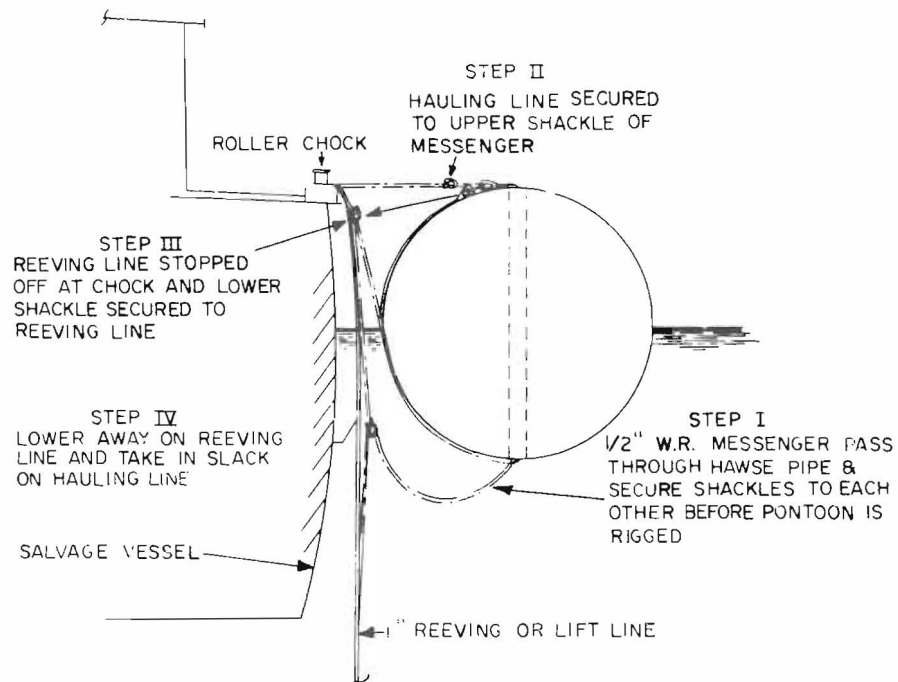
Responsibility for the pontoons belongs to the Commanding Officer of the salvage vessel. He must assign key persons to take charge of the pontoons. A system which has proven very satisfactory provides for assignment of one person to the white end of the pontoon and one person to the red end. These two men should be responsible for rigging and handling the respective pontoon ends from start to completion of the operation. The Salvage Officer should control the air supply and personally check the setting of all valves.

5.2.6. Preparation for Lowering

1. Thread a 1/2-inch diameter wire rope messenger, piece 35 (NOTE: Piece numbers refer to equipment in Table 5-1), through each hawsepipe and shackle two ends of each messenger together. If desired, this may be done before launching and prior to tow. If possible, this messenger should be placed so as to come between the pontoon and the ship. The pontoon is now ready to accept the 1-inch diameter reeving lines, piece 27 or 23 (Figure 5-7).

2. Vent down end compartments to atmospheric pressure (see step 4 of Paragraph 5.2.4.).

3. Attach air hoses, piece 44, to white and red end blow valves on the pontoon and to salvage vessel's air manifold.



METHOD OF PASSING REEVING LINES AND TAIL LINES THROUGH PONTOON HAWSEPIPE.
FIGURE 5-7

Lash hoses as near the blow connections on the pontoon as possible; this is to protect blow valve fittings.

4. Remove gag screws from relief valves and stow screws on salvage vessel.

5. Secure pelican hooks on nylon rope lowering line to long links on pontoon.

6. Attach 1-inch wire to reeving lines, piece 27 or 23, and haul through pontoon hawsepipes by means of the 1/2-inch wire rope messenger (see step 1). Keep all slack out of slings until pontoons have been attached to them and blown to positive buoyancy.

7. If the pontoon is to be attached to wire slings, slip cable clamps, piece 14, over combination wires until they rest on hawsepipe. However, if the pontoon is to be secured directly to the chain, omit the cable clamp but lash chain stoppers, piece 15 or 16, to pontoon near the hawsepipes before lowering.

8. To partially flood the pontoon, set valves as follows:

a. White end vent		shut
b. White end blow		open
c. White end flood		open
d. Center compartment blow		shut
e. Center compartment flood, structural No. 1-10 only		shut
f. End-to-end sluice		shut
g. Red end vent		shut
h. Red end blow		open
i. Red end flood		open

9. Check that the center compartment is clear of water by observing the telltale vent, then shut the telltale vent valve.

10. If the pontoon is to be at a depth of 200 feet or less, build up the pressure in it to 15 psig, close the center compartment blow valve, and remove the hose. The pontoons should not be set to depths greater than 200 feet unless relief valves have been installed on the center compartment.

If relief valves have been installed on the center compartment and the pontoon is to be set at a depth greater than 200 feet, attach a blowing hose to the center compartment blow valve and to the salvage vessel's blow and vent manifold and open the center compartment blow valve.

11. To complete flooding of the pontoon, open the white and red end vent valves; vent also through the hoses attached to the white and red end blow valves.

12. As the pontoon sinks, maintain it level and just below the surface by means of the lowering lines. Close the vent valves on the salvage vessel when venting through the hose stops. When all venting stops, close the red and white end vent valves.

13. If the pontoon is being set with its axis parallel to the submarine's centerline, open the end-to-end sluice and close the flood valve nearest to the end of the submarine being raised first. If the pontoon's axis is athwart the submarine's centerline, leave sluice valve closed.

14. The pontoon is now ready for lowering with both end compartments completely flooded and the center compartment entirely free of water and with an air pressure of 15 psig.

5.2.7. Pontoon Lowering and Setting

1. Pay out the lowering lines and hoses evenly until the pontoon reaches the desired depth. The lowering lines and hoses should be marked either by painting or with manila rope yarn in order that the depth of the pontoon can be quickly ascertained.

2. If the pontoon has relief valves fitted to the center compartment and is to be set at a depth greater than 200 feet, the pressure in the center compartment must be kept at about 5 psi greater than the mean depth of the pontoon.

3. Send divers down to report on the attitude of the pontoon and its absolute depth as well as its depth with respect to other pontoons previously set.

4. Adjust the pontoon depth and trim as necessary.

5. Have the divers secure chain stoppers to link of lifting chain at top of hawsepipe, or see that the wire rope cable clamps (flower pots) are seated at the top of the hawsepipe.

This will depend on whether chain or wire rope slings are being used. Have the divers tap the wedges on the cable clamps with a hammer to ensure that they are seated.

6. If a hose is attached to the center compartment blow valve, shut the blow valve, turn off the air, and vent down and remove the hose.

7. Divers now return to the surface.

5.2.8. Pontoons - Positive Buoyancy

1. A pontoon that is placed with its axis athwart the submarine's centerline, with the two ends of a single sling through its two hawsepipes, can be secured with positive buoyancy as soon as the diver is out of the water. To do this, simultaneously blow the white and red ends with compressed air for a short length of time. Secure the air and vent back the blow lines. If there is a small puff of air, but no sustained venting, then the water level has not been lowered to the end of the internal drop pipes. Blowing for a short time and venting back should then be repeated until the venting continues for an appreciable length of time and then suddenly stops. This indicates that the water level in the end compartments is at the level of the end of the drop pipes and the pontoon has been blown to positive buoyancy, and that the lowering lines may be removed. Slacking the lowering lines affords a further check on the buoyancy of the pontoon.

2. If the pontoons are being placed parallel to the submarine's centerline and with the two ends of the slings leading to two different pontoons, the first pontoon of each pair must be held with negative buoyancy while the second is being lowered (refer to steps in Paragraph 5.2.6). The four ends of the two pontoons must be blown to positive buoyancy while at the same time holding taut the four ends of the slings to prevent the slings from being hauled under the submarine by the first pontoon to reach positive buoyancy.

3. Divers should then go down and observe any leakage of air from the pontoon or connections. Take steps to correct any air leakage which may occur.

4. Trip the pelican hooks and retrieve the lowering lines. At this, the divers may be brought out of the water.

5. Tag and buoy-off the blowing hoses. The pontoon will need no further attention until the wreck is ready to be lifted.

6. Tag and buoy-off sling reeving lines.

7. At this stage, tow lines should be rigged to the submarine and to the surface craft and buoys placed in the direction of intended tow.

5.3. Breaking the Submarine Free of the Bottom

If conditions are such that the lift required to break the submarine free of the bottom may be large, and pontoons are used for control during breakout, the breakout will be accomplished as follows (refer to Figure 5-5B):

1. Recover buoyed-off hoses and connect to salvage vessel blowing manifold.

2. Blow completely all control pontoons on the end of the vessel which is to be lifted first.

3. Blow completely, in succession, remaining pontoons and tanks on the end to be lifted first until that end is lifted.

4. Secure open flood valves and sluice valve on surfaced pontoons.

5. Blow control pontoons on other end of submarine.

6. Blow, in succession, remaining pontoons and tanks on other end of submarine.

7. While blowing to lift the second end of the submarine, the draft of the control pontoons on the end, which was lifted first, should be observed to see that the blowing in progress does not unload those control pontoons. If necessary, submerged pontoons or tanks at the raised end should be reflooded to keep the control pontoons loaded to about one-half of their full lifting capacities.

8. When the second end lifts, close the flood and sluice valves on the surfaced pontoons.

9. After the breakout lift, the submarine is towed into shallower water and grounded.

5.4. Intermediate Lifts

After both ends of the submarine are afloat, observation of the draft of the control pontoon will give information as to the load being carried by them.

If the amount of water in the submerged pontoons and tanks can be accurately ascertained, the weight and longitudinal center of gravity of the submarine may be calculated and the distribution of lift can be altered if required in subsequent steps.

If suitable lifting vessels are not available and pontoons are to be used for succeeding phases of the salvage operation, proceed as follows (Figure 5-5D). After grounding the submarine following the breakout lift, only enough of the lower pontoons and/or tanks should be flooded to hold the ship firmly on the bottom while removing or resetting the control pontoons. By so limiting the negative buoyancy of the submarine, a large breakout force during the next lift can be avoided.

The revised salvage plan may permit removal of one or more pontoons because of the more accurate information available and/or the reduced breakout force required. The procedure for removing a pontoon is as follows:

1. Pick up and hold slings taut.
2. Rig pontoon lowering lines.
3. Install 1/2-inch diameter wire rope lines as bridles on the cable clamp wedges and take tension on bridle if wire slings are being used.
4. Open pontoon end compartment flood and vent valves and flood pontoon until cable clamps or chain stoppers are free.
5. Remove cable clamps or chain stoppers.
6. Haul pontoon to surface.
7. Blow pontoon dry.
8. Remove slings or reeving lines from hawsepipes.

If pontoons are to be used for control during the next lift, they should be reset to the new lower position on the slings. This is accomplished by first freeing the cable clamps (steps 1 to 5), then lowering the pontoon and setting it as described in Paragraph 5.2.6., steps 1, 2, 3, 4 and 6.

Proceed to make the lift as described in Paragraph 5.3., steps 1 through 9.

If surface lift ships, cranes, or barges are available, the more accurate information now available and the smaller breakout force to be encountered on the next lift will permit them to be used for control with safety. In this case, proceed as follows:

1. Remove those control pontoons no longer needed.
2. Reset other control pontoons which are needed, in addition to the surface lift, to a lower position on their slings.
3. Take one sling at each end of the submarine to a lift ship.
4. Take maximum lift permitted by available lifting vessels and sea conditions on each lift ship.
5. Blow pontoons and tanks until both ends can be lifted. Take care that pontoons do not come up beneath the lift craft.
6. Monitor loads on surface-lifting gear to ensure that they are carrying a load, otherwise the submarine may become light enough to float without any surface lift.
7. Continue lifting until pontoons arrive at the surface. Keep the submarine reasonably level during lift to minimize the effect of free surface.
8. As the lift progresses, tow the submarine shoreward and adjust the lift by surface ships so as to keep the submarine just above the bottom.
9. When the submarine has been raised to the least depth at which the salvage vessels can move freely over her at all stages of the tide, stop the lift and continue to tow shoreward until the submarine grounds; then rig for the final lift.

5.5. Towing

Towing should be at a very slow speed so as to avoid damage to the lifting gear when the submarine grounds. The towing vessel pulls the submarine and one of the lift ships, which is in turn towing the buoys for the sling reeving lines and the other lift ship. The second lift ship should be towing a small tug or other craft which will prevent her from overriding the tow. Hoses to the pontoons and to the submarine should be retained on the salvage vessel which has been furnishing air for the salvage operation.

Presumably, the salvage vessel is one or both of the lift ships; but even if it is another vessel, it should be towed by the second lift ship or a large towing vessel attached to the second lift ship. In this case, the salvage ship should be towing the small tug mentioned above.

If the lift has been made with pontoons for control, the towing vessel should tow the submarine only. The salvage vessel is towed by the submarine and, in turn, tows some craft which can prevent her from overriding the submarine and pontoons.

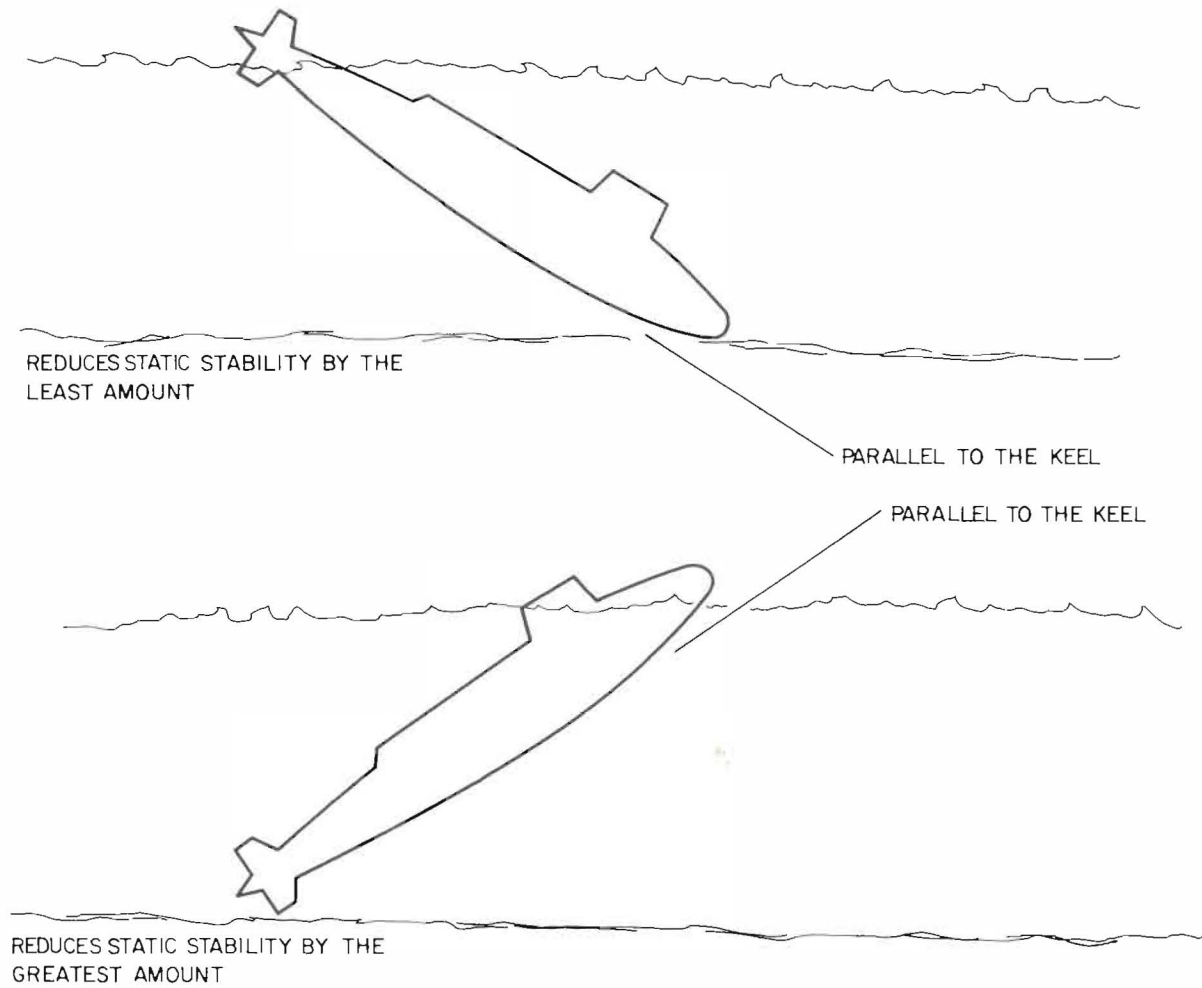
5.6. Final Lift to the Surface

For the final lift it is necessary to bring the submarine to a draft which will permit it to enter the selected harbor. Pontoons must now be placed longitudinally and alongside the submarine (Figure 5-5E). Since there will not be room to place one pontoon above another on the same slings, and two slings will now be needed for each pair of pontoons, additional slings will probably be needed. Messenger wires for these slings can be swept under the submarine before final grounding and after the last intermediate lift, to obviate tunneling for the new slings.

Since only a single level above the bottom of the submarine is now available for pontoons, space may not be available for enough pontoons to make the lift without some additional self-buoyancy. (Refer to Chapter 6 for means of providing self-lift.)

Even though it may be possible to float the submarine using self-lift, stability considerations may render it desirable to use some pontoons for the final lift. For this lift, it will usually be better to raise the stern first. When the first end has been surfaced, that part of the submarine which is resting on the bottom, and at which the bottom or ground reaction is applied, will generally be at a higher waterline plane on the submarine if it is at the bow, than if it is at the stern (bottom of the rudder); it will therefore cause less reduction in stability in this condition (Figure 5-8).

Since the improvement in stability provided by the pontoons can be transmitted to the submarine only by the friction of the slings, the pontoons at each end should be fully blown before lifting that end so that the slings will be well loaded when the first end lifts. While the other end is being made buoyant, the pontoons on the surface should be kept loaded to near capacity by reducing the self-lift or lift pontoon buoyancy at that end, if necessary.



GROUND REACTION AT BREAKOUT.
FIGURE 5-8

When the second end leaves the bottom, the change in attitude is likely to cause further blowing of residual water from tanks which could not be fully blown with only one end of the submarine on the surface. In addition to this gain in buoyancy, the tank being blown at the time the ship leaves the bottom will be further blown by the expanding air in it. The sequence of blowing tanks and compartments should be such as to minimize the gain in buoyancy as the second end rises.

After the second end of the submarine has been raised, its pontoons should also be kept well loaded so as to maintain adequate stability during the tow into port.

5.7. Towing the Submarine into Port

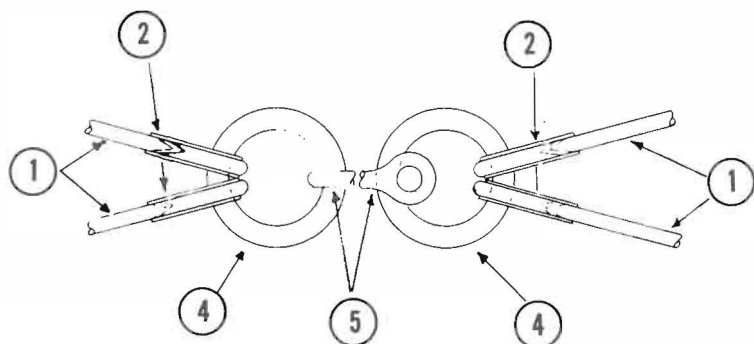
After the final lift to the surface, the towline should be from the towing vessel to the submarine. A towline is needed from the stern of the submarine to the salvage vessel which controls the venting and blowing of tanks and pontoons to ensure keeping the salvage vessel near enough to the submarine to avoid danger of breaking the hoses.

TABLE 5-1
SUBMARINE SALVAGE MATERIAL POOL
EQUIPMENT LIST

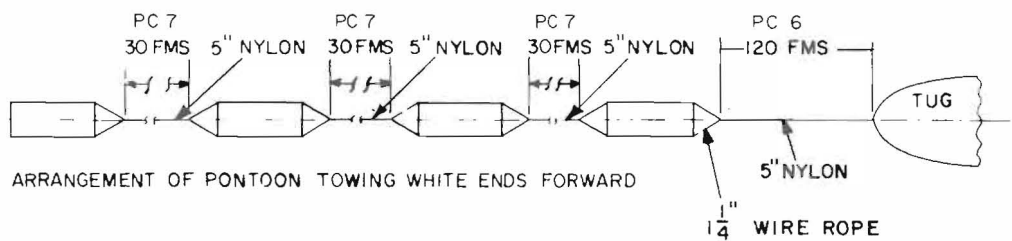
Pc No.	Equipment	Amount Required	Specifications or Federal Stock No.	Remarks
<u>Pontoon Towing Bridle Assembly</u>				
1	Towing Bridle, 1-1/4" Wire Rope	28	9Z4010-286-7640	6X25 IPS Fiber Core Preformed Wire Rope-Mil.RR-W-410
2	Thimble, Wire Rope 1-1/4"	56	9Z4030-266-0075	For Pc 1;Mil.FF-T-276 Galvanized
3	Rope Coupling for 5" Circ Nylon Rope	16	Stainless Steel	BuShips Dwg S805-2130889
4	Towing Ring	14	Med Steel	U.S. Navy Drop Forging Die Book No. 3307-B
5	Shackle,Chain Type 1-3/4" Galvanized	42	9Z4030-290-4092	Chain Shackle - Safety, Bolt Type, BuShips Dwg S2500-921727 & 921728
6	Towing Line 5" Circ Nylon Rope	2	9Z4020-752-8880	100 Fathoms Long; Mil. R-17343
7	Towing Line 5" Circ Nylon Rope	6	9Z4020-752-8880	30 Fathoms Long; Mil. R-17343
NOTE: Items 6 and 7 are held by supply activities because of their short life and will have to be requisitioned when needed.				
8	Link, Detachable 2-3/4" Dielock	14	None - (retain G-4010-149-5638 for Identifica- tion)	BuShips Dwg 2603-921790

5-21

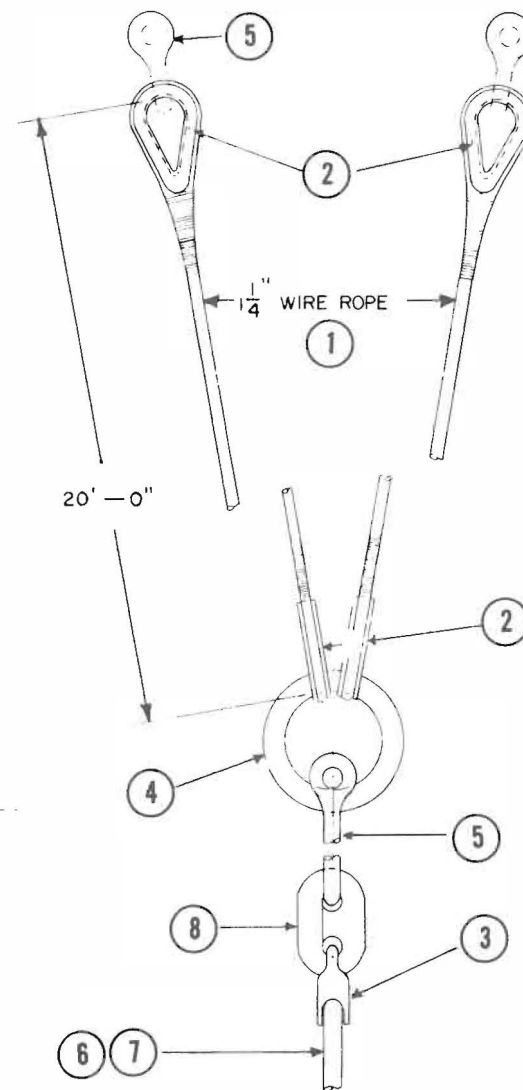
Lifting and Towing 5.



BRIDLES SHACKLED TOGETHER



ARRANGEMENT OF PONTOON TOWING WHITE ENDS FORWARD



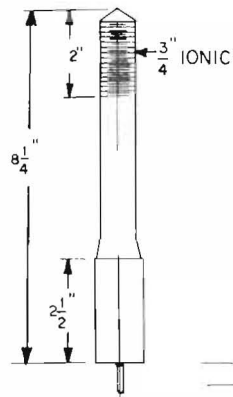
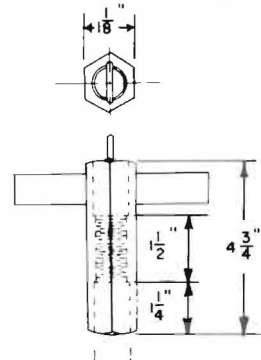
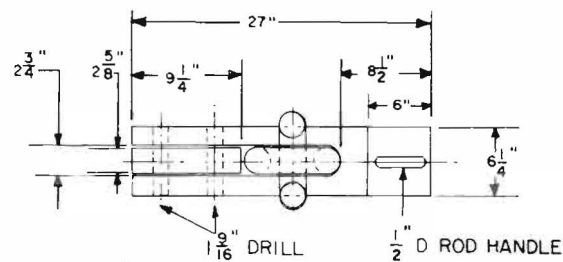
PONTOON TOWING BRIDLE

PONTOON TOWING BRIDLE ASSEMBLY.
DRAWING A

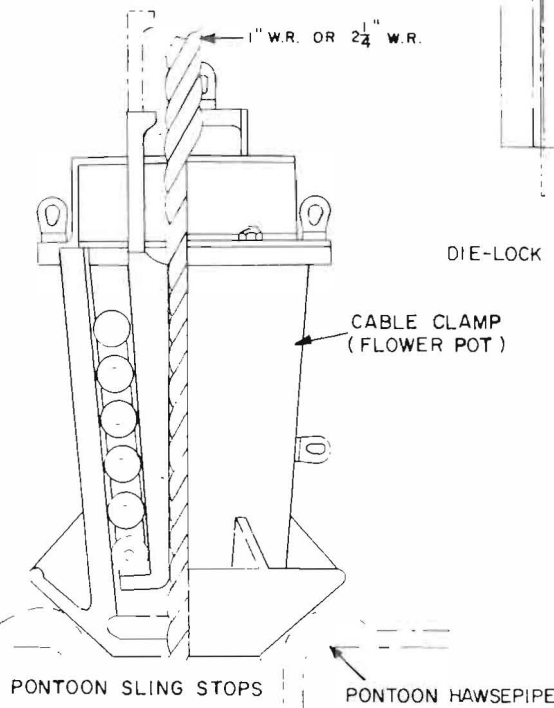
TABLE 5-1 (Cont)

Pc No.	Equipment	Amount Required	Specifications or Federal Stock No.	Remarks
<u>Pontoon Lowering Assembly</u>				
9	Lowering Line, 5" Circ Nylon Rope	6	924020-752-8880	100 Fathoms Long, Mil. R-17343 Rope Coupling One End - Pc 11
10	Lowering Link/Stiffener	25 (5 spare)	Med Steel	Fabricate and Attach to Pontoon as shown
11	Rope Coupling for 5" Circ Nylon Rope	6	Stainless Steel	BuShips Dwg, S805-2130889
12	Pelican Hook, 1-3/4" Swing Release	6	924030-369-3976	BuShips Dwg, S2605-852066
13	Link, Detachable	12	None-(Retain G-4010-149-5642 for Identification)	1-5/8" Dia Dielock 1-1/4" Dia Dielock BuShips Dwg S-2603-921790
<u>Pontoon Sling Stops</u>				
14	Cable Clamps(Flower Pot)	20		BuShips Dwg 149232
15	Chain Stopper, Complete	40	Med Steel	Fabricate as Shown, for 2-1/2" Dielock Chain
16	Chain Stopper, Stud-Link	40	Med Steel	Fabricate as Shown, for Stud-Link Chain
17	Toggle Bolt	100	Med Steel	Use with Pc 16

NOTE: (Applicable to items 15, 16 and 17) All new lifting chain Pc-25 will be dielock link chain, and new chain stoppers, Pc 15, are required when used. The stocking of stud-link chain stoppers, Pc-16 & 17 will be maintained until dielock link chain completely replaces the stud-link chain.

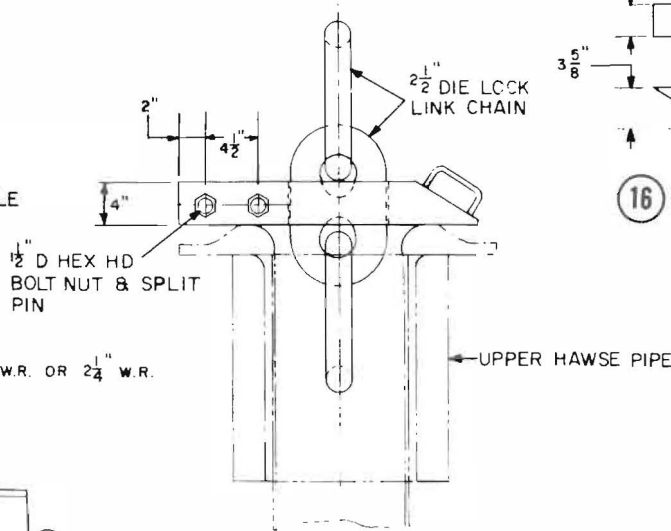


TOGGLE BOLT (17)

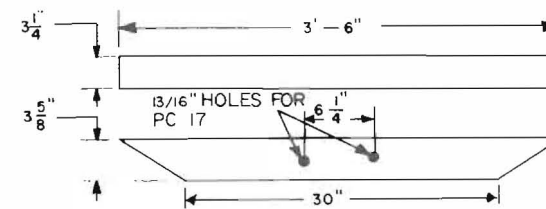


PONTON SLING STOPS

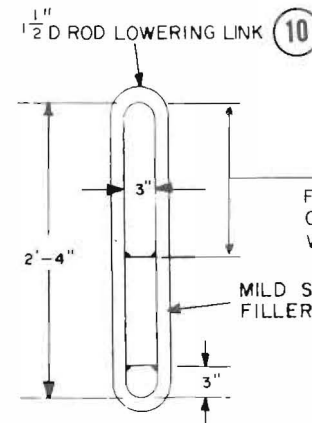
(14)



DIE-LOCK CHAIN STOPPER (15)

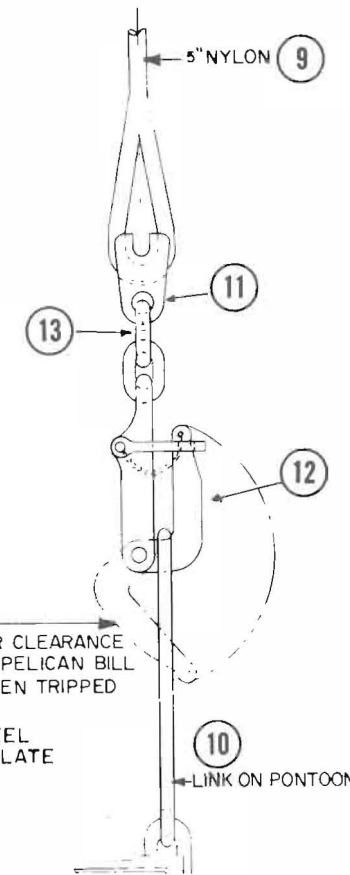


(16) STUD-LINK CHAIN STOPPER



MILD STEEL FILLER PLATE

FOR CLEARANCE OF PELICAN BILL WHEN TRIPPED



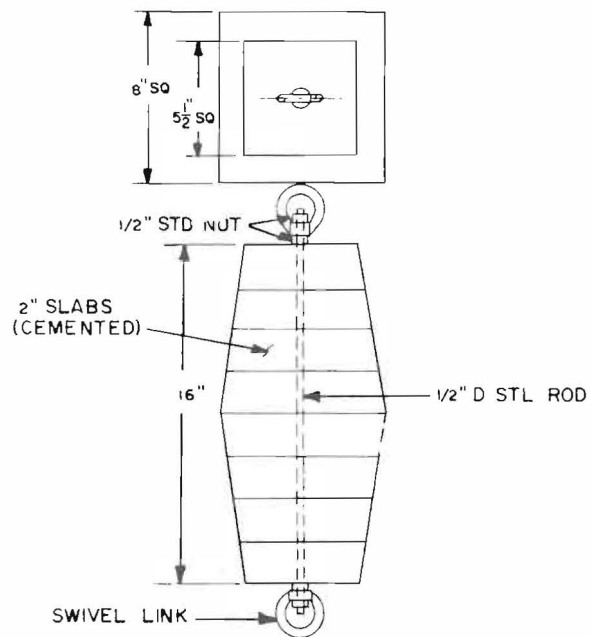
PONTON LOWERING ASSEMBLY

PONTON SLING STOP AND PONTON LOWERING ASSEMBLY.

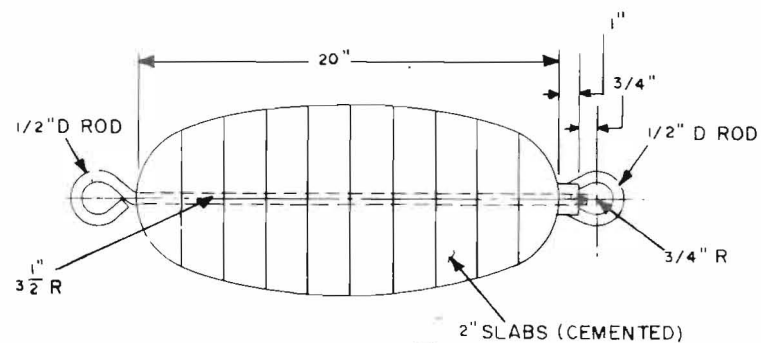
DRAWING B

TABLE 5-1 (Cont)

Pc No.	Equipment	Amount Required	Specifications or Federal Stock No.	Remarks
<u>Buoys</u>				
18	Roebling Buoy	10	Med Steel	Fabricate as Shown
19	Diver's Marker Buoy (Cork)	100	Cork	BuShips Dwg S9400-921-598
20	Spherical Buoy	25	Med Steel	Fabricate as Shown
<u>NOTE:</u> Harbor defense, 36-inch diameter buoy is an acceptable substitute.				
<u>Special Wrenches</u>				
21	Wrench, for Submarine Salvage Deck Fittings	12	9Q5120-371-8696	Or as Shown
22	Wrench, for Pontoon Flood Valves	6	Med Steel	Fabricate as Shown

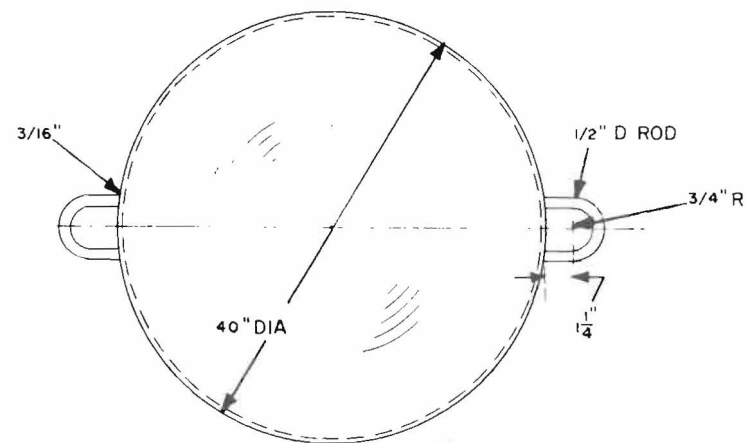


BUOY (CORK) (19/1)

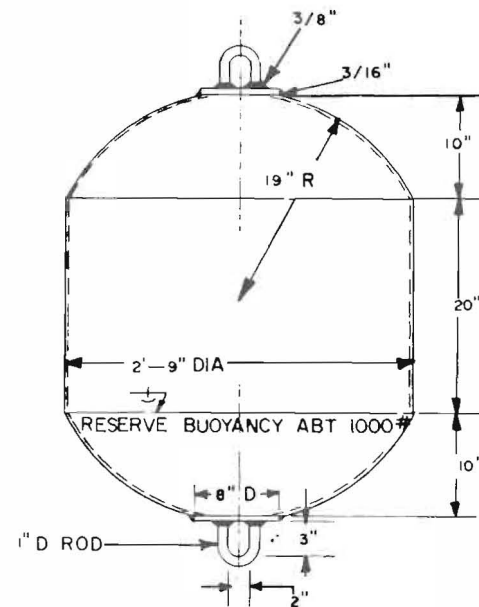


BUOY (CORK) (19/2)

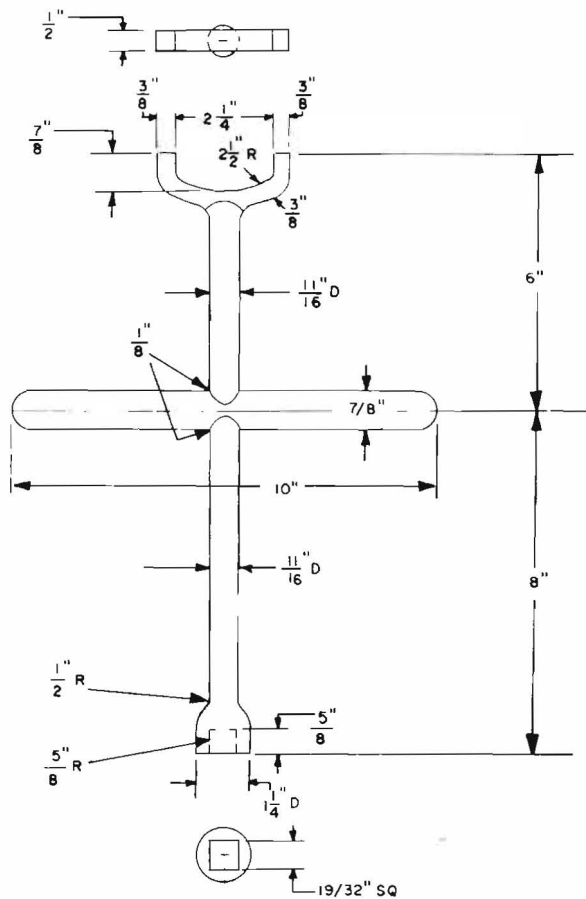
BUOYS.
DRAWING C



SPHERICAL BUOY (20)



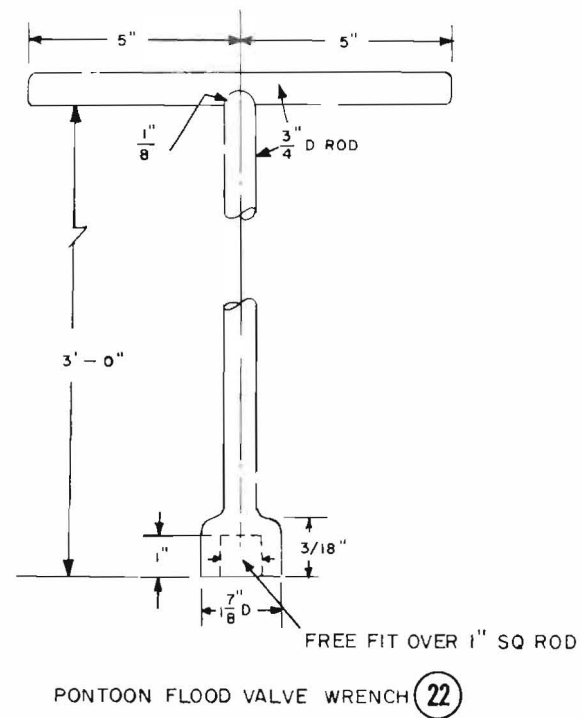
ROEBLING BUOY (18)



WRENCH FOR SALVAGE DECK FITTINGS (21)

SPECIAL WRENCHES.

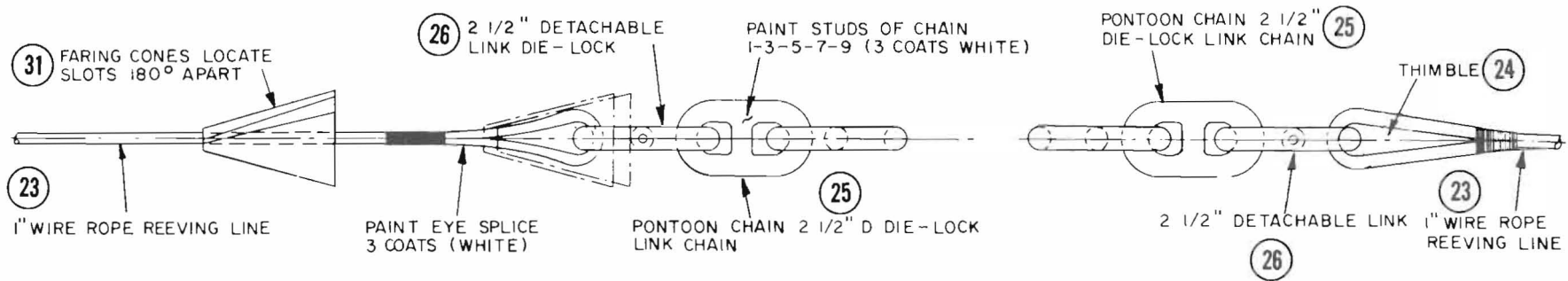
DRAWING D



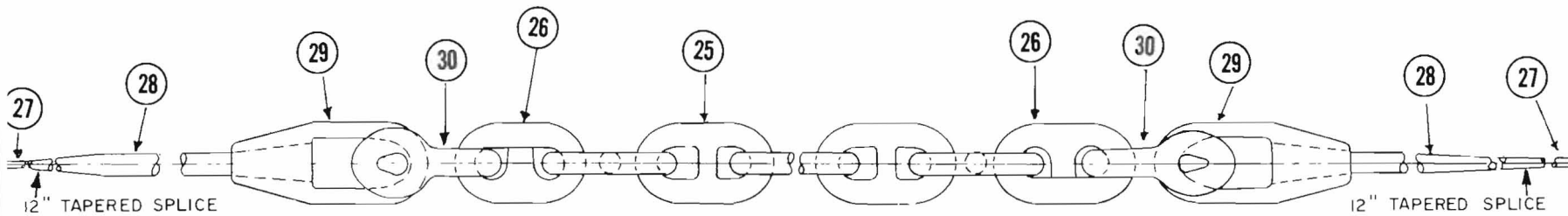
PONTON FLOOD VALVE WRENCH (22)

TABLE 5-1 (Cont)

Pc No.	Equipment	Amount Required	Specifications or Federal Stock No.	Remarks
<u>Handling Lines and Chain</u>				
23	Reeving Line, Shallow Lift 1" Wire Rope	12	9Z4010-272-8846	6x25, IWRC, IPS, Preformed, 300 Feet Long, Thimble One End, Pc 24. Mil. RR-W-410
24	Thimble, Wire Rope 1"	12	9Z4030-266-0071	Galvanized, Mil. FF-T-276, for Pc 23
25	Chain, Lifting Sling, 2-1/2" Dielock	12	2H4010-165-5627	25 Fathoms Long, BuShips Dwg S2603-860341
26	Link, Detachable 2-1/2" Dia Dielock	45	1H4010-165-5627	BuShips Dwg S2603-860062
27	Reeving Line, Deep Lift, 1" Wire Rope	20	9Z4010-272-8846	6x25, IWRC, IPS, Preformed, 600 Feet, One End Spliced to Pc 28. Mil. RR-W-410
28	Lifting Line, 2-1/4" Dia Wire Rope	20		6x37, IPS Fiber Core, Preformed, 250 Feet, One End Spliced to Pc 27, Closed Socket One End, Pc 29. Mil. RR-W-410
29	Socket, Closed, 2-1/4"	20	9Z4030-221-0776	For Pc 28. Galvanized. Mil. RR-S-550
30	Shackle, Chain Type 2-7/8" Connecting	20	9Z4030-164-6662	With Pc 29, BuShips Dwg 601-1992102



DETAIL OF PONTON CHAIN
AND LIFT LINES FOR SHALLOW WATER OPERATION

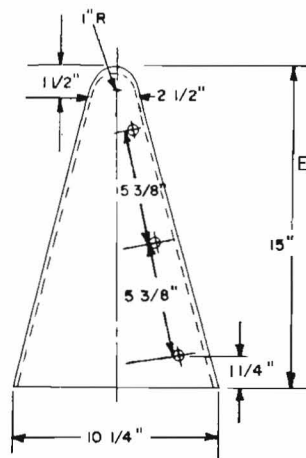
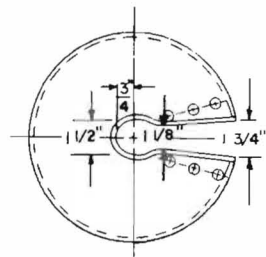


ASS'Y OF PONTON CHAIN &
COMBINATION LIFTING AND REEVING LINES

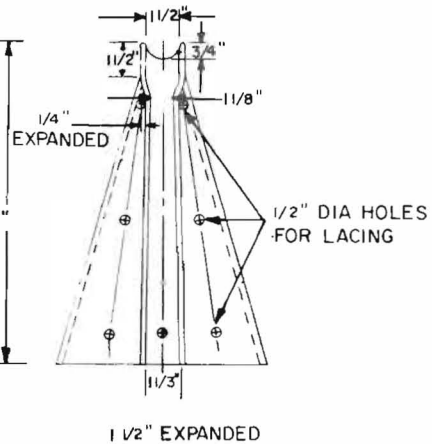
HANDLING LINES AND CHAIN.
DRAWING E

TABLE 5-1 (Cont)

Pc No.	Equipment	Amount Required	Specifications or Federal Stock No.	Remarks
<u>Special Fittings</u>				
31	Fairing Cone	30	Med Steel	Fabricate as Shown
32	Reeving Plate, Complete	2	Med Steel	Fabricate as Shown
<u>Hose Fittings</u>				
33	Air Hose Couplings	450 (50 Spare)	Brass	Fabricate as Shown, 225 Male & 225 Female
34	Air Hose Salvage Connection Assembly	100	9C4730-241-8102	BuShips Dwg SN9400-921627
<u>Other Equipment</u>				
35	Reeving Line, Messenger 1/2" Wire Rope	20	9Z4010-286-7718	6x37 IPS, Fiber Core, Pre-formed, 36 Feet long, Thimble Both Ends- Pc 36, Mil. RR-W-410
36	Thimble, Wire Rope 1/2"	40	9Z4030-266-0066	For Pc 35. Galvanized. Mil. FF-T-276
37	Shackle, 3/4", Screw Anchor	40	9Z4030-242-5575	With Pc 36. Mil. RR-C-271
38	Reeving Wire, 1/4" Wire Rope	3	9Z4010-273-2901	6x19 IPS, Fiber Core, Pre-formed, 80 feet long, Use with Salvage Lance. Mil. RR-R-571, Pc 41



FAIRING CONE

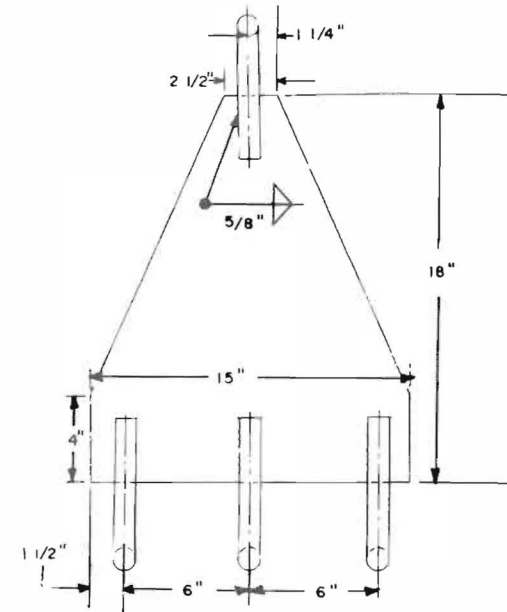


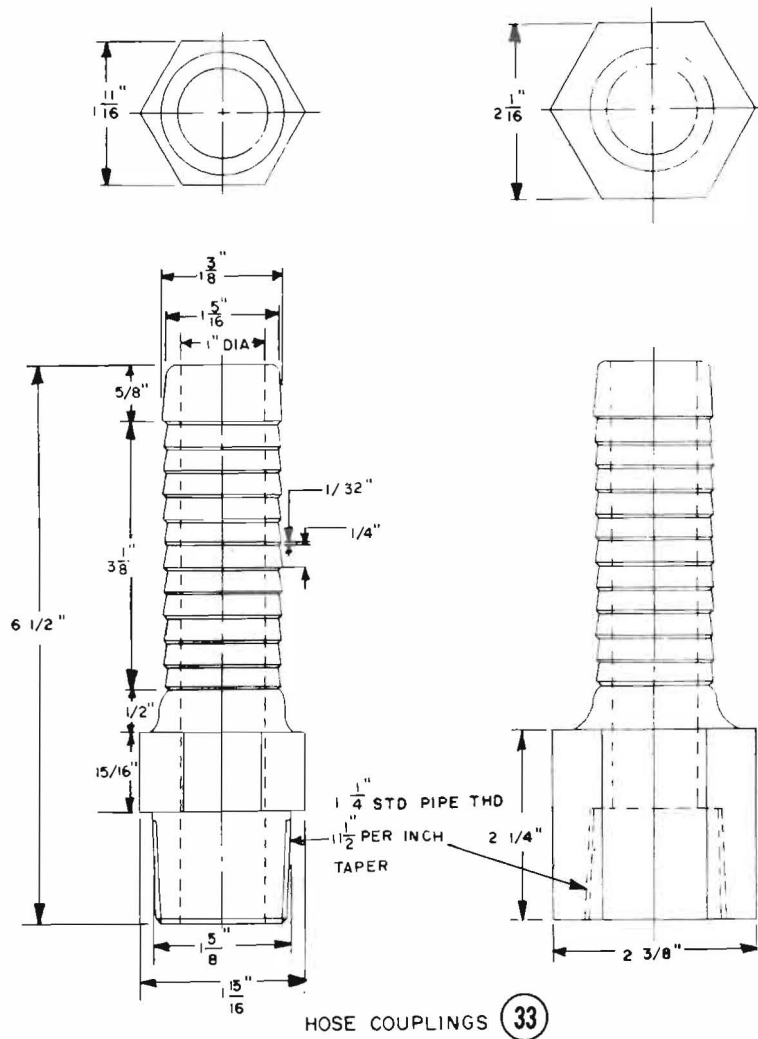
1 1/2" EXPANDED

31

SPECIAL FITTINGS.**DRAWING F**1" DIA ROD BENT TO
TAKE CONNECTING
SHACKLE

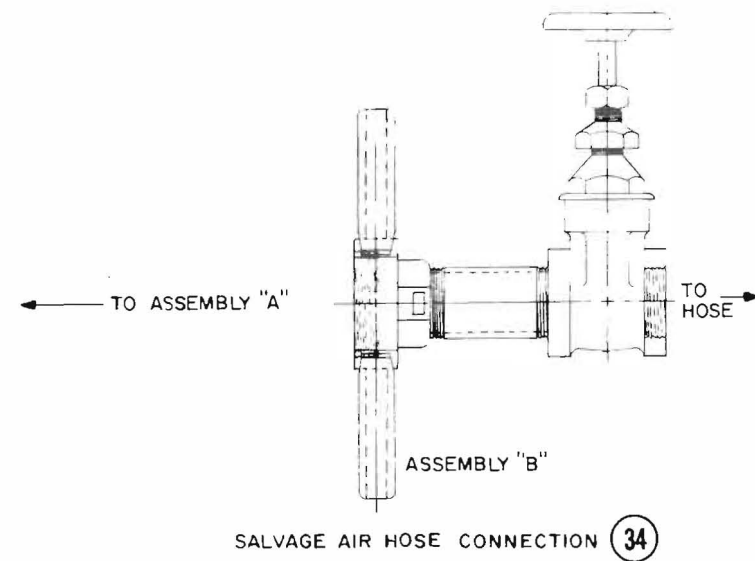
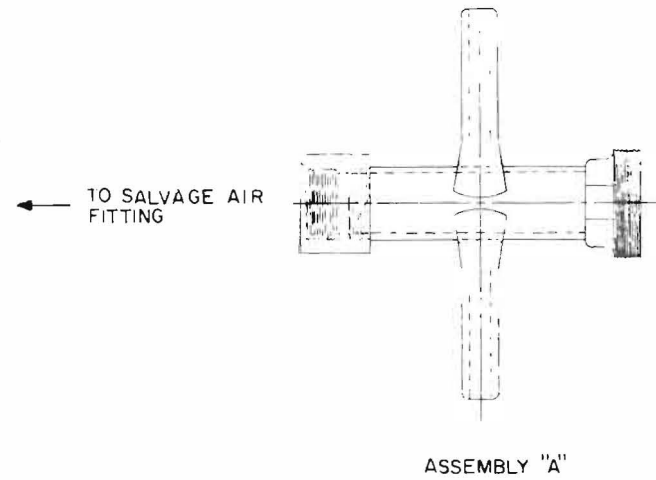
REEVING PLATE 32



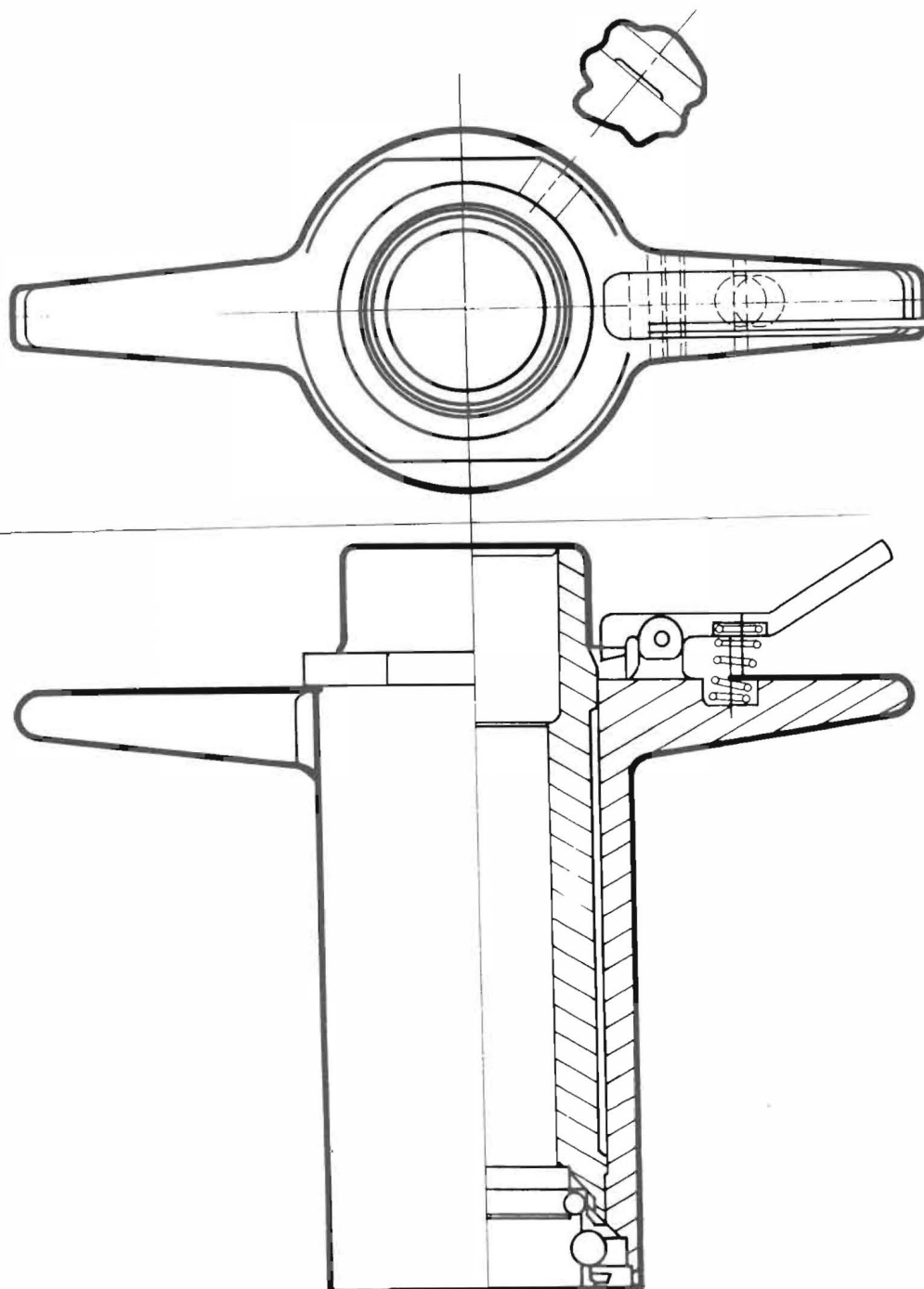


HOSE COUPLINGS (33)

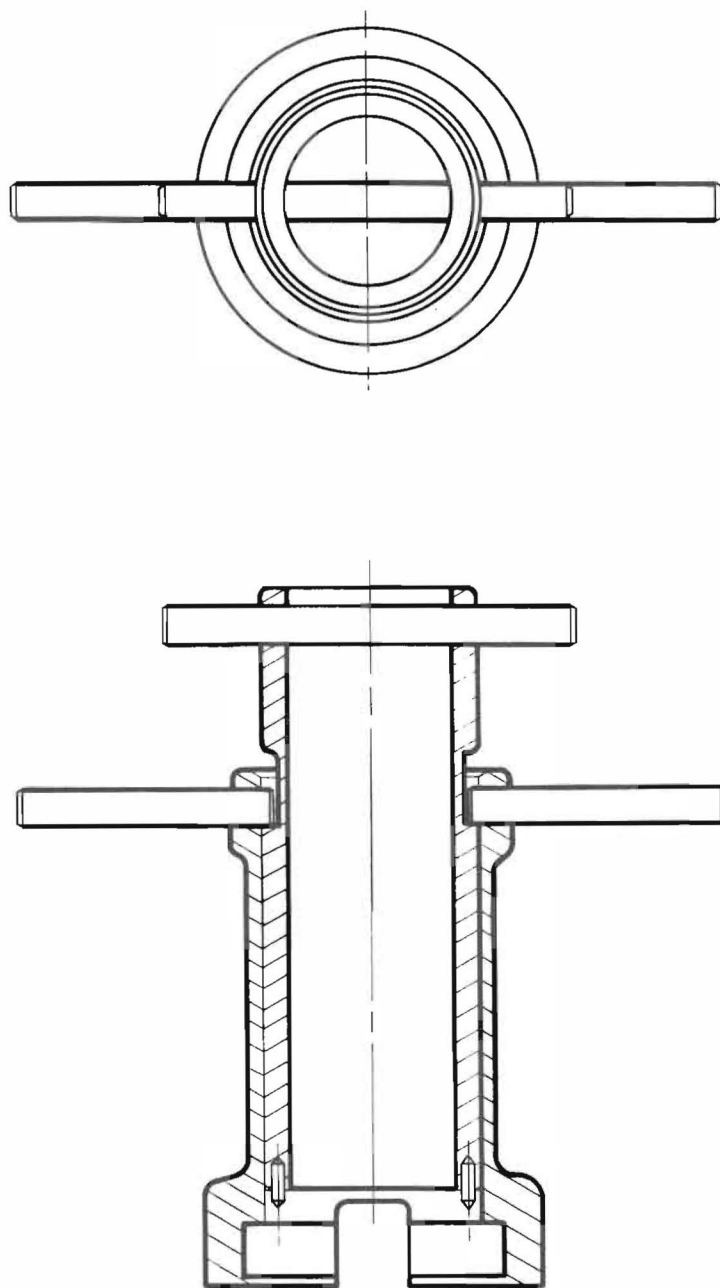
**HOSE FITTINGS.
DRAWING G**



SALVAGE AIR HOSE CONNECTION (34)



QUICK RELEASE COUPLING ASSEMBLY
ROYLYN 7714, AIR SALVAGE.
DRAWING H



SUBMARINE ROYLYN CAP REMOVAL
TOOL, AIR SALVAGE.
DRAWING I

TABLE 5-1 (Cont)

Pc No.	Equipment	Amount Required	Specifications or Federal Stock No.	Remarks
<u>Other Equipment</u>				
39	Thimble, Wire Rope 1/4"	6	9Z4030-266-0062	For Pc 38. Galvanized. Mil.FF-T-276
40	Tool Sets for Dielock Chain Links	2	1H4010-272-8705	Use with Pc 13 & 26
41	Salvage Lance	2	None-(Retain H4220-151-7712 for Identification)	BuShips Dwg 365240
42	Washing Nozzle	2		Falcon Type, BuShips Dwg 138917
43	Cement Gun	2	Med Steel	BuShips Dwg 147043
44	Air Hose, 1-1/4" Dia	200	9C4720-230-6522	50-Foot Lengths. Mil.H2699, Type B, Working 100 psi; Burst 600 psi
45	Air Hose Clamps	1300		For Pc 44 and 33.Mil.F-2808
46	Fire Hose, 2-1/2" Dia	20	9C4210-202-8188	50-Foot Lengths
<u>NOTE:</u> Items -- 44 and 46 are held by supply activities because of their short life and will have to be requisitioned when they are needed.				
47	Special Air Coupling Assembly	40	1H4730-789-0215	Roylyn Corp., Glendale, Calif. Part No.7714. Will be required for New Type Salvage Nipples on Submarines
48	Cap Removal Tool, Air Salvage	5		Part No. 0160-0003

TABLE 5-2
DISPOSITION OF SUBMERSIBLE PONTOONS

Structural No. & Type	Net Lift (tons)	Net Wt. (tons)	Length (ft.)	Diameter (ft.)	Location
2,3,6,7,9, 10, Type I	85	38.4	34' 7/8"	13' 13/4"	1st Naval District Boston, Mass.
31,32, Type III	80	35	32	12-1/2'	1st Naval District Boston, Mass.
63 & 64 Type IIIA	90		34	13	1st Naval District Boston, Mass.
1,11,12,14 Type II	80	40.1	32	12-1/2'	Supervisor of Shipbuilding, Conversion and Repair San Diego, California
15,19,53, 54, 55 Type III	80	35	32	12-1/2'	Supervisor of Shipbuilding, Conversion and Repair San Diego, California
75 Type IIIA	90		34	13	Supervisor of Shipbuilding, Conversion and Repair San Diego, California
65 to 74 Type IIIA	90		34	13	14th Naval District Pearl Harbor Naval Shipyard Pearl Harbor, Hawaii
33 to 40 Type III	80	35	32	12-1/2'	Charleston Naval Shipyard Charleston, South Carolina
61, 62 Type IIIA	90		34	13	Charleston Naval Shipyard Charleston, South Carolina