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THE DUKW

ITS OPERATION AND USES

G-5 SECTION, AP&SC



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HEADQUARTERS UNITED STATES ARMY FORCES, PACIFIC OCEAN AREAS

15 October 1944

MANUAL: The DUKW: Its Operation and Uses.

The Standing Operating Procedures and technical data outlined in this manual are the results of practical study and recent experience in the European and Pacific Theaters. They are published to provide up-to-date information designed to promote the most efficient utilization of DUKWs in current and future operations. Intended primarily for the guidance of DUKW operating personnel, this manual is also valuable for officers planning amphibious assault operations, as well as those charged with supply activities in undeveloped ports.

By Command of Lieutenant General RICHARDSON:

O. N. THOMPSON,
Colonel, AGD.
Adjutant General.

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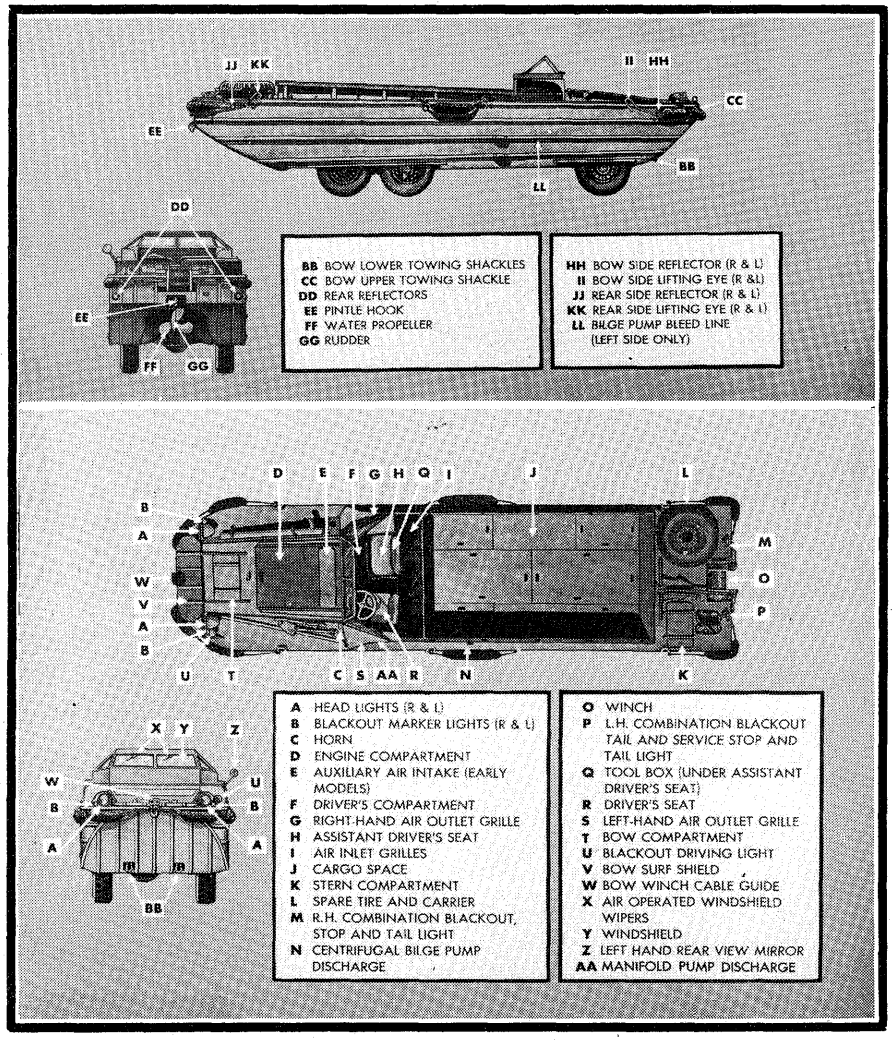
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CHAPTER I
GENERAL DESCRIPTION

1. *General*: The DUKW described herein is an amphibious conversion of the standard Army 2½-ton 6x6 truck. Thus the DUKW has similar automotive characteristics to the parent truck. In addition, it is equipped with an integral water-tight welded steel hull. The thickness of the bow is approximately ⅛", the bottom approximately 3/32", and the sides approximately 1/16". For land operations the vehicle uses six driving wheels



Location of Various Parts

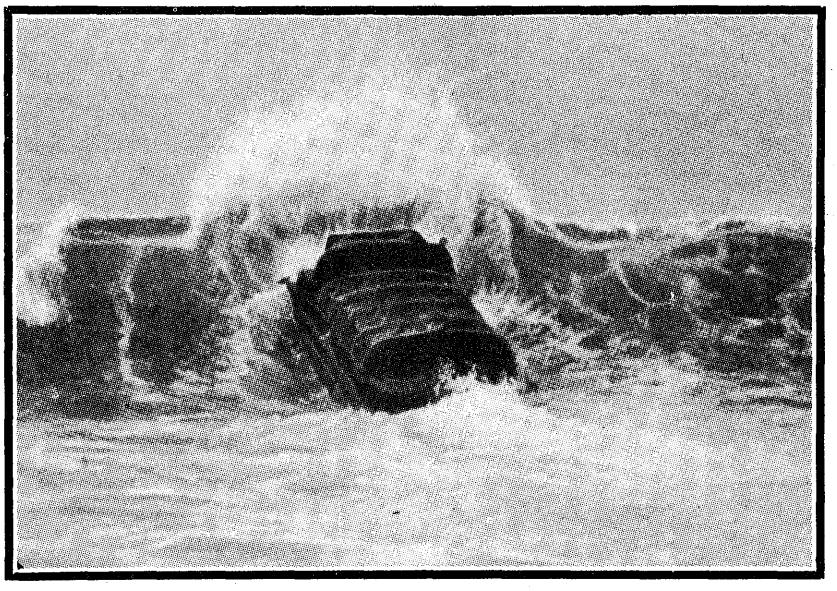
—driven by a six cylinder valve-in-head gasoline engine developing approximately 90 horse-power net. For water operations the DUKW is driven by a 25-in. diameter, 14-in.

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pitch, three-bladed weedless propeller, driven by the engine through the transmission and a water propeller transfer case. As a truck, the front wheels are steered in the conventional manner. When operating in the water, steering is accomplished by a rudder interconnected to the truck steering gear. There are two propeller shaft-driven bilge pumps of approximately 250 gallons per minute total capacity, and in addition there is a 25 gallon per minute hand pump.

2. *Capabilities*: a. In the absence of adequate port facilities, the DUKW provides a most effective means of moving supplies from ship to dump, rail head or transfer point on shore.

b. Large volumes of cargo can be moved through restricted beaches. Congestion at beach is eliminated as is the slow, difficult and dangerous cargo handling from beached boat to land conveyance.



DUKW In Heavy Surf

c. Beach performance is excellent, far exceeding that of other wheeled equipment. This results from use of large desert type tires with tire pressure controllable by driver while the DUKW is in motion.

d. Surf performance is excellent due to low center of gravity and simultaneous traction in water and on land. A ten-foot surf can be negotiated safely.

e. The DUKW can negotiate offshore bars, reefs and coral which present an obstacle to landing craft.

f. Each DUKW is equipped with a power winch with 10,000 pound line pull, and may be fitted with an "A" frame to serve as a temporary crane with a 5,000 lb. capacity.

3. *Limitations*: a. The DUKW is not an assault vehicle. Its relatively light skin affords no protection from enemy fire.

b. DUKWs must operate in areas free from soft mud, swamps, marshes, quicksand, stumps, wreckage, wire, large rocks and boulders.

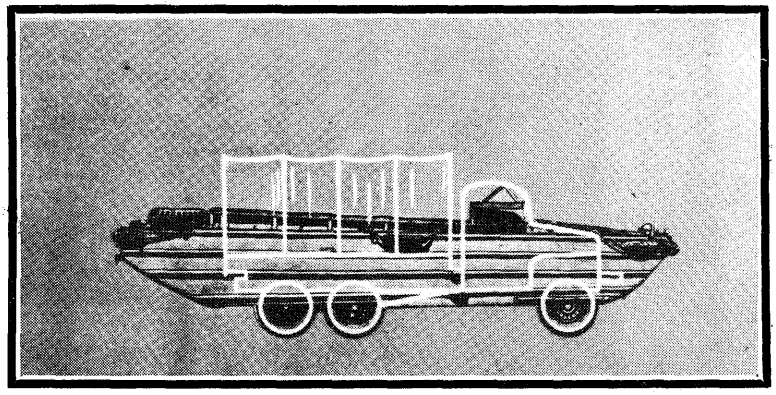
c. Limited water speed makes long water hauls unprofitable.

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d. Limited reverse power and the fact that bilge pumps operate only when propeller shaft is turning forward, make special DUKW mooring system imperative. (See Chapter XV.)

e. Size of vehicle is small and freeboard low in comparison to loads carried. Therefore, size and number of drafts and position of cargo must be suited to existing conditions.

f. Design requires that all cargo be put in or out *over* the side. The advantages of a ramp or even a truck's tail gate are not available.



DUKW Compared To 2½ Ton Land Truck

4. *Cargo Space*: Cargo space is 149" long, 82" wide, and approximately 28" deep. It has a ¾" plywood removable floor which should be protected by the use of dunnage for any cargoes producing concentrated loads. Cargo space can be covered by a tarpaulin, either directly over the cargo or over removable steel bows. Capacity is 5,000 to 10,000 pounds of cargo, depending on conditions of operation. (See paragraph 156 for details.) If carrying personnel, the capacity is 25 fully equipped combat troops.

5. *Crew*: The normal crew is two men, consisting of the driver, who can completely operate the vehicle, plus an assistant driver or gunner.

6. *Armament*: Each DUKW has sockets for installation of a scarf ring mount which can carry a .50 caliber machine gun. The present Army T/O supplies 13 machine guns and mounts per company of 50 DUKWs.

7. *Characteristics Of The DUKW*:

a. Dimensions:

Length Overall	31′ 0″
Height—top up	8′ 11″
Height—top and windshield down	7′ 6″
Width—overall	8′ 4″
Ground Clearance—hull	1′ 5″

b. Freeboard and Draft—5,000 lb. load

Freeboard to deck—bow	1′ 11″
Freeboard to deck—rear	1′ 3″
Freeboard to coaming	2′ 6″
Draft to front wheels	3′ 8″
Draft to rear wheels	4′ 4″

c. Weights:

Fully equipped—no pay load—15,000 pounds.

Loaded, 20,000 to 25,000 pounds, depending on load.

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d. Maneuverability:

Turning circle on land—70′ diameter.

Turning circle on water—40′ diameter.

e. Performance:

On land: 50 m. p. h. maximum, and average consumption of gas, 4.0 gals. per hr.

Afloat: 5000 pound load, smooth water.

2nd Gear, 2500 RPM—6.0 Land Mi. Speed using 6.8 gal. gas per hr.

2nd Gear, 2200 RPM—5.3 Land Mi. Speed using 4.4 gal. gas per hr.

3rd Gear, 1000 RPM—4.8 Land Mi. Speed using 3.2 gal. gas per hr.

3rd Gear, 800 RPM—4.0 Land Mi. Speed using 1.6 gal gas per hr.

Reverse Maximum, 2.2 miles per hr.

CHAPTER II

EMPLOYMENT AND SPECIAL USES

8. *Cargo Over Undeveloped Beaches*: The prime function of DUKWs is to handle cargo from ship directly to dump or transfer point, over undeveloped beaches.

9. *Cargo In Damaged Ports*: Where dock facilities are damaged or blocked, DUKWs can unload from ship to transfer point, warehouse or rail head using a prepared landing spot. The smooth water afforded by the harbor together with easy (prepared) landing allows maximum loads to be carried, and affords most efficient operations.

10. *Division of Work With Landing Craft*: The DUKW can operate over offshore bars, shoals and coral which preclude the use of landing craft. The low center of gravity, the combined traction and steering on land and water, and the elimination of need for stopping in the breakers, makes possible operation of DUKWs in surf too heavy for landing craft. Where both DUKWs and landing craft are using the same beach, a suitable landing should be marked for the DUKWs, and boats kept off that spot.

11. *Division of Work With LVT*: In operations where both LVTs and DUKWs are used, the work should be apportioned so the LVTs do the assault work for which their armor makes them suitable, and for operations involving mud, swamps, wire, heavy brush and all land impassable to wheeled vehicles. DUKWs are not suitable for assault work under fire, but should do the supply work, as they can maneuver better at ship's side, and can operate ashore with a minimum of damage to roads and communications.

12. *Division of Work With Land Trucks*: DUKWs are much better suited to sand and beach operations. Trucks should be used for all possible land operations beyond two miles from the beach, primarily to permit DUKWs to perform water operations where the trucks can not be used, and secondarily because the trucks are lighter, shorter, easier to maneuver, and require less maintenance. Also because the small heavier tires of the trucks are less vulnerable to shell splinter damage, and the truck's ability to use chains is a help where heavy mud is encountered.

13. *Use of Landing Mat*: Where sand is soft, landing mats should be used to reduce chance of DUKWs becoming stuck at water's edge, also to keep axles and brakes out of the sand which will reduce necessity of otherwise heavy brake maintenance.

14. *Landing of 105MM Howitzer and Ammuintion From LSTs*: Details are given in Chapter XX.

15. *Casualty Evacuation*: DUKWs can carry 12 stretcher cases with attendant, or up to 40 walking wounded, direct from field dressing station to hospital ship. Casualties may be protected from sun and spray by use of tarpaulins. If LSTs are used for hospital work, the DUKWs can drive straight up the ramp without loss of time. When placing stretcher cases in DUKWs, the first two should be placed crosswise on forward end of cargo floor heads to the left. The next four should be placed longitudinally on floor, feet against rear bulkhead. Next, four stretchers should be placed heads to left, across coamings starting at rear end of cargo space. The last two should be placed on coaming over first two that were loaded. All stretchers on coamings should be lashed so they will not shift. DUKWs delivered after May 1944 are furnished with four removable coaming extension boards, which may be temporarily clamped on coamings to secure stretchers.

16. *Special Uses*: In addition to the uses listed above, there are numerous special uses for which DUKWs have been employed. Any load up to 7500 pounds with center of gravity not aft of center of cargo space or above deck level can be carried if it will fit in the cargo space. A 5000 pound load can have center of gravity 18" above deck level, provided it is not aft of center of cargo space. When loads are excessive, and where center of gravity is higher than desirable, extra precautions must be taken to seal out water which, when in the bilge, will slosh from side to side and decrease the stability.

17. *Personnel*: Twenty-five combat equipped troops can be carried, together with mortars or machine guns, and up to 1500 pounds of ammunition. The ammunition boxes can be arranged to form seats all around the sides of the cargo space.



57mm Anti-tank Gun in DUKW

18. *SCR-399 Radio, or Message Center*: The house for this unit, or similar message center unit, should be placed in the DUKW cargo space against the forward cargo bulkhead with the heavy end of the unit forward. However, since the regular door of the radio housing cannot be swung open while the unit is in the DUKW, a special water tight door must be cut in the roof of the radio house to permit entry and servicing. If generators are carried, they must be over rear deck, clear of access to rear hatch, and mounted as

high as possible to keep out of water. Before installing main unit in cargo space, bilge must be thoroughly cleaned, painted and treated with rust preventative (see paragraph 70). Bilge pump system, if chassis number is below 4203, must be modified as per TB ORD 5 Section II, cleaning, rescreening and raising intakes 2" above floor. Tube extensions must be fitted on grease fittings on propeller shaft thrust bearing, propeller shaft stuffing box and Higgins bilge pump, leading to marked fittings accessible in aisleway. After installing shack in cargo space, a cover must be fitted to tightly close gap around sides and rear coaming, with access openings to permit operation of two rear drain valves. If generators are installed over rear deck, in order to reduce weight on stern, spare tire must be mounted over aisleway or forward face of shack, and anchor must be mounted *in* forward compartment against inner face of bow. Watertight canvas covers must be fitted to protect generators (which should also be waterproofed) during water trip.

19. *Precision Equipment—Radars—Searchlights*: Numerous articles that must be taken ashore without being subjected to worse than spray, can be landed to great advantage in DUKWs.

20. *Miscellaneous Light Artillery*: Any field piece equivalent to or smaller than a 105mm howitzer may be carried in a DUKW. Ammunition and/or personnel may be added to bring the load up to limit for conditions encountered. Two 37s or smaller pieces can be carried, crossing their trails in cargo space, removing breech guard from first gun loaded.

Howitzer wheel chocks (paragraph 216) are placed upside down and backwards to raise wheels enough for gun barrel to clear windshield base. Howitzer sling is rigged around axles inside of wheels, and around neck of lunette, to rear of positioning plate, as shown in picture above. Place board below trail to protect cargo floor.

21. *Reconnaissance*: A DUKW is extremely suitable for exploring beaches to determine suitable landing spots. The ease with which it can run from dry land into deep water affords a quick method of exploring, sounding and charting.

22. *Carrying Water:* In extremely favorable conditions, two 250-gallon water trailers can be carried— one forward with lunette over windshield, and one rear with lunette over rear deck. Use 105mm wheel chocks (see paragraph 216). In normal conditions only one trailer should be carried, placed in forward end of cargo space with lunette to the rear. A 600-gallon water tank can be carried in forward end of cargo space. In all cases, keep tanks chock full while afloat—a partially full tank allows the water to swash from side to side and is dangerous to stability.

23. *155MM Ammunition*: Thirty-three rounds can be placed in two rows across the forward end of cargo space. Behind these, 11 clover leaves of 3 charges each can be placed, with fuzes as needed.

24. *40MM Bofors AA Guns*: By removing forward cargo bulkhead, and blocking forward end of cargo floor (which would otherwise be unsupported) a Bofors AA gun can be carried in a DUKW with lunette over rear deck. It is advisable to carry 1000 pounds of ammunition *below forward corners* of cargo floor (before placing gun on board) to insure maximum stability of the DUKW. 20mm Navy AA guns may also be carried in DUKWs.

25. *Pallet Mounted M45 QUAD .50 Caliber AA*: When trailer mounted, this unit is known as M51 and must be landed in LCM or larger craft. By removing mount from trailer and placing on 6'x5' sled pallet, the unit can be landed in a DUKW and can fire during transit.

26. *Firing 105MM Howitzer from DUKW*: (See paragraph 234).

27. *Rocket Firing from DUKWs*: Rocket Launcher Mark 7 permits firing 144 4.5" barrage rockets from a DUKW, either afloat or ashore. California Institute of Technology Type 7 Model 1 Launcher permits similar firing of 42 7.2" barrage rockets.

28. *Smoke Generators*: The units commonly mounted on 2½-ton trucks can be used on DUKWs. In that way they can be transported to whatever location is desired (seaward or on land) to lay protective smoke covering.

29. *Watering Land Tracks*: On some soft beaches where traction is bad for DUKWs and land trucks, DUKWs can perform valuable service by watering the tracks. On its way to shore, each DUKW collects some water in its hull by opening the drain valves for



Lifting a Jeep with an "A" Frame.

Note carefully the way sling is rigged. Rear part goes under the frame but must lead *over* the rear drive shaft. Use two 17 foot slings or 38 feet of a mooring line, as shown above.

15 seconds, then closing them again. The drain valves are opened as the soft sand is reached and the DUKW drives forward. This is also a good means of laying dust on dry roads. Water should not be taken into the DUKW if the surf conditions are bad, if the landing is difficult or if very heavily loaded.

30. *Small Vehicles*: (See paragraph 202). A jeep, or if desired, a jeep with a 37mm gun on top of it, can be carried. Also, a ¼-ton amphibian or an M29C (Weasel) can be carried when water is too rough for them to operate on their own bottom.

31. *Salvage*: The DUKW, with its power winch, "A" frame and towing ability is well suited to improvised salvage work. The air compressor and tire pumping hose are useful in conjunction with diving equipment. A DUKW while using an "A" frame afloat must be stablized by being rigidly secured to another DUKW.

CHAPTER III

TRAINING AND PERSONNEL

32. *Training Period*: The DUKW is a specialized weapon, and personnel intended to operate it requires special DUKW training for a minimum period of three weeks. Personnel should have had truck operating experience and, if possible, stevedore training.

33. *Officer Training*: In order to be able to make decisions which will increase the efficiency of DUKW operations, DUKW Company officers require a considerably greater amount of training than enlisted personnel.

34. *Subjects*: Subjects taught should be as follows: Land driving, entering and leaving water, water driving, coral reef operations, anchoring and towing, mooring, cargo handling at shipside, cargo handling ashore, compass correction, winching, handling of artillery, operations with LSTs, DUKW control, first second and third echelon maintenance, and also any special techniques which local conditions and special missions may require.

35. *Facilities*: Training facilities include a cargo ship, an LST, cargo of various types and artillery. Training site should include a good beach having occasional medium to heavy surf, some coral reefs, dunes of soft sand, and rough inland trails.

36. *Personnel Strength*: It is necessary that sufficient personnel is trained to man and maintain their vehicles at all times. During operations DUKWs will usually be required to work around the clock over long periods. Therefore a minimum of three men should be trained as drivers for each vehicle. An average of two mechanics for every five DUKWs is necessary in the maintenance section. (See Chapter XIV—Round the Clock Operations.)

CHAPTER IV

MODIFICATIONS AND PREPARATIONS OF DUKWs BEFORE OPERATING

37. *General*: Thorough accomplishment of the modifications and preparations described in this chapter will enable DUKWs to perform their mission with minimum demands upon maintenance personnel and a minimum need for spare parts. Additional important information, particularly applying to DUKWs built during 1943, can be found on TB ORD 5, "Emergency Field Maintenance for 2½ ton Amphibian Truck", War Department, 31 December 1943. Items included in TB ORD 5 and in the first eleven items described below can be readily accomplished with materials available at any staging area.

38. *Steering Gear Adjustment to Prevent Shear Pin Failure*: (Applies to all DUKWs above chassis #1505).

a. Failures are caused by a faulty adjustment which caused the rudder linkage at the stern to reach the end of its travel before the steering gear is stopped by the front axle stoppers. This occurs most frequently when afloat, at which time the front axle drops, allowing the steering gear to turn further to the left than when on land.

b. The faulty adjustments may be in one or more of the following:

(1) Front axle stop—for left turn.
(2) Adjustment of steering cable where attached to tiller in stern.
(3) Incorrect rotational position of cable spool on steering column.

c. To insure against shear pin failures, all DUKWs will be checked and adjusted in sequence given below:

(1) Set front wheels straight ahead on level ground.
(2) Check that steering wheel marker pins are at top center. Relocate pins if necessary.
(3) Check that there are 3¾ turns of cable above and 3¾ turns of cable below center attachment on steering column spool. Remove shear pin and rotate spool on steering column if necessary. If cables have been improperly wound on spool, it may be necessary to unrig one or both ends of cable and re-wind them on spool. (Note that there must be 7½ turns of cable on spool).
(4) Check position of rudder linkage as is shown on page 486 TM 9-802, dated 1 September 1943, Figure 264. Adjust cable attachments to tiller lever if necessary to secure proper position.
(5) Check that main portion of rudder blade is straight ahead (exclusive of offset tab at trailing edge). Straighten or replace rudder and rudder control lever assembly if necessary, to secure this alignment.
(6) Turn steering wheel *full hard left,* exerting approximately a fifty (50) pound pull, and hold it *full* left. In this position there should be *not less than* 1½ inches free travel remaining at end of slot in rudder control lever. If less than 1½ inches free travel is secured, then build up left front axle stop bolt so that steering wheel cannot be turned beyond the position which gives 1½ inches free travel. (Before making permanent stop adjustment, jack up

front axle and turn wheel again *full hard left* to be certain that in this position rudder control lever does not overrun.) Maximum front wheel angle should not be reduced to less than 27 degrees left. If checks (1), (2), (3), (4), (5) above have been accurately followed, front wheel angle will be limited at 28 degrees.

d. If faulty adjustment has been found, always remove and inspect shear pin. Replace pin with new one if it is nicked or partially sheared.

e. On receipt of this information, all DUKWs above chassis #1505 will be carefully checked as outlined above, and adjusted as necessary. At the same time, steering cables will be carefully inspected, particularly at attachments to tiller, also in way of the sheaves, and on spool on steering column. Turn steering wheel full left and full right while inspection is being made. Replace cable if rusted, nicked, or rough or frayed. All sheaves, and cable in way of sheaves and on spool, should be well lubricated.

f. The instructions outlined in c, d, and e above should be made part of the regular *Monthly Maintenance.*

39. *Permanent Sealing of Auxiliary Air Intakes*: (Applies to all DUKWs until they are manufactured *without* auxiliary air intake in rear portion of engine hatch.) After two full years of operation, it has been thoroughly proven that the DUKWs will cool satisfactorily with this auxiliary air intake closed. Simple expedients to improve cooling are given in paragraph 72. In addition, many unnecessary accidents and much unnecessary engine maintenance has resulted from the auxuliary air intake being opened or being forced open in rough water. The cure is simple and very important. The seal of the auxillary air intake must be put in good condition so the opening will not leak. Then the air intake must be closed and clips welded on it, or locking lugs tack welded so that it cannot be opened and will not open itself in spite of vibration and the force of the surf. Be careful not to burn the seal during the welding, otherwise a bothersome leak will be created. Remove and discard dash instruction plate regarding auxiliary air intake on DUKWs fitted with the plate.

40. *Propeller Guard*: (Applies to all DUKWs.) To minimize damage to propeller from rough coral, rocks and wreckage, the guard shown on next page has proven very successful. Before making the welds to hull, care must be used to clean out the rear compartments thoroughly to prevent fire hazard. Welders must be very careful not to burn through hull bottom or tunnel sides, or a dangerous leak may be created.

41. *Primary Wire Insulation*: (Applies to all DUKWs.) Refer to page 210 TM 9-802. 1 September 1943. Note part E in figure 101, the insulated terminal on the ignition shield on the right hand side of the engine, slightly back of the middle. The primary ignition wire leads to this terminal. When this wire shorts across to the body of the ignition shield, the engine will cut out. To prevent this, the conection should be cleaned, then wrapped with rubber insulating tape and painted with suitable insulating compound. Then, even if water and dirt get on this connection, the engine will not cut out.

42. *Plug Racks in Driver's Compartment*: (Applies to all DUKWs not so fitted — production installation started approximately with June 1944 deliveries.) To minimize danger from attempts at water operation with bottom plugs missing, racks and stencils pictured in the accompanying drawings are to be installed on windshield base. See paragraph 71 regarding proper use of all plugs.

43. *Modified Drain Plug Wrench*: (Applies to all DUKWs not so fitted.) To speed up and simplify plug removal and installation, and to eliminate loss, it has been found prac-

tical to frabricate the several plug removal wrench inserts into a single tool as shown in the drawing. Convenient brackets for this should be fitted in driver's compartment.

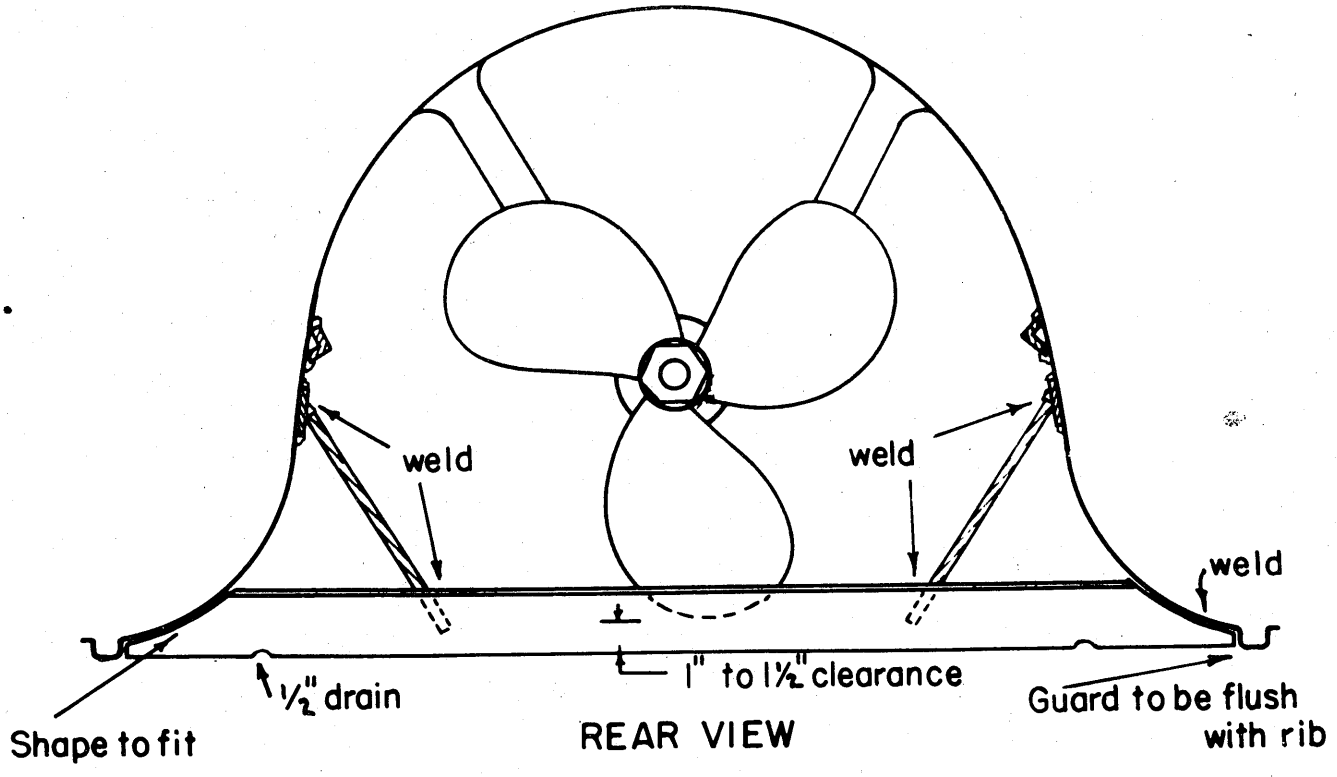
44. *Shorten Trap Bows to Facilitate Proper Stowage*: (Applies to DUKWs delivered in 1943 and first half of 1944.) Proper tarp bow stowage has been a bothersome problem. Starting in June 1944 tarpaulin bows were shortened 3" each leg. The original bows were approximately 38 inches high, if standing up on a smooth floor, from the floor to the top of the bows. This should be reduced to 35 inches. This reduced height makes it practical to stow the bows in the forward compartment. Put them in one at a time through the forward hatch, pushing them in the left cooling air passageway until the other end will clear the hatch. Then swing them back so they lay flat against the inside of the front of the hull with each end of the bows in the corners immediately forward of the front wheel cut outs. This stowage could be accomplished with the full length bows, but in order to get them in, the first end of the bow had to be slide back in the air outlet passage and then temporarily extend into the driver's compartment *through* the driver's compartment heater slot, after which the bows could be centered as described above. This was too laborious to be practical. Some of the bows have been stowed under the air intake grating in the aisleway, but this location interferes with bilge inspection and access, and to some extent, with the inflow of cooling air. Sometimes bows have been racked behind the driver's compartment or in either end of the cargo space. This definitely interferes with loading cargo at ship's side. The correct answer is short bows in the forward compartment. While on this subject, it is mandatory for the safety and operation of the DUKW that other equipment not be stored in the forward compartment, or air passages on each side of the engine. The heat of the engine cooling air, plus the heat of the exhaust piping is almost certain to start a fire. Keep the bow compartment clear except for the short tarpaulin bows and the cab top type bow when not in use.

45. *Additional and Relocated Fender Eyes*: (Applies to DUKWs delivered in 1943 and first quarter of 1944). For details see paragraph 109.

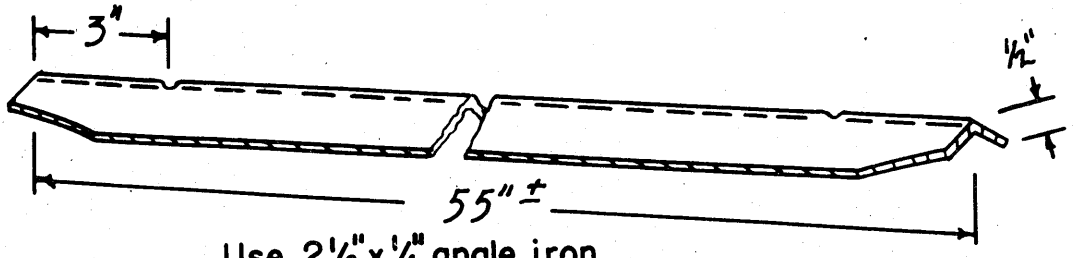
46. *Rear Axle Brake Hose Protectors*: (Applies to all DUKWs). All necessary details for fabrication and installation can be procured under MWO G-508 W-1 from Office of the Ordnance Officer, CPBC, APO 456 c/o Postmaster, San Francisco, California. By the installation of 6 sharpened blades on each DUKW, the possibilities of wire, cargo binders, or rope damaging any of the 4 rear brake hose are virtually eliminated. See paragraph 52 below regarding Front Brake Hose Protection.

47. *Daily and Weekly Driver Maintenance Plates*: (Applies to all DUKWs not so fitted). Reproductions of Daily and Weekly Driver Maintenance plates shown in paragraph 64 and 66 should be affixed in a conspicuous position in the driver's compartment and protected with a clear lacquer or similar water proof protection.

48. *Front Drain Valve Reach Rod*: (Applies to DUKWs between chassis #2004 and #4206). DUKW chassis numbers between 2004 and 4206 are equipped with four hull drain valves. The two rear valves and the center valve are just like those in all later DUKWs. The forward valve is in the same hull position, but its handle is shorter and can be reached only after opening the engine hatch. This results in hull damage by reluctance to drain as often as when handle is more readily accessible, and in addition, on entering the water it is impossible to check that front valve is closed, without opening engine hatch. The installation of a reach rod to driver's compartment as installed in all later DUKWs eliminates the difficulty. Details are shown on next page. Parts temporarily removed from a new DUKW may be used as a guide.



REAR VIEW



Use 2½"x¼" angle iron
1 per DUKW

Fig. 1

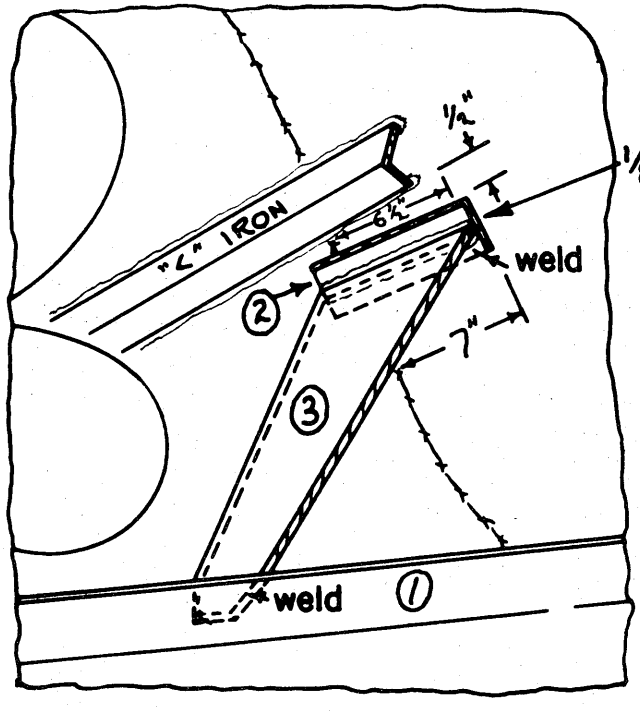
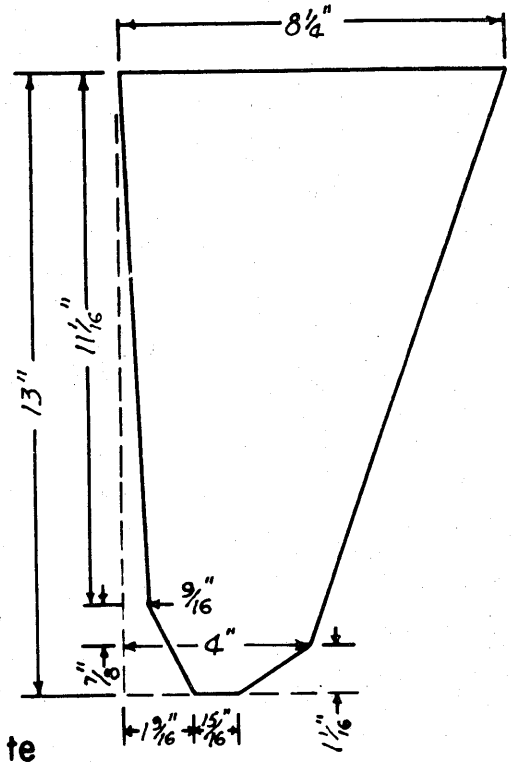


Fig.2

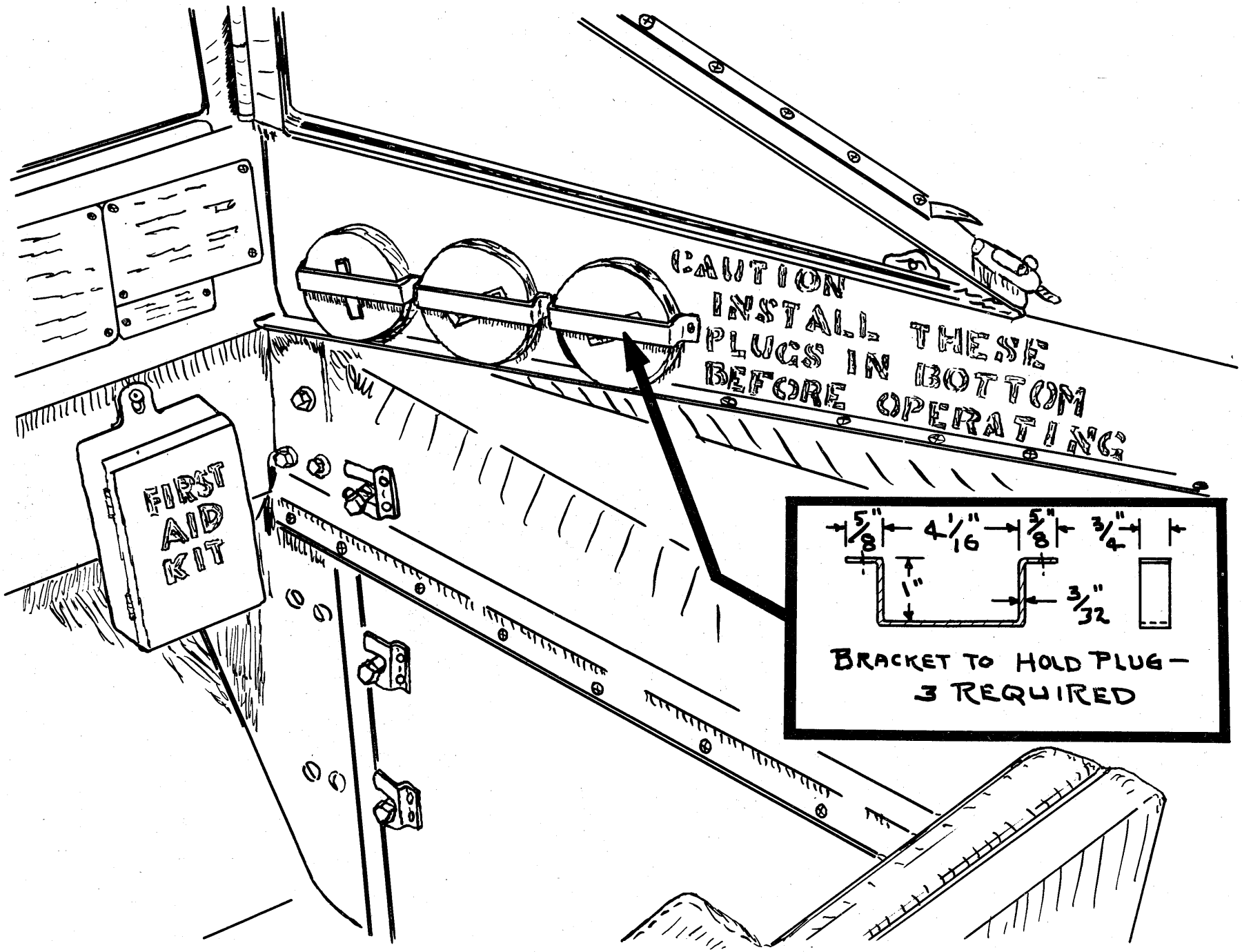
⅛"x2"x9¼" black strap iron
2 per DUKW

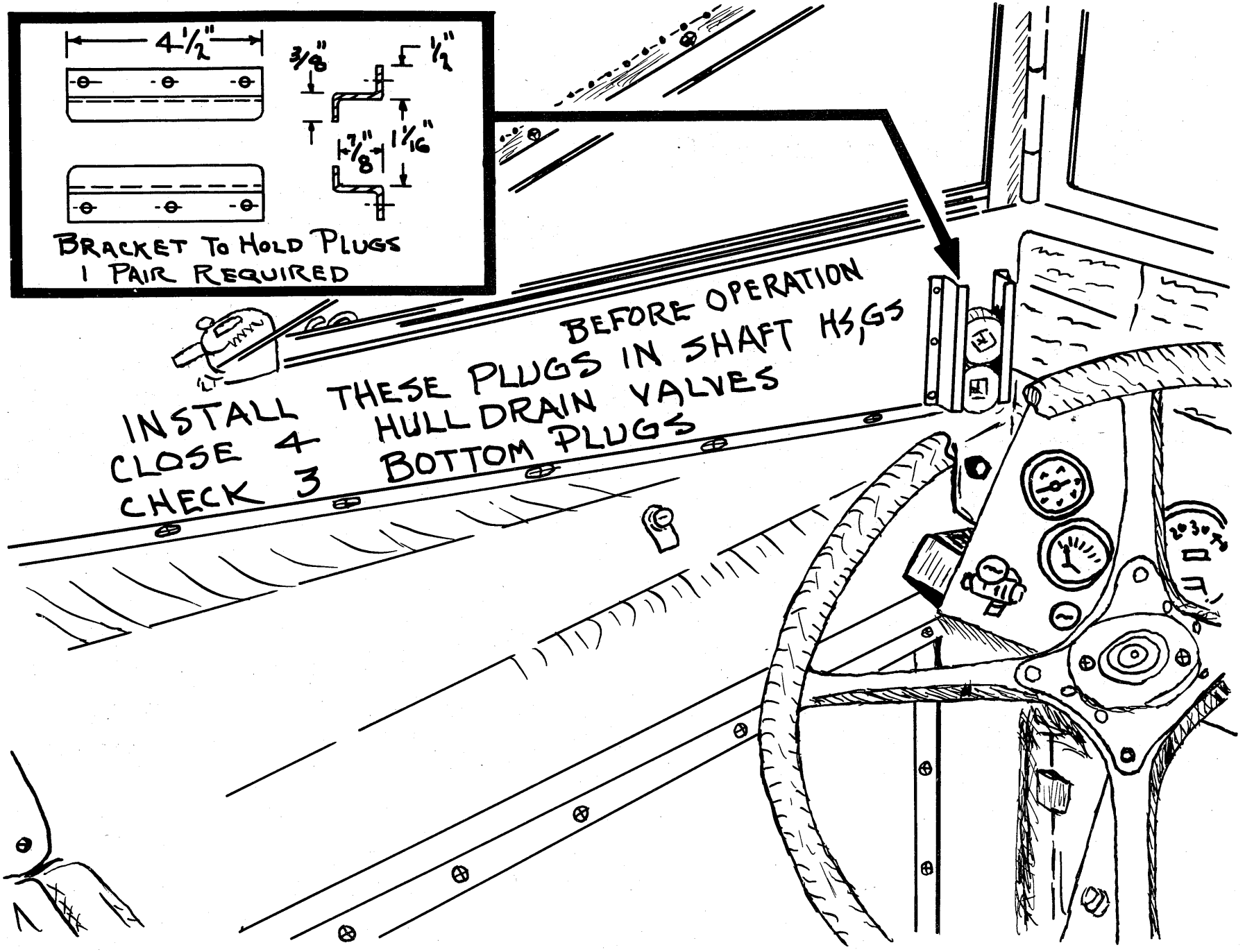


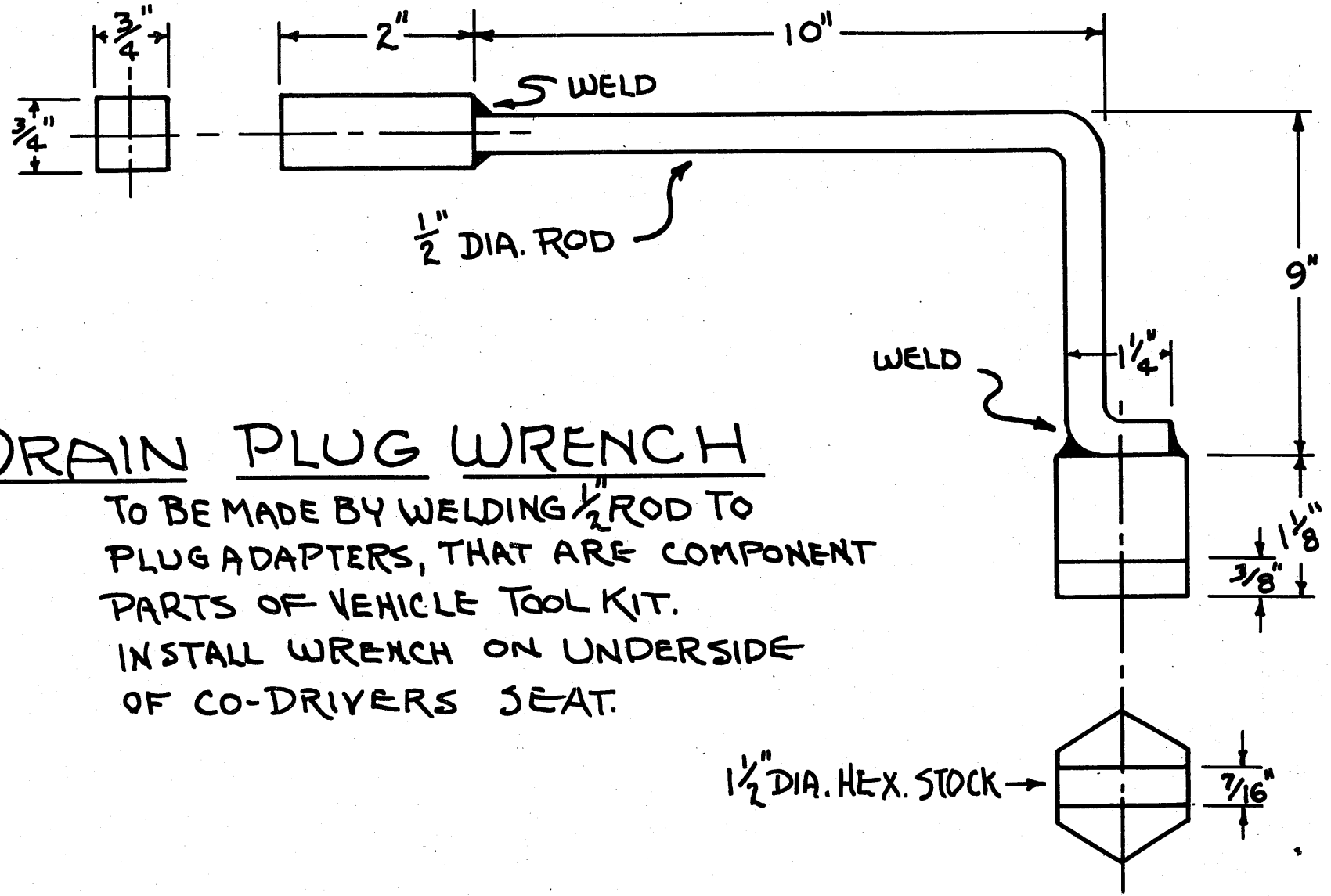
Use ¼" steel plate
2per DUKW

Fig.3

PROPELLER GUARD FOR DUKW


CAUTION
INSTALL THESE
PLUGS IN BOTTOM
BEFORE OPERATING
FIRST
AID
KIT
5/8"
4 1/16"
5/8"
3/4"
1"
3/32"
BRACKET TO HOLD PLUG —
3 REQUIRED


4 1/2"
3/8"
1/2"
7/8"
1 1/16"
BRACKET TO HOLD PLUGS
1 PAIR REQUIRED
BEFORE OPERATION
INSTALL THESE PLUGS IN SHAFT HSGS
CLOSE 4 HULL DRAIN VALVES
CHECK 3 BOTTOM PLUGS



DRAIN PLUG WRENCH

TO BE MADE BY WELDING 1/2" ROD TO PLUG ADAPTERS, THAT ARE COMPONENT PARTS OF VEHICLE TOOL KIT.
INSTALL WRENCH ON UNDERSIDE OF CO-DRIVERS SEAT.

49. *Air Compressor Lubrication Modifications*: (Applies to all DUKWs above chassis 2005 and through deliveries during first half of 1944). FS MWO G-501 W-30 covers 4 seperate improvements to air compressor lubrication system. The first improvement was an extension of the breather (at about chassis #5069), which raised the breather about 5" from its original position just above the top of the crankcase to the final position abreast of cylinder head. At chassis #8329 (May 1944) the original flat base plate from crankcase was replaced by an interchangeable dished base plate having approximately ¼" additional oil depth. At the same time the oil pump intake was extended downwards to provide adequate lubrication at temporarily lower levels of oil. In June 1944 a new filler plug was used having wing-nut ears and an attached dip stick in place of the earlier type of screw plug. Until the added protection can be obtained from the above modifications special care must be used to *maintain oil level to the top of the fill hole at all times.*

50. *Conversion of Forward Pump from Oberdorfer to Gould*: (This applies to DUKWs 2505 to 4205). On DUKW with 2 speed propeller transfer case, it is relatively easy to convert from Oberdorfer belt driven gear pump to Gould chain driven self-priming centrifical pump. Much maintenance will be eliminated and safer operations result from the conversion. The following parts are the minimum required to make the change. Until such time as they are available, all modifications to Oberdorfer forward pump system as covered in Section II TB ORD 5 should be thoroughly accomplished to insure the best possible results from the Oberdorfer system.

1-GM-2199846	Pump, Bilge Forward Assy. (GDP 2510-1½)
1-GM-2200901	Sprocket, Driven, Forward Bilge Pump
1-GM-2200902	Sprocket, Drive, Forward Bilge Pump
4-GM-2103149	Bolt, Forward Bilge Pump Drive, Sprocket to Hub
1-GM-2200830	Hub, Forward Bilge Pump Drive Sprocket
1-GM-2200471	Chain, Drive, Forward Bilge Pump Assy.
1-GM-2202737	Bracket, Hanger, Forward Bilge Pump (GDP-232-107)
1-GM-2200834	Bracket, Support, Forward Bilge Pump Assy.

51. *Central Tire Control Hub Fittings*: (This applies to DUKWs with compressor in forward compartment, having all built-in parts of central tire pressure control but shipped short of external linkage from hull to wheels). Kit is available under FS MWO G-501 W-23, containing all parts necessary to complete installation.

52. *Front Brake Hose Protectors*: (This applies to all DUKWs.) Kit is available under G-501 W-28. This kit not only protects front brake hose from wire or other damage, but by its cutting action, will clear wires which might otherwise damage external tire control linkage when wrapping around front wheels. The kit eliminates the otherwise advisable precaution of shutting off front brakes before operating in wire-strewn areas.

53. *Steps in Preparing DUKWs for Operation after Modifications are Completed*:

a. Record vehicles by W number on Maintenance Schedule.

b. Log Book (Form #7255) installed on each vehicle.

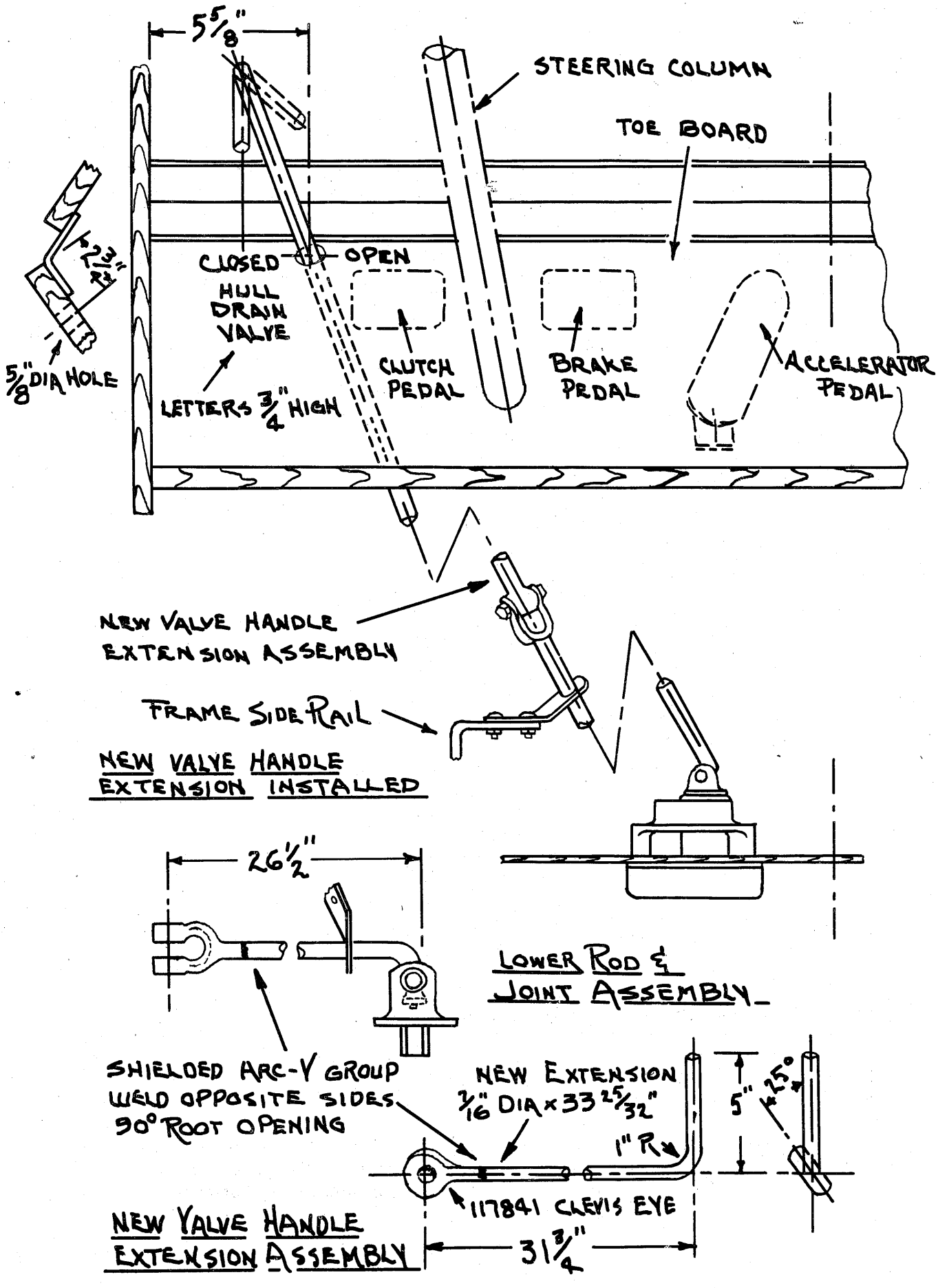
c. Issue of vehicle to driver and his assistant.

d. Assignment of mechanic to specific vehicles, so that each mechanic will be responsible for the maintenance of his 4 or 5 vehicles.

e. Make up Preventative Maintenance Schedule, by vehicle organization number, as suggested in paragraph 67.

f. (1) Unpacked crates, be sure to police up all nails and steel straps, as they will damage tires and brake hoses if left lying around DUKW parking area.

(2) Check and stow all equipment in correct places. Make list of shortages.


5 5/8"
STEERING COLUMN
TOE BOARD
2 3/4" R
CLOSED
OPEN
HULL DRAIN VALVE
5/8" DIA HOLE
LETTERS 3/4" HIGH
CLUTCH PEDAL
BRAKE PEDAL
ACCELERATOR PEDAL
NEW VALVE HANDLE EXTENSION ASSEMBLY
FRAME SIDE RAIL
NEW VALVE HANDLE EXTENSION INSTALLED
26 1/2"
LOWER ROD & JOINT ASSEMBLY
SHIELDED ARC-V GROUP WELD OPPOSITE SIDES 90° ROOT OPENING
NEW EXTENSION 3/16" DIA x 33 25/32"
1" R
5"
25°
117841 CLEVIS EYE
NEW VALVE HANDLE EXTENSION ASSEMBLY
31 3/4"

g. Install windshield.

h. Inspect hull, chassis and associated parts for leaks and damage.

i. Wire brush, clean and repaint all rust spots.

j. Install three hull bottom plugs and two (three if were removed) drive shaft housing plugs.

k. Remove four hull drain valve emergency plugs and install in rack inside engine hatch. These plugs are *not* to be used as long as hull drain valve are in working condition.

l. Remove all wire lashings, tape and cloth from winch cables and hook.

m. Unwind winch cable and clean off grease. Then give cable a coat of rust preventive thin film (or Navy Tectyl 506) rewind it and secure hook to winch cable guide.

n. Remove valve cores from tire valve stems, stow them in spare parts container inside engine hatch. (DUKWs with central tire control are shipped with valve cores temporarily in place.)

o. Scrape paint from black out and black out marker lights, but leave reflectors painted.

p. Fill grease gun and oil can.

q. Oil pintle hook parts until they work freely.

r. Remove, grease and replace gas tank hull drain plug. Drain any water from gas tank.

s. Check that exhaust manifold heat control valve is in "off" position.

t. Remove and clean fuel pump filter and drain main fuel filter.

u. Remove tape from generator, air cleaner, etc. in engine compartment.

v. Remove tapes over both bilge pump discharge holes, etc.

w. Close cab heating doors at lower front sides of cab.

x. Drain any water from air tank.

y. Check on tightness of coupling bolts on drive shafts between transmission and transfer case. Tighten if necessary.

z. Check that exhaust recirculation ducts are in closed position. These two ducks can be reached at each end of the air intake aisleway by removing the square plate with four Phillips screws on the inner side of the coaming.

aa. Clean bilges, remove all wood splinters, paper, rags, etc.

bb. Clean dashboard instruction plates and instruments as necessary.

cc. Weld extension bolt on flush drain plug in air compressor base.

dd. Secure organizational spare parts in accordance with SNL G-501.

ee. Perform monthly (1000 mile) maintenance check. While wheels are removed, treat brake parts as outlined in next paragraph below.

54. *Protection From Corrosion*: (Applies to all DUKWs.) Steam clean the vehicle thoroughly inside and out, remove any loose paint, prime and touch-up paint job, and then coat thoroughly with Rust Preventative Thin Film or Navy Tectyl 506. This is the one and only way to keep ahead of rusting difficulties. It should help insure a longer life for the light sheetmetal hull. It is not advisable to use this treatment in the bow compartment, in the engine space, or in the stowage space below the rear deck (those parts of a new DUKW that are painted white.) It is particularly important to include with this treatment all parts of the brake mechanism except the surfaces of the linings and the braking surface of the drums. Pins, springs, cylinders, backing plates, shoes, etc., etc., should be treated. In treating the wheel cylinders, they should be sprayed when they are in the retracted position. After rust preventive has dried, the wheel cylinders should be expanded to the normal "on" position and the exposed parts under the lip of each cap should be coated with a mixture 1/3 white lead and 2/3 water pump waterproof grease.

This mixture can also be put around the threaded portions where the stem comes out on each wheel cylinder cap. By careful treatment of the hull and also the brake parts as outlined, many hours of maintenance will be saved, the DUKW's life will be lengthened and the brakes will be more dependable.

55. *Winch Drag Brake Adjustment and Protection*: Disassemble and mask surface of band and braking surface. Paint thoroughly with Rust Preventive Thin Film or Navy Tectyl 506. Cover threads below adjusting nuts with mixture 1/3 white lead, 2/3 water pump grease. When the winch power take off in the driver's compartment is in neutral, and the winch jaw clutch on the rear deck is in the disengaged position, the winch shaft should rotate freely in the "forward" direction, but should be noticeably stiff in reverse. Make the test in the rear hatchway. With clean hands and clean shaft, it should be relatively easy to rotate the shaft forward with one hand. In the reverse direction it should be *just possible* with *one hand,* but still reasonably easy with *two* hands. Don't set the drag brake too tight or it will overheat and be damaged when paying out cable. Spray nuts and spring with rust preventive after an adjustment is completed. Check adjustment weekly, and always before using "A" frame.

56. *Protection of Propeller Shaft and Three Winch Drive Shaft Steady Bearings*: Using mixture of 1/3 white lead and 2/3 water pump grease, pack around outside of above bearings without disassembling, to exclude bilge water and spray which otherwise may get into and damage bearings. Make this part of regular weekly check.

57. *Naming and Numbering DUKWs*: Name as selected by driver and number and other markings shall be neatly painted on each side as directed.

58. *Air Outlet Shutters*: (Applies to all DUKWs.) Refer to pages 42, 43 and 44 in TM 9-802, 1 September 1943; also Section III, TB ORD 5. These air outlet doors are installed for only one purpose, that of preventing the escape of engine-discharged hot air at such times as this air is needed to heat the rest of the hull and the pump system to prevent dangerous formation of ice. Occasionally the shutters may also be used when the DUKW is being sealed for long overseas shipment or storage in an exposed area. At all other times the outlet shutters must be *hooked fully open.* The shutters are *not* intended to close temporarily during passage through heavy surf. The exhaust air keeps out most of the water and any that may get in at that point will not cause trouble. On the other hand, if the shutters are closed or partly closed, engine cooling will not be satisfactory and serious damage may result, not to mention discomfort to crew. The right procedure is to open the shutters wide and then turn the catch at each end of each shutter and allow the catches to come down over the pin at the end of each shutter, after which it is physically impossible for the shutter to shut by itself.

59. *Stowage of Oil Can in Driver's Compartment*: (Applies to DUKWs 001 to 4201) As oil must be applied to many points at frequent intervals, the relocating of oil can from engine compartment to driver's compartment is recommended. Remove the oil can and bracket from engine compartment, then mount bracket and can in driver's compartment on dash, just to the right of the lower corner of map compartment.

60. *Stowage of Grease Gun in Driver's Compartment*: (Applies to DUKWs 001 to 4201) To facilitate frequent lubrication of important pressure fittings, grease gun should be stored in driver's compartment. Using a suitable bracket, mount it on underside of gunner's seat.

61. *Stowage of Jack in Engine Compartment*: (Applies to DUKWs manufactured in 1943.) Early vehicles had no special location for the jack. On later vehicles the jack

was to be clamped in a bracket fitted to right frame side rail below air intake grating, where it was frequently rendered inoperative by water damage. The jack should be secured in the left front corner of engine compartment, using clamp from frame side rail on a ½x1x6 inch block, or using canvas or metal strop where clamp is not available. Clean, lubricate and paint jack to make operative before storing in engine space.

62. *Cargo Floor Beam Reinforcement*: (Applies to DUKWs 001 to 4650.) The three transverse cargo floor angle (channel) supports in chassis below No. 6450 may become bent as a result of dropping heavy cargo on the floor. These supports should be reinforced by adding ⅛x1 inch angle iron or similar leg-struts from frame rails. Weld the reinforcements in place. If metal reinforcements are not available the supports can be reinforced by using 1½ inch square hardwood legs.

CHAPTER V

PREVENTIVE MAINTENANANCE AND OPERATIONAL SAFEGUARDS

63. *Assignment of Vehicles*: Each DUKW and its equipment must be assigned to a driver and assistant driver who will be held responsible for same. Driver and/or assistant will be on their DUKW whenever it is operated.

64. *Daily Preventive Maintenance*: Daily preventive maintenance duties are described in TM 9-802. The important items are covered by a dashboard instruction plate reproduced herewith. It is the duty of the driver (assistant driver if driver is not present) to accomplish these items.

MINIMUM DRIVER DAILY MAINTENANCE

Refer to TM 9-802 and Lubrication Order #505 for Details

BEFORE OPERATION—or on relieving another driver—
CHECK Fuel, oil & water—In engine, tire pump, & spare cans.
LUBRICATE V-strut—**CHECK** rudder, propeller, hull, tires, & equipment.
CHECK that all drain plugs & valves, seals & hatches are tight.

DURING OPERATION—at halt or traveling light—
CONSTANTLY CLEAN cargo space, bilges, and pump intakes.
LUBRICATE propeller stuffing box and V-strut. **CHECK** fan belt tension.
OIL all joints, pivots, bolts, hinges, clamps, wing nuts, shackles, pintle hook, switches, controls, etc., inside and outside of hull.

AFTER OPERATION—or before turning over to relief driver—
CLEAN & DRAIN bilges, pump intakes, and drive shaft hsgs. **OIL** pump chains.
REPLACE plugs. **CLOSE** drain valves. (Except in freezing weather).
CLEAN AND CHECK rudder, propeller, hull, seals, tires and fenders.
LUBRICATE V-strut, inter-axle shaft (3), front springs (6), drag link (2), tie rod (2) tire inflation hubs (6), bilge pumps (2), stuffing boxes (2).
OIL outside of front axle "U" joints. **CHECK** oil level in air cleaners.
REFILL fuel, oil, & water—In engine, tire pump & spare cans.
CHECK AND STOW tools & equipment. **CLOSE** hatches. Rig cab tarpaulin.

Daily Maintenance Plate

65. *Assignment of Mechanics*: To provide direct control of details of preventive maintenance and general operating conditions of each DUKW, it is recommended that a group of 5 DUKWs be assigned to each of the 10 best company mechanics. The driver and assistant driver of each of the 5 DUKWs in a given group will be under the direction of the assigned mechanic in all matters of mechanical nature. The assigned mechanic will then be directly responsible for mechanical condition and all scheduled preventive maintenance of his 5 DUKWs.

66. *Weekly Preventive Maintenance*: Weekly preventive maintenance duties are described in detail in TM 9-802. The important items are covered by a dashboard plate

reproduced herewith. It is the duty of the driver and assistant driver, with help from, and under the direction of, the assigned mechanic, to accomplish these items at the scheduled time.

MINIMUM DRIVER WEEKLY MAINTENANCE

Refer to TM 9–802 & Lubrication Order #505 for Details

DRAIN water from fuel tank & filter, & **CHECK** system for leaks.
CHECK fuel, oil, & water—In engine, tire pump, and spare cans.
CHECK oil level in transmission, main & prop. trans. cases, winch worm hsg.
OIL hand and foot throttle, choke, starter linkage & 2 cups on tire pump.
LUBRICATE controls for main & propeller transfer cases, brakes & clutch.
LUBRICATE V-strut & bilge pumps, **CHECK** drain valves & plugs all tight.
CHECK battery water & crankhouse & carb. Air cleaners—Clean radiator.

MAKE LAND TEST RUN. CHECK foot brakes & compass adjustment.
CHECK idling speed for 510 R.P.M. **CHECK** for loose manifold nuts.

MAKE WATER TEST RUN. CHECK for leaks. **CHECK** operation of pumps.
CHECK for 2350 minimum R.P.M. & not over 185° temperature at full throttle.

CLEAN & drain bilges, **LUBRICATE** 3 "U" joints through housing drains.
CHECK 4 breather tubes, 6 housing seals & inter-housing drain.
REPLACE plugs, **CLOSE** drain valves. **REMOVE ANY WATER** in pillow block, differentials and front axle "U" joints. **CHECK** lubricant levels.
LUBRICATE V-strut, inter-axle shaft (3), front springs (6), drag link (2), tie rod (2), tire inflation hubs (6), bilge pumps (2), stuffing boxes (2).
GREASE 3 winch points—**OIL** & **REWIND** cable. **OIL** pump drive chains.
CLEAN & paint rusted parts. **CLEAN** & **OIL** outside of front axle "U" joints.
CHECK & **STOW** tools & equipment. **CLOSE** hatches. **RIG** cab tarpaulin.

Weekly Maintenance Plate

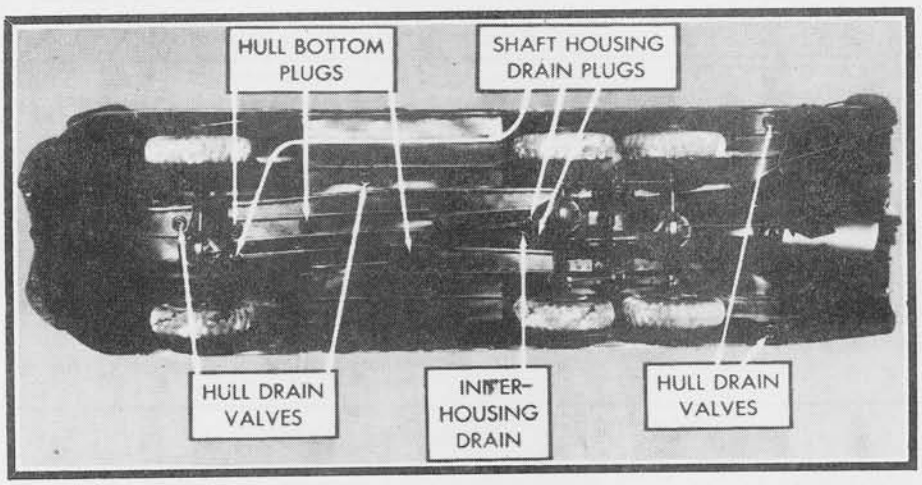
67. *Scheduled Maintenance and Numbering of DUKWs*: In order that maintenance facilities will not be overtaxed by necessity of servicing too many DUKWs at any given period, it is necessary to set up a schedule as shown on next page, for assigning specific times for accomplishment of weekly, monthly and semi-annual preventive maintenance. Details of all maintenance operation are given in TM 9-802 and Lubrication Order #505. To use schedule as shown, the DUKWs in each company should be numbered from 1 to 50.

SUGGESTED SCHEDULE FOR PREVENTIVE MAINTENANCE

	MON.	TUE.	WED.	THURS.	FRI.	SAT.	SUN.	MON.	TUE.	WED.	THURS.	FRI.	SAT.	SUN.	MON.	TUE.	WED.	THURS.	FRI.	SAT.	SUN.	MON.	TUE.	WED.	THURS.	FRI.	SAT.	SUN.	MON.	TUE.	WED.	THURS.	FRI.	SAT.	SUN.
6 MONTH PREVENTIVE MAINTENANCE (REPEAT EVERY 28 WEEKS)	1							3							5							7							8						
	2							4							6														9						
1 MONTH PREVENTIVE MAINTENANCE (REPEAT EVERY 4 WEEKS)		8	15	22	29	36	43		10	17	24	31	38	45		12	19	26	33	40	47		14	21	28	35	42	49		1	15				
		9	16	23	30	37	44		11	18	25	32	39	46		13	20	27	34	41	48							50		2	16				
WEEKLY PREVENTIVE MAINTENANCE	3	10	17	24	31	38	45	1	8	15	22	29	36	43	1	8	15	22	29	36	43	1	8	15	22	29	36	43	3	10	17				
	4	11	18	25	32	39	46	2	9	16	23	30	37	44	2	9	16	23	30	37	44	2	9	16	23	30	37	44	4	11	18				
	5	12	19	26	33	40	47	5	12	19	26	33	40	47	3	10	17	24	31	38	45	3	10	17	24	31	38	45	5	12	19				
	6	13	20	27	34	41	48	6	13	20	27	34	41	48	4	11	18	25	32	39	46	4	11	18	25	32	39	46	6	13	20				
	7	14	21	28	35	42	49	7	14	21	28	35	42	49	7	14	21	28	35	42	49	5	12	19	26	33	40	47	7	14	21				
							50							50							50	6	13	20	27	34	41	48							
AVAILABLE DUKW EACH DAY	43	41	41	41	41	41	42	43	41	41	41	41	41	42	43	41	41	41	41	41	42	43	42	42	42	42	42	42	41	43	41				

68. *Monthly and Semi-Annual Preventive Maintenance*: Monthly and semi-annual preventive maintenance will be accomplished by the maintenance personnel with the driver and assistant driver in attendance, ready to offer any necessary assistance. Time not needed for actual mechanical work will be devoted to cleaning and painting the vehicle.

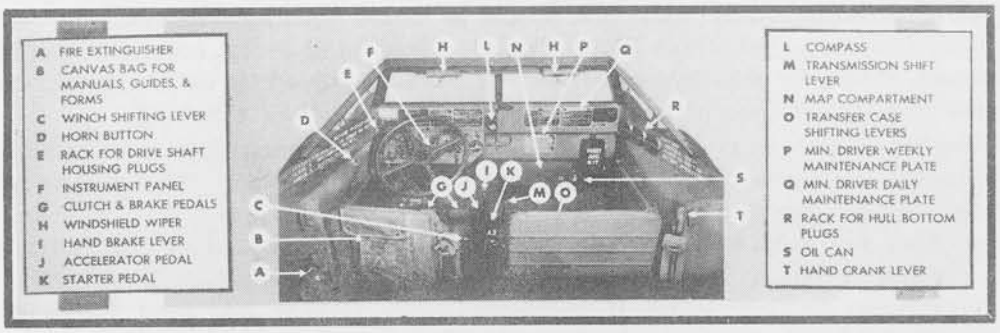
69. *Fire Caution*: The DUKW hull is a tight unit. Gasoline which leaks, or which may be spilled inside the hull, becomes a serious fire hazard. Any gasoline which has spilled or which has leaked into the hull must be cleaned up promptly and thoroughly. The hatches should be opened and the floor boards removed to allow all possible ventilation. Follow the advice given on the various warning and instruction plates. The fire extinguishers must be kept full and in good working condition. Smoking is never permitted on a DUKW when it is in the water.



70. *Clean Bilges*: It is of the utmost importance that bilges be kept clean. Any rubbish, dirt, or other foreign matter dropped in the vehicle eventually will get into the bottom of the hull unless it is cleaned up promptly. This material, if allowed to remain in the hull, is likely to get into pump intakes, drain valves, radiator core, and other key positions where it may cause damage serious enough to sink the DUKW. Sand is constantly carried aboard by personnel or with cargo. It must be cleaned out immediately to protect the pumps and to insure their satisfactory operation. When cleaning bilges, particularly when afloat, the hull should be checked for leaks. If any leaks are found their location should be noted so that maintenance crew may attend them at once.

71. *Drain Valves and Plugs*: All DUKWs are fitted with three (3) 3" diameter hull bottom plugs and three (3) 1½" diameter shaft housing drain plugs. In addition, all DUKWs whose manufacturers' number is above 2006, have four (4) hull drain valves. Before DUKWs are taken into the water, all bottom openings must be carefully checked to insure proper installation of plugs. At no time should the large bottom plugs be left out. They may be removed only temporarily for draining oil or cleaning center bilge. As a precaution, any plugs removed must be placed in racks in windshield base (see paragraph 42 and accompanying drawings) to remind the driver to install them before operating the vehicle. The three (3) 1½" diameter shaft housing drain plugs must be removed and replaced for weekly lubrication of "U" joints. They must also be removed to drain

housings after operation or immediately on leaving water when the temperature is below freezing. In chassis which have a manufacturers' number above 3620, the upper rear housing drains automatically through the flexible tube to the lower housing. Also in all vehicles, when the center bilge is dry, forward housing will empty itself out of its rear end into the hull when the vehicle is climbing up out of water. On leaving the water, the four (4) hull drain valves should be opened to drain the hull. (See paragraph 42.) As soon as the hull is drained the four valves should be closed. All four (4) valves should be kept in open position when the vehicle is being stored or shipped. In the event of valve failure, the hole in the drain valves is tapped to permit emergency use of the small screw plugs, which are located in the rack on the left side of the engine space. The defective valve should be repaired or replaced as soon as possible.



Driver's Compartment—Note plug racks "E" and "R"

72. *Over-Heating*: The cooling system of a DUKW *differs fundamentally* from that of a truck. The motion of the DUKW does not force air through the radiator, as is the case with a truck. All the cooling in a DUKW is accomplished by the engine fan. To secure adequate engine cooling in hot weather, all parts of the cooling system must be properly maintained. Proper functioning of the cooling system eliminates the necessity of opening the auxiliary air intake or box hatch. Both of these, when open, admit salt water which damages many parts of the engine, exhaust, and electrical system. To insure maintenance of cool engines, personnel should:

a. Maintain proper fan belt adjustment.
b. Keep radiator filled.
c. Keep surge tank half filled where no anti-freeze is used.
d. Keep air intake passages clear. Carry no cargo, equipment, or personnel on intake grating. Keep space below grating clear. Stow tarpaulin bows in bow compartment and not below intake grating.
e. Keep air outlets clear and outlet shutters latched fully open.

73. *Fan belt Adjustment*: Fan belt adjustment must be checked daily. Most overheating, and also fan belt wear, is caused by slipping of a fan belt that is too loose. A belt that is too tight will wear out water pump and generator bearings. The correct tension can be judged by turning the fan when the engine is stopped. Using one finger on the uppermost blade, it should be just comfortably possible (10 pounds pressure) to turn the top blade toward the right side of the DUKW. If it is difficult to move the fan, the belt is too tight. If the fan turns easily check that belt and pulleys are clean of oil and grease, and then tighten as necessary.

74. *Turning Off Engine*: Before turning off the ignition the engine should be allowed to idle slowly for 30 to 40 seconds. This action will overcome the tendency of the motor to continue to run, and will prevent damage to the early type of exhaust manifold from sudden cooling.

75. *Valve Adjustment*: The correct setting for exhaust valve rocker arm clearance is .016". Intake valves should be .012" as originally.

76. *Governor Adjustment*: No-load maximum speed with engine at approximately 180° temperature should be 2750—2900 RPM. Set carburetor stop screw to give 510 RPM idle speed.

77. *Front Spring Breakage*: This trouble has largely been the result of excessive tightening of rear bracket pin. The nut on this pin should be pulled tight and then backed off ½ or ¾ turns in which position it should be locked with a cotter pin.

78. *Keep Decks and Coamings Water-Tight*: All leaks in decks, coamings, particularly rear corners, should be promptly repaired. Winch cable guide hole covers in rear coaming and below windshield be kept in place and tight, except when winching.

79. *Remove Water from Fuel System*: Rough water operation, particularly when heavily loaded, will result in some water getting in fuel system. The following steps should be taken to eliminate trouble:

a. Keep fuel tank cap and its gasket in good condition, and so that it fits tightly when in place. Replace cap if necessary.
b. Weekly, or more often if necessary, after DUKW has been standing, drain enough from tank to eliminate water. Grease hull drain plug before replacing.
c. Weekly, or more often if necessary, drain filter, by removing base plug. Be certain to catch fuel in container. Do not allow any fuel to drain into hull bottom. Monthly, clean filter by disassembling .
d. Weekly, clean fuel pump. Be certain to catch any fuel that is spilled with suitable rags or container. Do not allow any fuel to get into hull bottom.
e. Monthly, clean out carburetor float chamber.
f. Always prime system by operating hand extension on fuel pump for about one minute after above cleaning operations. Also prime after running out of fuel, and after vehicle has been idle for over four days.
g. After above six items have been completed, carefully check entire fuel system to make sure there are no leaks—before starting engine.

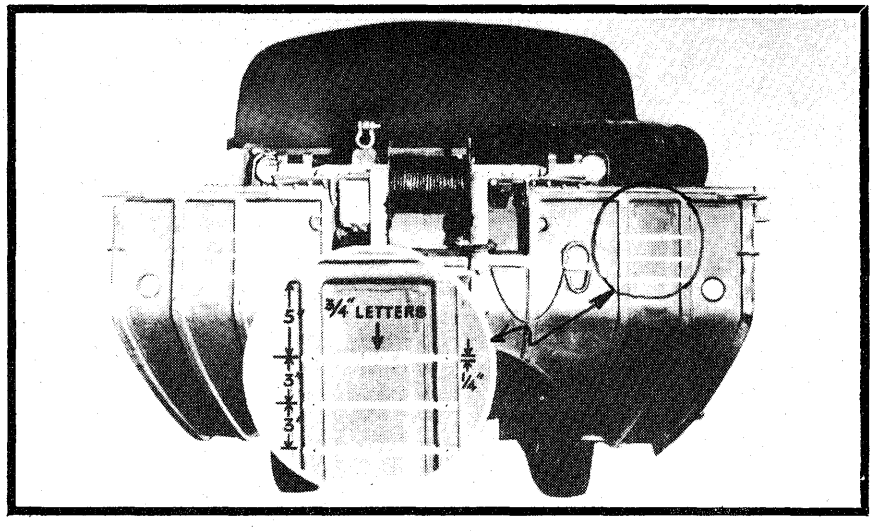
80. *Propeller Damage*: If propeller or shaft is damaged this results in excessive vibration. Operation of propeller in this condition is certain to result in additional damage to shaft, bearings, V-strut, hull, fuel tank or steering gear.

81. *Lubrication of "U" Joints Through Housing Drain Plugs*: All DUKWs with chassis numbers above 3325 have pointers below aisleway (visible from driver's seat) which enables the driver to stop in the right position so "U" point lubrication fittings will be accessable through drain plugs. The markings for rear "U" joints painted on forward *edge* of emergency brake drum, 1 mark for each joint (Unless they happen to be positioned so they can both be lubricated at one position). The mark for front "U" joint is pointed on a knuckle of the inside front "U" joint. These marks should be repaired clearly if obliterated, and should be added on old DUKWs not so marked.

82. *Preparation for Storage or Shipment*: It is very important that all parts particularly subject to salt water damage be thoroughly serviced before periods of infection. These parts would include brakes, winch drag brake, wheel bearings, pillow block (on

front rear axle) differentials, front axle "U" joints. It is desirable that DUKWs be loaded *dry* after servicing, when they will be on shipboard for a long time; where they must be loaded wet, if space permits, servicing should be done after loading.

83. *Maintenance During Advance Operations*: During an operation in which DUKWs are employed, the DUKW maintenance unit should establish itself at a suitable point as soon as possible. The best point is at the DUKW Assembly and Bivouac Area (see paragraph). If conditions ashore do not permit this, then it should be established on board an LST or other ramp landing craft. The maintenance personnel should have with them all the tools which their table of equipment authorizes, and all spare parts considered necessary to keep their DUKWs running for the duration of the operation. One DUKW from each company can be assigned to the maintenance section, and fitted up with work bench and parts and tool cabinets. By this means, a highly mobile repair shop will be available for minor emergency repairs at any desired point afloat or ashore.



Details of Load Markings

84. *Fueling During Advance Operations*: Before permanent shore fuel tanks are installed, the most efficient method of refueling DUKWs during an operation is by five gallon jerricans. When a DUKW refuels in this manner empty cans must be returned to the source of supply. When possible, operating DUKWs should refuel at the "cushion" at DUKW Control Point (See paragraph 133). Non-operating DUKWs can refuel at the DUKW Assembly and Bivouac Area. When gasoline is not available on shore, DUKWs can be refuelled on the tank deck of an LST, or at shipside by lowering cans to them. (See paragraph 200).

85. *Rudder Cable Wear*: At time maintenance, rudder cable should be cleaned carefully and inspected closely at all sheaves and spool while steering is turned from full left to full right. If broken strands or rust are found, cable must be replaced. After inspections, lubricate 6 rudder cable sheaves, and cable in way of sheaves and steering column spool. At point where cables are attached to tiller level, wires must be in grooves of thimbles. To prevent wire coming out of thimbles, nearest wire rope clamp must be secured within ¼" of ends of thimbles.

86. *Care of Life Presevers*: The life ring should be hung on hook on front face of forward cargo bulkhead. It should have 50 feet of clothes line attached to it, and neatly coiled, with coil hanging over life ring. This line serves to pull life preserver and person to whom it may be thrown, back to the DUKW. The three (3) jacket type life preservers must be kept out in the air and dried whenever possible to prevent their getting water-logged and rotten. Tie them to the cab top bow on each side above the aisleway when not in use. Do not stow them in the bilge where they get little ventilation and will quickly become water-logged and rotten.

87. *Spare Parts*: When spare parts are not available for deadline vehicles consideration should be given to removing parts off a DUKW or other vehicle that may be beyond repair. Frequently it will be found that parts from captured enemy equipment may be used.

Load Markings (See paragraph 157).

CHAPTER VI
LAND OPERATIONS

88. *General*: When on land, the DUKW has the uses and characteristics of a conventional 2½-ton, 6x6 truck, and is operated in the same manner. It has six driving wheels propelled by a six cylinder engine through the transmission, transfer case, and shafts. Instead of dual wheels on the rear and intermediate axles, the DUKW is equipped with single wheels. All six wheels are mounted with 11.00/18-10 ply desert type tires.

89. *Road Operations.* a. *Starting*: When starting the vehicle from a dead stop, the selection of the proper gear combination together with the proper operation of the clutch is most important. The following table gives the correct gear combination under various conditions:

DUKW Load	*Terrain*	*Gear*	*Range*	*Front Wheels*
Light load or empty.	Level road	2	High	Out
Light load or empty.	Up grade or in hole	1	High	Out
Heavy	Level road	1	High	Out
Heavy	Level, but off the road	2	Low	In
Heavy	Up grade or in hole	1	Low	In
Empty or loaded.	Wheels stuck in sand or mud	1	Low	In

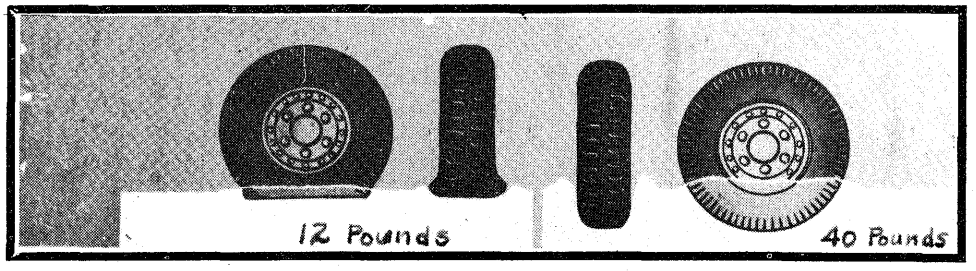
b. *Speeds*: Maximum speeds for each gear are indicated on the caution plate in the driver's compartment. Operators must keep below the maximum speed for each gear. They must also shift to a lower gear before the engine goes below 1200 revolutions per minute.

c. *Stopping*: The driver should learn to slow down well in advance of coming to a halt by releasing pressure on the accelerator and leaving the clutch engaged. The brakes should then be applied firmly but *gradually*. The clutch should not be disengaged until the DUKW has almost stopped.

90. *Operation On Hills.* a. *Uphill*: Before starting uphill the gear which will bring the DUKW to the top should be engaged. If the engine stalls on a steep hill, the driver will apply the foot brake and set the hand brake, shift into neutral and start the engine. Then, if necessary, he will shift into reverse and back down the hill. The driver will never step on the starter when the vehicle is rolling backward and the gears are engaged, even if the clutch pedal is down.

b. *Downhill*: The driver will use the same gear in driving down a hill that would be used in driving up the same hill. On grades over 30% the lowest gear should be used. Whatever gear is used, the speed will be kept down to or below the maximum speed shown on the dash plate for the gear being used. Apply brakes at intervals, only as needed. Coasting downhill with the clutch depressed or with the transmission in neutral is dangerous. Drivers will not attempt to change gears after starting downhill.

91. *Convoy Operations.* a. Safe Distances in Column: Under normal road and weather conditions, the distance in yards between vehicles in a motor convoy will be twice the driving speed. For example, at 25 miles per hour, there should be a distance of 50 yards between vehicles. Under actual or simulated battle conditions, no vehicle will be within 75 yards of any other vehicle.



At 12 pounds tire travels over sand—at 40 pounds it sinks in

b. *Blackout Lamps*: In convoy driving at night, under blackout conditions, the blackout marker lamps are of great assistance in estimating the distance between vehicles.

(1) The two rear lamps are divided into four parts each making eight parts in all. When the vehicle ahead is less than 60 feet away eight lights are visible; between 60 and 180 feet, four lights are visible; between 180 and 800 feet, two lights are visible; beyond 800 feet no lights are visible.

(2) The two front marker lamps are visible as four up to 60 feet; from 60 to 800 feet they appear as two; beyond 800 feet they are invisible.

c. *Rear End Collisions*: Dangerous leaks in the bow and broken winches result from rear end collisions. Such collisions are entirely due to careless driving. They can be avoided altogether if drivers will observe the following rules:

(1) When driving in convoy, do not come any closer than the proper convoy distance.

(2) *Before* starting up a hill, engage the gear which will take the DUKW to the top.

(3) When applying the brakes, apply them *gradually.*

(4) When about to slow down, stop or reverse, give a signal which will be clearly seen and understood by the driver in the vehicle behind.

(5) Always be on the lookout for signals from the vehicle in front. When a signal is seen, act at once, and pass on the signal to vehicle behind.

92. *Sand Operation*: a. *General*: Due to the suitability of its tires, the DUKW has exceptional ability to operate in difficult sand conditions.

b. *Front Wheel Drive*: For all soft sand operation the front wheel drive must be engaged.

c. *Tire Pressure*: Wherever soft sand is encountered, correct tire pressure must be used, in accordance with instructions on the dashboard. If tires have been deflated for sand operations, they must be inflated to 40 lbs pressure before the DUKW is parked for any length of time.

d. *Avoid Spinning Wheels*: With tires properly deflated, travel over the sand with full power. Do not "dig in." If progress stops, disengage the clutch immediately, then back out and make another try in a better place.

e. *Grades and Turning*: Difficult sand grades, up or down, should be negotiated straight and square. Keep rolling fast over sharp ridges, to avoid being straddled on the crest. The front wheels must be kept *dead straight ahead* to get maximum traction while going through a bad patch of soft sand.

f. *Follow the Leader*: Once the best available path has been picked by the leading DUKW, those behind should follow in the same tracks.

93. *Difficult Terrain*: a. *General*: Tree stumps, sharp rocks, etc. must be avoided. Soft deep mud and swamps should always be avoided, since no wheeled vehicle can operate in them.

b. *Wire*: In operations where wire may be encountered, the front brake shut-off cock must be closed. It is located on the right frame side rail below the middle of the driver's compartment. This is not necessary on vehicles which have been equipped with wireproof front brake hose protectors. Around dumps, the driver will be particularly careful of the steel bands which are used as cargo binders.

c. *Shapnel*: After bombings, naval bombardments, etc., the ground is littered with shrapnel fragments. These are very harmful to tires and will be avoided whenever possible.

94. *Goggles*: When roads are dusty, DUKW drivers can operate more efficiently if they are provided with dust proof goggles.

95. *Removal or Installation of Wheel and Axle Shaft*: To facilitate the changing of tires and the removal of axle shafts, the following procedure will be followed:

a. *Removal of Wheel and Tire.*

(1) Close individual valves at side of gunner's seat.
(2) Remove wheelhouse cover.
(3) Remove cover over hub unit to valve stem hose.
(4) Disconnect hose from valve stem and insert core in valve stem.
(5) Back off 3 hub unit mounting set screws, pull off hub unit and hang it on side of hull.
(6) Stamp end of wheel mounting stud next to valve stem with a numeral "6".
(7) Remove wheel and tire.

b. *Installation of Wheel and Tire.*

A fixed relation must be maintained between valve stem, wheel mounting stud, and the 3 special extended hub unit mounting bolts in axle flange.

If axle flange has not been removed, and if wheel mounting stud next to valve was stamped "6" before removal of wheel, proceed as follows:

(1) Mount wheel with valve next to #6 stud, and tighten wheel nuts.
(2) Replace hub unit and tighten 3 mounting set screws.
(3) Remove valve core from valve stem and immediately connect hose (from hub unit) to valve stem, hand tight. *Do not use pliers.*
(4) Replace cover over hub unit to valve stem hose.

(5) Replace wheelhouse cover.

(6) Open individual valves at side of gunner's seat.

c. *Installation of Axle Shaft & flange.*

In order to maintain the correct relation between 5 axle flange cap screws, 3 special extended hub unit mounting bolts, wheel mounting studs, and valve stem, *positions of certain of these should be marked before disassembly as follows*:

Before removal of wheel and tire, wheel mounting stud next to valve stem should be stamped "6".

Before removal of any axle flange fastenings, positions of the 3 special extended hub unit mounting bolts should be located by prick punching hub (not axle flange.)

d. *If shaft has been removed before marking or if marks have been obliterated,* proceed as follows:

(1) Before installing axle shaft and flange locate #1 wheel mounting stud in following manner: Select the 2 diametrically opposite wheel studs and the 2 diametrically opposite tapped holes in hub all of which are in line with each other and calling either of these wheel studs #1, #6 wheel stud will then be the 1st stud counter clockwise and if not marked should be stamped "6".

(2) Identify axle flange tapped holes in hub as 1 to 8 clockwise, #1 being nearest #1 wheel mounting stud. Mark hub with prick punch adjacent to tapped holes 1, 3 and 6 so that punch marks will be visible after axle shaft and flange have been installed.

(3) Install axle shaft and flange. Assemble the 3 special extended hub unit mounting bolts in punch marked positions (1, 3, 6) in hub, install regular cap screws in remaining five tapped holes.

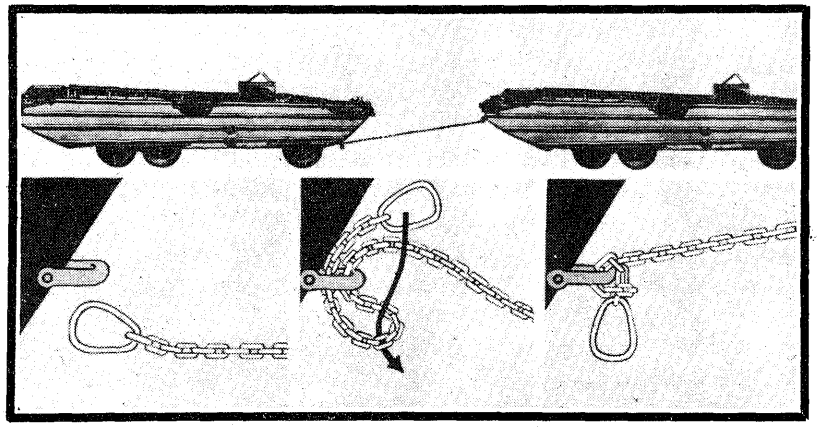
CHAPTER VII

WINCHING OPERATIONS

96. *General*: a. A thorough knowledge of winching techniques, circumstances in which the winch may be used, and methods of rigging are very important. The winch, because of its great power, can be of assistance under many conditions. Its main uses are to enable a DUKW to extract itself when stuck, to assist another vehicle when it is stuck, to refloat a beached landing craft, and for lifting, loading and unloading in conjunction with an "A" frame.

b. The winch on the DUKW is basically the same as that on a regular 6x6 truck except that on the DUKW it is mounted at the stern. It can be used for pulling either forward or backward. When winching forward, the cable is led through the winch guides in the rear coaming and at the base of the windshield, and then through the bow fairlead. When winching astern, the cable leads directly from the drum.

Land Towing: Do *not* use the winch cable for land towing. Instead, use the tow chain from the stern pintle hook to one of the lower bow shackles on the other vehicle. See fig. below. Never secure to above deck bow cable fairlead. It is only a cast iron guide and is easily broken by attaching to it when towing.



Land Towing With Chain—Showing details of Securing Thru Bow Shackles

97. *Details of The Winch*: a. The winch is equipped with 150 feet of half inch galvanized cable (breaking strength approximately 18000 lbs.) The cable is protected by a shear pin which will shear when the load on the cable exceeds 10,000 lbs. The shear pin is located below the rear deck at the coupling where the winch drive shaft goes through the stern of the DUKW. Spare shear pins are in a rack close by. Each DUKW is supplied with snatch block, tow chain and 75 ft. auxiliary cable.

b. *Power Take-Off Lever*: The winch is operated by a power take-off lever on the left side of the transmission. It can be placed in high, low and reverse gears with two

neutral positions in between. The hinged locking plate attached to the cab floor must be down when the winch is not in use, to lock the lever in the neutral position between reverse and low.

c. *Sliding Jaw Clutch*: The sliding jaw clutch on the rear deck is used to engage and disengage the winch drum. When in the disengaged position (handle moved toward the left side of the DUKW) the winch drum will rotate freely on its shaft.

d. *The Drum Flange Lock*: The drum flange lock is mounted on the sliding jaw clutch handle mechanism. It can be made to engage one of several holes in the winch drum flange when the sliding jaw clutch is in released position. It thus prevents the cable from unwinding while the vehicle is operated, the jaw clutch being normally left in the disengaged position.

98. *Operating Cycle*: a. *Signals*: It is most important that at all times when the winch is in use, a signal man will direct the winch operator with a clear system of hand signals. He will stand in such a position that his signals can be seen by the operator, who will watch him all the time, and take directions from him only.

b. *To Hook Up*: To hook up the cable, the sliding jaw clutch lever must be in the disengaged position and the drum flange lock released. Pull out as much cable by hand as is needed for the desired hook up. A minimum of at least five turns must be left on the drum, or the end may pull out.

c. *To Wind In*: Engage the sliding jaw clutch. Then operate the winch by shifting the power take-off lever in the cab, using the clutch in the same way as when driving. High speed should be used to take up slack in a loose cable or for extremely light loads, and low speed should be used for heavy pulling. Before starting to wind in the cable, the cable already on the drum must be tightly and evenly wound. The assistant driver should watch the cable closely while it is being wound in, and guide it with the hand crank bar so that it winds evenly and does not kink or jam.

d. *Engine Operating Speed*: When using the winch, the maximum engine speed should be 1000 RPM or about 1/3 throttle. The winch mechanism and bearings will be damaged if higher speeds are used.

e. *To Stop*: To stop the winch, the driver should depress the clutch pedal and shift the power take-off lever to neutral.

f. *To Pay Out Cable*: Whenever the cable is under load, the winch power take-off must be shifted into reverse to pay out cable. However, if the cable is slack and if there is more than ten feet to be paid out, the cable should be pulled out by hand, by releasing winch jaw clutch. The paying out of cable must be stopped when at least five turns remain on the drum, otherwise the cable load will fall directly on the end attachment, and it will pull out.

g. *When not in use*: After the winch has been in use, the cable must be cleaned and well coated to prevent rust, and must be wound up evenly on the drum. The best protection for the cable is Rust Preventive Thin Film. The hook at the end of the cable is secured to one of the winch guides. The cable must not be passed around the winch guides.

99. *Rigging Methods*: a. *General*: When winching, use an adequate rig upon the first attempt. This will eliminate failures and save time and equipment.

b. *Winching Point*: The term "Winching Point" is applied to any fixed object to which the winch cable or rigging is attached during winching operations. The winching point should be as nearly as possible in line with the direction in which the stuck vehicle is to be moved. Winching points will include the following:

(1) *Other Vehicles*: The most practical winching point is one or more vehicles. They can be moved to exactly the right position.

(2) *Trees*: If no suitable vehicle is at hand, a well rooted tree is the next best choice. Winching point should be as close to the roots as possible.

(3) *Anchor*: Where no trees are available, the DUKW anchor can be used for moderate pulls. It is most effective in soft sand where it will dig itself down when a pull is applied to it. In hard ground it should be buried in a manner similar to that described below for the deadman. The anchor is not strong enough to make more than a single rig effective. (See sub paragraph c (1) below.)

(4) *Deadman*: A deadman can be used when no vehicle or tree is available and when the anchor will not be effective. It should be a heavy log at least 10 feet long, buried in a trench 4 feet deep. A shallower trench leads off at right angles to the deadman trench, in the direction of the pull. This is for the tow chain, which is wrapped twice around the center of the deadman.

c. *Cable Hook-ups*: The effective power of the winch can be varied by a variety of cable hook-ups, involving the use of one or more snatch blocks, and sometimes, one or more auxiliary cables. The power of any hook-up will be greatest when the cable is paid out to the bottom layer of the drum. The following methods could be used:

(1) *Single Rig*: The simplest hook-up is a direct cable led forward or backward. It provides a maximum 10,000 lbs. pull. Auxiliary cable extends reach by 75 feet.

(2) *Double Rig*: When a single rig is not sufficient, the pulling power of the winch can be doubled by leading the cable through a snatch block which is secured by tow chain to the winching point. The end of the cable is brought back and hooked to the DUKW. For longer reach, the auxiliary cable can be hooked between the snatch block and the winching point.

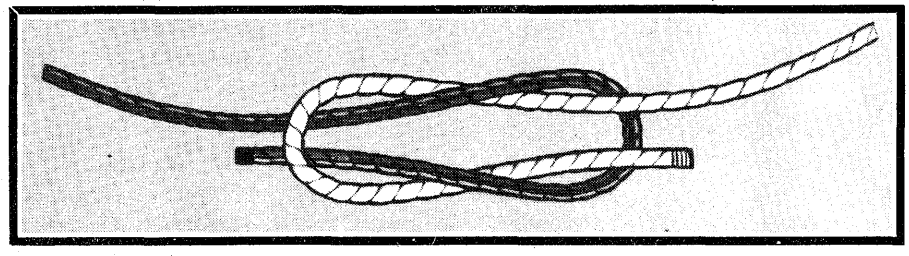
(3) *Triple Rig*: To pull out a badly stuck DUKW, the cable can be tripled by leading it through two snatch blocks. This will provide up to 30,000 lbs. effective pull. The first snatch block is at the winching point, or on the end of the auxiliary cable if that is needed for reach. The second snatch block is hooked on lower bow shackle of DUKW that is stuck (or in stern pintle—using pear shaped link for rearward pull). The cable is lead through the first snatch block, back through the second, and then secured to the winching point.

100. *Winching Operations.* a. *Winching on DUKW*: The most frequent use of the winch is to enable a DUKW to pull itself out when it has become stuck. A suitable winching point and rigging method should be selected. Do not engage the wheels until the winch cable becomes tight. When it is tight, assist the winch by engaging the wheels (low low for forward travel or low reverse for reverse travel).

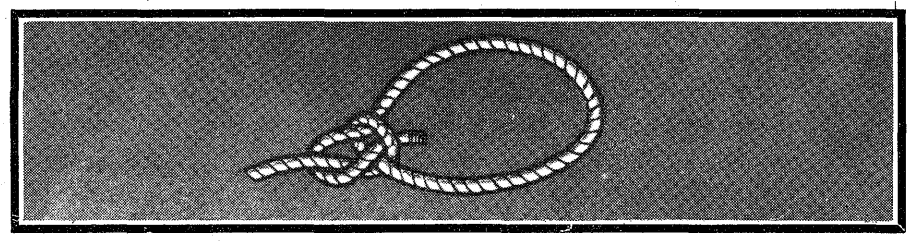
b. *Winching Another Vehicle*: To assist another vehicle that is stuck, it is better to use the winch on the assisting vehicle. Apply hand and foot brakes before attempting to winch. If the winch merely pulls the assisting vehicle toward the stuck vehicle, it will be necessary to secure the assisting vehicle to a tree or to another vehicle. If none is available, in soft ground or sand the assisting DUKW can disengage the winch, and engage its wheels for a few moments. This will dig the wheels of the assisting DUKW into the ground and help anchor it.

CHAPTER VIII
KNOTS AND FENDERS

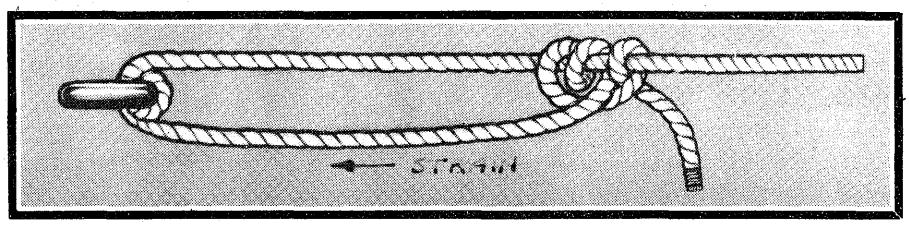
101. *General*: Knots, wire splicing and fenders are used constantly in DUKW operations. Not infrequently the safety of the DUKW and its crew will depend on ability to make a dependable knot quickly. DUKW crews must learn the following knots, and must practice tying them frequently. They should also learn to tie them with their eyes closed, for they will often have to use them at night.



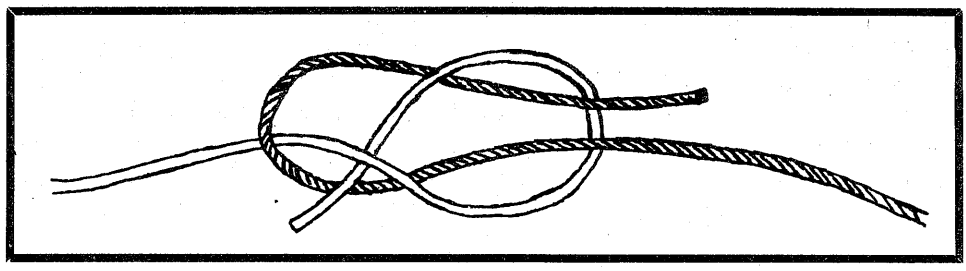
102. *Square Knot*: For square knot see figure above. This knot is suitable for joining two ropes of approximately the same size, or for joining the two ends of a lashing line. If a square knot is pulled very hard it will be difficult to untie.



103. *Bowline*: For bowline see figure above. It will make a loop at the end of a rope which will not pull tight on itself. The bowline can be easily untied, even after a heavy strain, but the rope must be slack while untying.

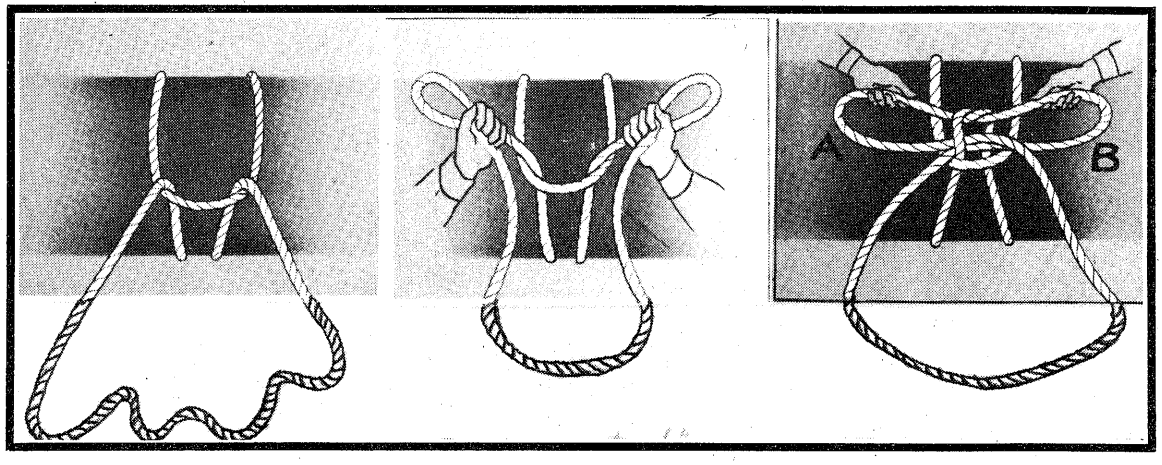


104. *Rolling Hitch*: The rolling hitch, see figure above, is used to make fast a rope to itself or to another rope that is already tight. It is handy in making a spring line fast to a guest warp (see paragraph 141). It is also used to make fast the ends of the hand ropes on the DUKW tarpaulin and the securing of the ends of fender lashings (see paragraph 109). It should be noted that the two turns should be on the side from which the strain comes.



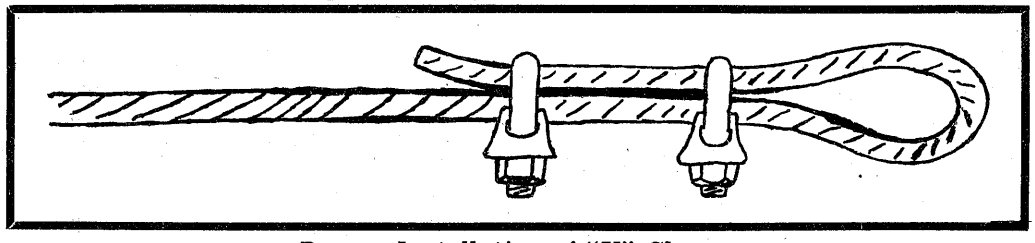
Sheet Bend

105. *Sheet Bend*: The sheet bend, see figure above, is used to join the ends of two ropes which will be subjected to considerable strain. If used to join ropes of different sizes, the bight should be made in the larger rope, and an extra turn made in the smaller rope.



Sling Knot—Used to Shorten a Sling

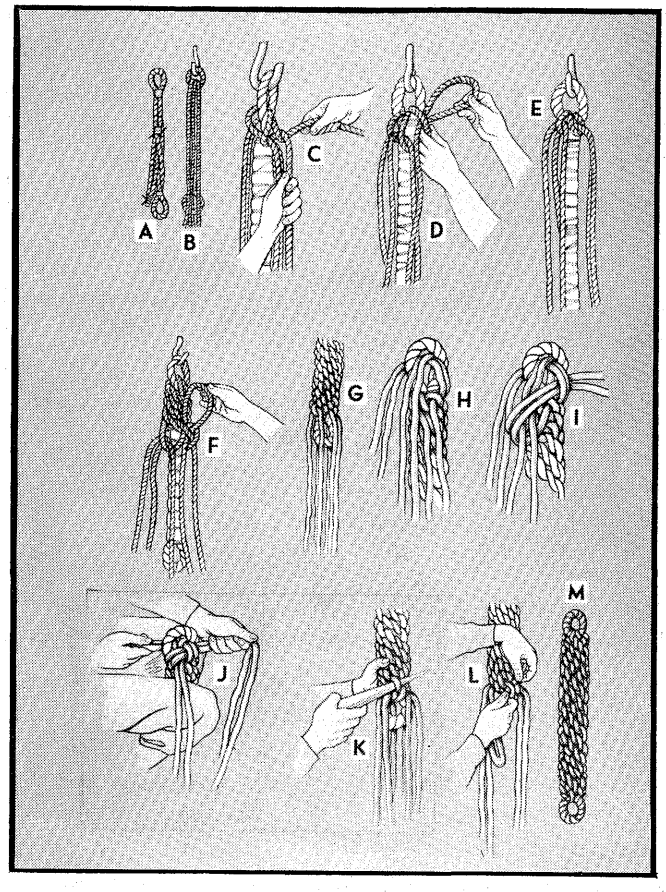
106. *Sling Knot*: The sling knot is used to shorten a continuous sling that is around a package to be lifted. A short bight of the excess sling lengths is held in each hand and the double ropes forming those 2 short bights are tied in an overhand knot (like the first half of a square knot). The hook for lifting the package is then hooked through the two ends of the short bights as marked A and B in figure above.



Proper Installation of "V" Clamps

107. *Wire Splicing*: In making wire cable slings, guy wires for "A" frames etc., "U" clamps are used. Two clamps are necessary for any splice. For proper installation of "U" clamps, see figure above. Note that saddles are on long part of wire, with "U" bolts over short end.

108. *Fenders*: Fenders, sometimes called bumpers, are rope cushions made to protect the sides of the DUKW. Mooring alongside ships in rough water, fender wear will be rapid, so it is important that DUKW companies familiarize themselves with details of making fenders as shown in figure below. Two men working together can make and install two fenders in two hours. One entire fender can be made from 48 feet of 1" diameter rope plus rags, canvas or scrap rope for padding out the core. First cut off 8 feet, and make the 40" over-all core by splicing an 8" eye in each end of the piece. Do not



cut off the ends after splicing. They will help pad the core. Next cut off two pieces each 20 feet long and unlay them, producing 6 pieces of 20 feet. These should be hung evenly through the upper eye of the core, and it is from these that the fender body is woven. Three 8 foot lengths of $\frac{3}{8}$" diameter rope will provide the three fender lashing ropes.

a. The first step, shown in figure "A" is to make the core which should be 40" long overall, including eyes. The center part of the core to be made of two pieces of line each of which is doubled having 6" eyes placed opposite each other. These eyes should be lashed securely to each other at several points. The center of core should be made larger with additional ropes wrapped with canvas or rags all securely bound in place with twine or marline. The diameter of the core should be about 5".

b. Figure "B" shows the next step which is to hang the core at the highest convenient working height. Then lead six lines through the upper eye, with the center of the line resting in the eye. These lines should be ⅜ to½ inch rope, each one measuring about 20 feet. The 3 strands of the 1" rope on the DUKWs, used individually, are ideal for fender making.

c. For purpose of description number the ropes 1 to 12, starting with the front left rope and going in a counter clockwise direction. In the figure above, to clarify the drawing, only 3 ropes giving 6 ends are used instead of 6 ropes giving twelve ends. However, the procedure is the same. Rope numbers 1 and 12, 2 and 11, 3 and 10 etc. are the front and back of the same ropes respectively. Bring #12 around the left side of the core and under #1, leaving a small loop. Now lead #1 under #12 and extend #1 to the right. Hold #12 in left hand. Carry #2 over the front of #1. Head #1 over the front of #2 toward the left and into the left hand. This completes figure C.

d. Continue this same procedure by bringing #3 over the front of #2. Then bring #2 over the front of #3 toward the left and into the left hand. Bring #4 over the front of #3. Bring #3 over the front of #4 toward the left and into your left hand. Bring #5 over the front of #4. Bring #4 over the front of #5 toward the left and into your left hand. Continue process around to #11. Lead #11 around in back of core and through the small loop under #12 as shown in figure D. (This loop was made when #12 was brought around the left side of core and under #1 as the first step in paragraph c.)

e. Figure "E" shows the completion of the first row. Each of the six ends (in making DUKW fenders it will be twelve ends) has been tucked over and all pulled up evenly and tightly.

f. Figure "F" shows the fender after 4 full rows have been completed and the 5th row is having its final tuck preparatory to tightening. After each round all ends hanging down must be untangled and kept clear.

g. Continue the above procedure until the lower eye is reached as shown in Figure "G".

h. Now take the fender down and turn bottom end up. Hold it between the knees, then take two sets of four ropes and criss-cross them through the eye as shown in figure "H". (In this case the ropes are in pairs.)

i. Complete the crown by leading the remaining set of four ropes as shown in figure 1. This last set of ropes does not go through the eye.

1. This last set of ropes does not go through the eye.

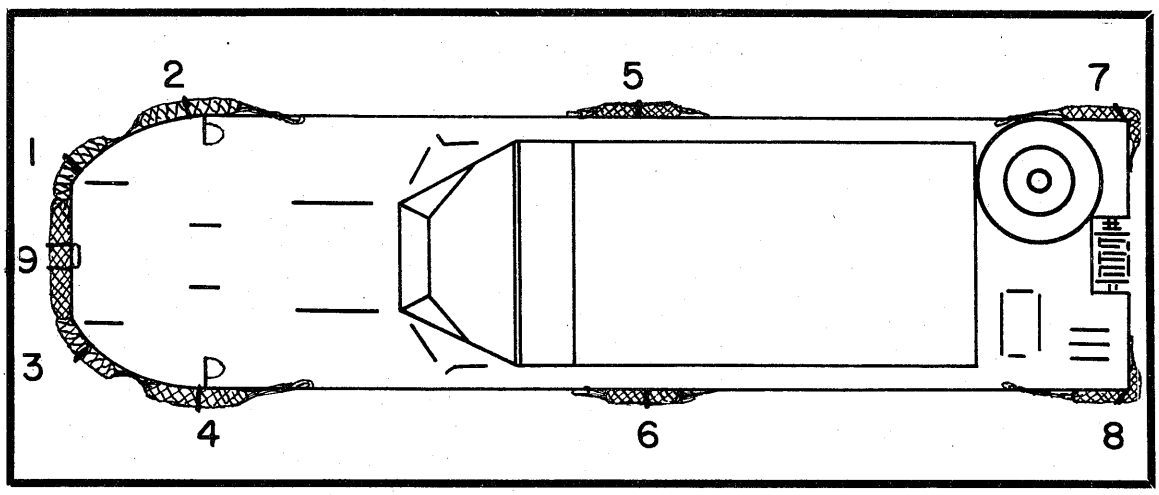
j. Figure "J" shows you how to pull the crown down tightly. Always pulling on two sets of ropes at at time.

k. Hang up fender in original position. Using a marline spike or fid as shown in figure K, tuck back the strands in a manner similar to splicing.

l. Each rope should be tucked under one strand, over the next and under the next, against the lay of the fender.

m. Figure "M" shows complete fender after loose ends have been pulled tight and then cut off.

109. *Installation of Fenders*: It is very important that the fenders are correctly installed on the DUKW, otherwise they will not protect the vulnerable points. For maximum protection, each DUKW should be equipped with nine fenders. For purpose of description, the fenders are numbered 1 to 9 in figure below.

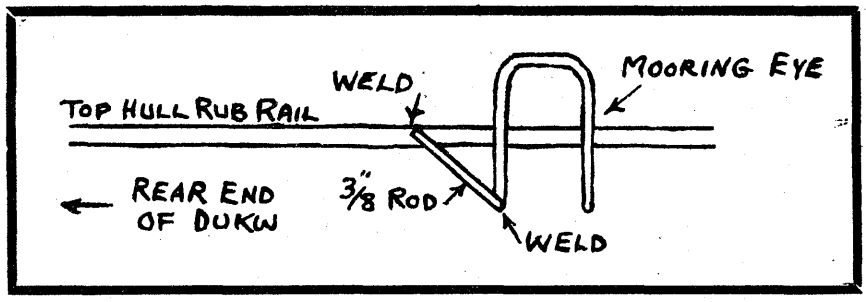


a. In all cases, lashing lines must be passed back and forth through lashing eyes as many times as the length of the line will permit. With the end of the line, make a rolling hitch around all the turns. (See paragraph 104). It will be found that 18 inches is needed to make the rolling hitch.

b. All the fenders are identical, with a lashing line at each end and one in the middle, except for #1 and #3, which have lines at only end. Lay #1 on the ground and join it to #2 at the end which has no lashing line. Make the join by overlapping the loops and lashing them together so that there is a space of ten inches between fenders. Hold up the pair of fenders so that fender #2 is centered under its lashing eye on the deck of the DUKW. Take the line at the end of #2 and lead it through the forward lifting eye, then back through the loop of the fender and lash it as described in paragraph a. Then take the line at the end of #1, and lead it through the small eye alongside the bow towing shackle. Pull the line as tight as possible before completing the lashing. Then take the middle line of fender #2 and lead it through the eye at the edge of the deck above it and then bring it down, over the outside of the fender, through the eye below. Complete the lashing as usual, taking as many turns as possible. Lash the middle of fender #1 in the same manner. (Note: In some older DUKWs the middle lashing eyes for fenders #1 and #3 are in the wrong position. Eyes should be welded to the hull in line with the middle of fenders #1 and #3.) Install fenders #3 and #4 in the same manner as #1 and #2.

c. Hold up fender #5 so that it is centered between the upper and lower fender eyes, which are located about midway along the side of the DUKW. Make the rear end of the fender fast to the lashing eye which is located further aft, and make the front end fast to the mooring eye. It is important that the lashing line is passed around the *forward* end of the mooring eye, or better still, a four inch length of $\frac{3}{8}$" rod can be welded from the bottom of the rear end of the mooring eye, to the hull rub rail, at a 45° angle to it. This will form a suitable lashing eye. (See figure below.)

If the aft end of the mooring eye is used as a lashing eye, the mooring hook will very soon cut through the lashing. Lash the middle of the fender, using the two lashing eyes Install fender #6 in the same manner. If fender eyes as described for fenders 5 and 6 are not installed on old DUKWs, they should be added. Locate them by measuring from mooring eye. Upper and lower eyes should be 28" aft of mooring eye and rear eye should be 56" aft of mooring eye.



d. In the case of fender #7 and #8 *about ¾ of the fender must be along the sides* of the DUKW. Hold the fender up in that position and then lash the forward end to the lifting eye. The rear end of the fender can then be pounded until it rounds the corner of the DUKW, and is made fast to the lashing eye on the stern, pulling the line as tight as possible. Then lash the middle of the fender in the usual manner.

e. An additional fender (#9) in the center of the bow is extremely useful. The top center lashing eyes for #1 and 3 can be used to lash the ends. The middle lashing can be passed around in back of the bow fairlead, then outside the fender and down to the lashing eyes alongside the bow towing shackle.

f. After several water operations, it will be found that when the fenders have dried, the lashing lines have stretched and slackened. It is necessary to take up all slack The checking of fenders and lashings is a part of Daily Driver Maintenance. It is very important to repair them, turn them, and replace them as often as necessary.

CHAPTER IX
WATER OPERATION

110. *General*: The amphibian truck is as much a seagoing craft as a land truck. While drivers may be familiar with land operation of a 6x6 truck, boat handling will be an entirely new experience for most of them. Instructions applicable to water operations, therefore, should be studied carefully. If there is a DUKW Control Point on the beach, he will give instructions and advice on the correct techniques to be used. (See Chapter XII.)

111. *Preparing to Enter the Water from Shore*: a. *Conditions.* The principal considerations are: (1) how *steep* is the beach (can the DUKW get back out), (2) how soft is the sand (can it be crossed and at what tire pressure) and (3) how rough is the ground (can be *seen* above water, and must be negotiated below water). Obstacles under water will be more difficult to negotiate than if they were on dry land. Avoid mud, swamps, marshes, quicksand, stumps, wreckage, large sharp rocks and boulders.

b. *Tire Deflation. A very soft* sandy beach will require tire deflation to a *minimum* of 12 pounds, soft sand 20 pounds, while reefs of coral or sharp rocks require tire inflation to 30 pounds. For overloads all recommended pressures should be increased 1 pound for each 1,000 pounds over the 5,000 pound pay load.

c. *Hatches.* All hatch covers must be clamped tightly. Early model vehicles were equipped with auxiliary air intakes. Make sure this intake is also tightly clamped. However, air exhaust grill covers must be left *open,* except in sub-freezing weather.

d. *Hull drain valves, housing drain plugs and bottom plugs.* Before entering water, be sure that bilges are reasonably dry and that all 4 drain valves are closed and all plugs are tight. See paragraph 71 for details.

e. *Tarpaulins.* For surf over 5 feet high, rig the cargo tarpaulins securely. Tarpaulins must also be used when long hauls are to be made or when the hauls will be made in rough water.

f. *Surf.* Unless water is smooth, the bow surf plate must be set up. If the cargo comes up to or above the coamings, the tarpaulin may be lashed directly over the cargo and coamings without the use of tarpaulin bows.

112. *Entering the Water*: a. When operating in water, all men aboard will wear life jackets. When moving outside the cargo compartment, personnel should always maintain a secure hold with at least one hand.

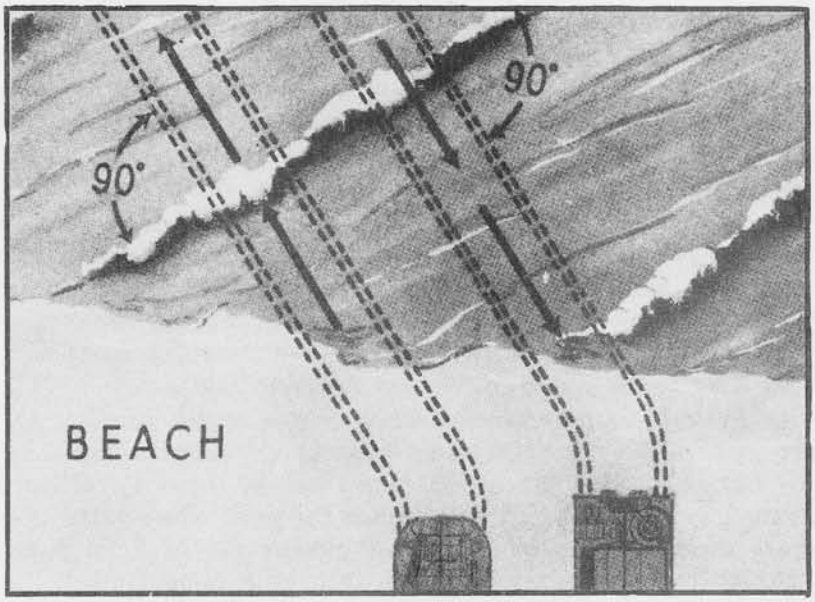
b. Set the bilge pump manifold open to the center or main compartment. Close other manifold valves, and close the manifold drain on DUKWs that are fitted with these. See dash instruction plate for pump system details.

c. Survey the beach and select the most desirable approach. This will vary with the location, but a hard, sandy, moderate grade beach is the best. Proceed with transmission in second gear, front wheels engaged and transfer case in low range.

d. Unless there is a heavy surf or strong current, *wait until fully afloat before engaging water propeller.* This practice will considerably decrease the chances of damaging the propeller. If the propeller is damaged, stop the propeller immediately before hull is punctured and return to shore, using wheels only. Operational beaches are usually littered close to the edge of the water with wreckage, spilled cargo, floating fuel cans, and

occasionally with barbed wire, stakes, coral, stumps, boulders and so forth. These should be avoided as much as possible. When engaging the propeller after floating, first give the brake pedal a touch to stop the wheels spinning.

e. If there is a heavy surf or strong current, the water propeller should be engaged before reaching the edge of the water. *The DUKW must be momentarily stopped* to accomplish this. Then proceed with *full throttle.* Face the bow at right angles to the surf as in figure below, except when there is a strong current parallel to the shore. In that case, point the bow sufficiently (generally about 15°) upcurrent of the normal course, to allow for the fact that the bow floats first and will be swung off.



Enter and leave the water at right angles to the waves.

f. When entering the water down steep banks or ramps, proceed *slowly* and do not engage propeller until afloat. Also set stern pintle hook in horizontial position so that it will not strike obstructions.

113. *In the Water*: a. *Driving Wheels*: The wheels will not be disengaged until the DUKW is clear of breakers and over all outlying reefs. Only approximately ½ mile per hour speed is lost by having the wheels and propeller engaged at the same time, and the danger of getting stuck is considerably decreased. When in deep water, stop the wheels by shifting the transfer case into neutral. *Do not disengage the front wheel drive.*

b. *Leaks*: As soon as the vehicle enters the water, look down through the air-intake grills. If there is excessive leaking, indicated by an abnormal quantity of water in the bilge, return to land as quickly as possible.

c. *Bilge Pumps*: There are three bilge pumps: (1) the rear pump which will discharge approximately 200 gallons of water per minute; (2) the forward pump, which will discharge approximately 50 gallons per minute; (3) the hand bilge pump, which will discharge approximately 25 gallons per minute.

(1) *Rear Pump*: The rear pump operates automatically whenever the propeller is driven ahead, but it does not begin to pump until the water is about 5 inches deep in the center compartment.

(2) *Forward Pump*: The forward pump, below the driver's seat, removes water from the left and the right rear compartments, from the center compartment and in old DUKWs, from the bow compartment. It is not practical to pump from more than one place at a time. It is dangerous for the pump to run *without* having one pump valve open. DUKWs that have 5 rods coming up through the floor immediately in front of the driver's seat have four manifold valves and a manifold drain. The center rod of the five is the manifold drain. Whenever afloat it is important that this manifold drain be in the closed position (control pushed down). If this control inadvertantly remains up, it will interfere with the pumping of the various compartments. Chassis numbers above 4202 have only 3 controls, these coming out through the front face of the driver's seat. On all DUKWs the different valves should be opened alternately, leaving an individual valve open as long as water continues to come out of the discharge. However, when no bilge water appears to be coming out it is advisable to operate the different valves in rotation, each valve for a minimum of about two minutes. The discharge should be watched. If an abnormal amount of water is being discharged from any one compartment, that section should be inspected for leaks and drain valves should be checked to see that they are shut tightly.

(3) *Hand Pump*: In emergencies, when engine is not running or power pumps are inoperative, the hand pump, buckets and helmets should be used for bailing purposes. If it is possible, cargo may be thrown overboard, particularly at the low side of the DUKW or near the point where water is coming in. Also move cargo as necessary to permit proper use of hand pump, particularly when it is necessary to pump from *rear* compartments.

d. *Steering*: Water steering requires more turning of the wheel than land driving. In water operations there is a conside able lag at both the start and at the finish of a wheel turn. The driver must anticipate turns, particularly in rough water. Swing the wheel ahead of time if possible. In the water, it is the *stern* that responds to the steering wheel, *not the bow*. In addition, the stern momentarily swings *toward* an object as the DUKW is steered *away* from that object. Rudder response will be less at reduced speed. But even at a very low speed, rudder control will be better if occasional short spurts are given, causing the propeller to drive sufficient water against the rudder to produce the desired turn.

e. *Speed*: At 2500 engine revolutions per minute smooth water speed without payload should be 6.5 miles per hour. This speed will be reduced about 0.1 miles per hour for each 1000 pounds of load carried, giving 6.0 miles per hour maximum speed with 5000 pounds of load and 5.7 miles per hour maximum with 8000 pounds of load. In addition, water speed will be reduced about 0.1 miles per hour for each foot of wave height encountered. Thus a DUKW with 7000 pounds load in 3 feet waves should make 5.5 land miles per hour (losing 0.2 for overload and 0.3 for wave height). Performance figures are given on dashboard plates. These figures are all based on *land* miles and must be multiplied by 7/8 to reduce them to nautical miles as used on most charts. Note that nautical miles may be multiplied by 1-1/7 to convert them into land miles.

f. *Endurance*: For runs where capacity of gasoline supply is not a factor, full throttle, with transmission in second gear, should be used. The propeller holds the engine down to reasonable operating speed of abou 2500 revolutions per minute. The maximum water range of the DUKW is 28 *nautical* miles. This is equal to 32 *land* miles. On extremely long runs when gasoline must be conserved, engine speed should be dropped to 2100 to 2200 revolutions per minute in second gear or to full throttle in third gear. The engine will have a tendency to run hot in third gear. Temperature can be brought down by periodically running the engine in second gear for several minutes.

g. *Manifold Glow*: At night in the water exhaust manifold glows cherry red and can be seen through floor boards. This is normal, and no sign of trouble.

h. *Refueling*: Refueling on the water is difficult. The DUKW should be maneuvered so that the gas fill is away from the waves, and rags should be kept handy to block out water as necessary.

i. *Reversing*: It is impossible to stop the DUKW quickly in water. Reversing is the only means of stopping. To do this, shift transmission into reverse, and also shift the propeller transfer case to overdrive (reverse) position. *Use full throttle* when reversing and engage all wheels in high range to get maximum effect. When traveling light, reversing is greatly improved by shifting the crew and any movable weights to the rear to keep the propeller tunnel under water.

j. *Precautions*: Keep clear of lines, moorings, anchor cables, nets and bouys, particularly on the windward or up-current side. Also keep loose lines clear of the propeller, particularly when towing. If the DUKW fouls a line or gets too close to one, disengage the propeller and wheels (if engaged) at once, use the boat hook to clear the lines and drift away. If a line becomes fouled in the propeller, try momentarily reversing and then going ahead again. This procedure repeated several times may throw the lines clear without causing damage. In no case *force* the propeller to turn when it is being held by a fouled line.

k. *Distress Signal*: While a DUKW is at sea, the driver may find himself in need of assistance. This may be on account of a mechanical breakdown or a fouled or damaged propeller. Whatever the cause, he may wish to summon another DUKW to tow him ashore or render other services. In such a case, during the day, he should lash a life jacket to one end of the boathook and hold the boathook up in a vertical position. At night, if the tactical situation permits, he can use his flashlight or headlight and flash the usual "SOS" signal in Morse Code (. . .- - - . . .). Upon seeing the distress signal, it is the duty of the nearest DUKW to come to the assistance.

l. *Towing*: In towing another DUKW, the towing DUKW will use its winch cable, which will be hooked in the towed DUKW's bow shackle. *Never use bow fairlead.* This is cast iron and will break easily. Unless conditions are very smooth, when a shorter cable can be used, the cable should be paid out until there are only five turns left on the winch drum. The towing DUKW must proceed very slowly until the cable is taut. Once taut, the cable should be kept that way to insure a steady pull.

m. *Anchoring at Sea*: There are normally two occasions during water operations when it is advisable to anchor. One is when the engine will not run and there is a possibility of the DUKW drifting into danger or away from the desired destination, before another vessel can come to its assistance. The other is when the engine will still run, but the position or desired course is not known, owing to darkness, fog, smoke, etc.

(1) The first step in anchoring is to ascertain the depth of water, if it is not already known. If the driver takes a sounding he will know how much anchor

line will be required. A suitable sounding line can be improvised by attaching the tow chain to the end of the heaving line.

(2) If the DUKW is not heavily loaded, and the sea is smooth or moderate, it can be anchored by the stern. Use the one-inch rope on the DUKW; tie it with bowline to the anchor, shackle, and tie the other end with a bowline around the winch drum, *before dropping the anchor overboard.* If a sounding has shown a depth of more than 30 feet of water, both 50-foot lengths of rope should be used. They should be joined with a sheet bend (see paragraph 105). If there is a depth of more than 75 feet of water, the winch auxiliary cable (75 feet long) can be used also by tying the rope to it with a bowline through the eye.

(3) If the sea is moderate but the DUKW heavily loaded, and in all cases when the sea is rough, the DUKW must be anchored by the bow. Attach the rope by a bowline to the bow lifting eye, leading it through the bow fairlead, and bring it back, outside of everything, to the stern deck. Make fast to the anchor as described before, and drop the anchor.

n. *Emergency Steering*: If the rudder cable or rudder shear pin breaks, the DUKW can still be steered with the tiller inside the stern compartment.

o. *Water Propeller Failure*: If the propeller fails, it must be immediately disengaged. With all wheels in high transfer range, third speed transmission and full-throttle about two miles an hour can be made under favorable conditions.

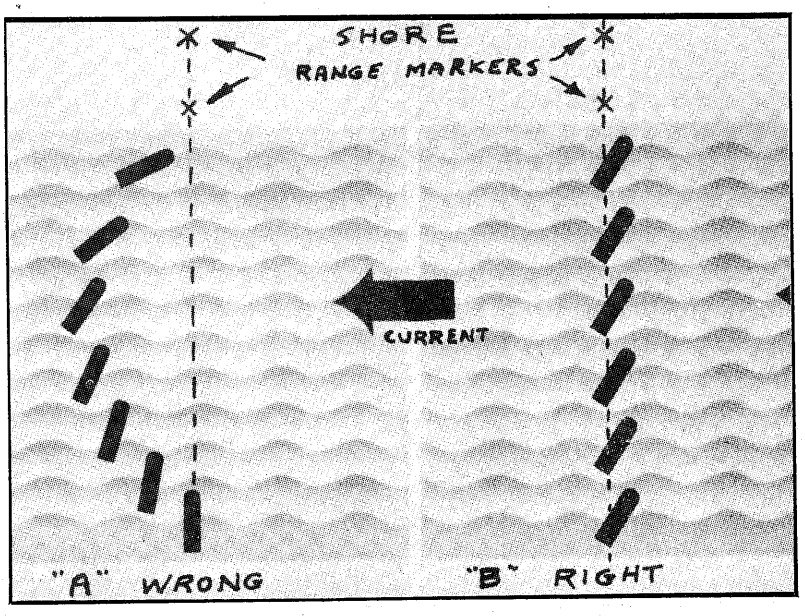
p. *Man Overboard*: Should a man fall overboard, the driver must immediately turn the wheel hard toward the side from which the man has fallen, to swing the stern and propeller away from him. Throw the life ring to him at once. At night, slow down and listen carefully in order to locate the man by his shouts. Great care must be taken not to run the man down. As a general preventive measure, personnel must not be permitted to walk outside the cargo space on the side decks.

r. *Current*:

(1) In water operations, the driver will often find that he must make frequent changes in his course in order to reach his destination. While the bow of the DUKW is headed towards the destination, the DUKW itself is being carried sideways by the current. In order to compensate for this, and thereby travel the shortest distance from point of departure to destination, he must steer the DUKW at an angle to his destination. To find what this angle must be, he should make use of ranges.

(2) When the DUKWs are operating in waters where there is considerable current, it is one of the duties of the DUKW Control Point to arrange for the setting up of range markers. One marker should be near the beach and the other farther away and higher. If range markers are not available, the DUKW driver must use natural ranges, by lining up his water entry point with a hill or tree or other prominent point behind it. If the ranges are kept in line, regardless of the direction in which the DUKW is headed, the driver will be traveling the shortest possible distance to his destination. (See figure).

(3) In heading from beach to ship the assistant driver can turn around and check to see that the ranges are being kept in line, and advise the driver accordingly. Or the ship may act as the marker ahead and the water entry point as the marker astern, with the DUKW kept on a straight line between them.



In "A" above the DUKW was headed for the shore point without allowing for current and keeping on the range.

114. *Preparing to Land*: a. *General*: The same careful planning and skill must be used in bringing the DUKW out of the water as is used when entering. The landing point should be reconnoitered, if possible. When in doubt, prepare for the most difficult landing conditions.

b. *Landing Spot*: Pick the most favorable available spot for landing. The principal considerations are: (1) how steep is the beach (can the DUKW get back out), (2) how soft is the sand (can it be crossed, and at what tire pressure) and (3) how rough is the ground (it can be *seen* above water, and must be *estimated* below water). Obstacles under water will be more difficult to negotiate than if they were on dry land. Avoid steep beaches, mud, swamps, marshes, quicksand, stumps, wreckage, large sharp rocks, and boulders. Set tire pressure (if equipped with central control) to best suited conditions. When DUKWs and landing craft are using the same beach, a small section should be marked off for the exclusive use of DUKWs so they will not be handicapped by having to operate over the big underwater holes dug out by the landing craft propellers.

c. *Approach*: Engage all driving wheels while still outside the line of surf. When landing conditions are unknown, wheels should be engaged at least 300 yards outside the breakers.

d. *Surf*: In rough weather, set up the rear surf shield. If the surf looks heavy, rig the tarpaulin. Before entering the breakers get in a position that will allow you to approach the desired landing point with the waves directly astern. While going through the breakers, *use full throttle,* and steer agressively to counteract any tendency for the waves to turn the DUKW off this safe course.

115. *Lading*: a. Landings on unfamiliar beaches should be made at *full throttle* with the transmission in second and the transfer case in low range, except for steep beaches (see paragraph *b* below) or for coral (see Chapter X). Come in at right angles with the

waves (paragraph 112). If the waves are at an angle to the shore, square around slowly after getting out of the surf and drive straight up the beach. Continue at *full throttle* until well ashore. On a rocky or coral beach drive *very slowly.* (See Chapter X).

b. *When the beach is steep or rocky, shift the transmission to first speed and the propeller to overdrive (reverse) position before reaching shallow water or surf.*

c. On a rough beach, on coral, and wherever wreckage may be in the water, it is very important to *disengage the propeller at the first possible moment.* This can be done as soon as some traction can be obtained from the wheels. This will greatly reduce the chances of propeller damage.

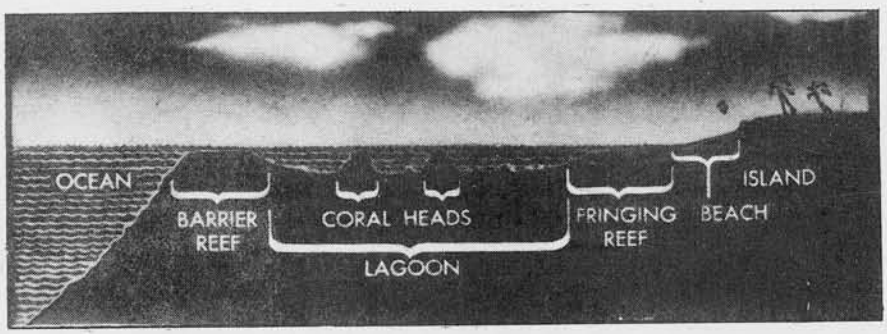
d. On beaches that are clear of obstacles, or in heavy surf or in strong current, the propeller should be disengaged as the DUKW leaves the edge of the water. It is not necessary to disengage the clutch or slow down. The propeller will disengage easily and quietly as soon as it lifts clear of the water,, since it is no longer under load.

e. In sand or mud, if progress stops because the wheels spin, disengage the clutch *immediately. Never allow the wheels to dig in.* If stopped in water, back up until well clear, using the propeller and all wheels at full throttle. Then try a better spot. If stopped practically clear of a bad surf, winch ahead. When stuck in rough water, rig tarpaulins immediately and keep pumps going.

f. As soon as possible after leaving water, open the 4 hull drain valves on vehicles so equipped. As soon as all water is drained out, close the valves. In below freezing weather, also drain axle housings immediately after leaving the water. For this condition note that in DUKW equipped with inter-housing drain, upper rear housing automatically drains through tube into lower rear housing. Also that in all vehicles when center bilge is dry, front housing will empty itself out of its rear end, into hull. Thus only lower rear housing drain plug would have to be temporarily removed.

CHAPTER X

OPERATIONS ON CORAL



Typical Coral Formation.

116. *General*: There are three basic types of coral formations.

a. *Barrier Reef*. The barrier reef is usually 1 or 2 miles off shore. It may run for many miles without a break, maintaining approximately the same distance from the shore. It is generally about 300 feet in width. The barrier reef acts as a breakwater and forms, between the reef and the shore, a smooth lagoon which is deep in most places. Seen from offshore, the barrier reef with its heavy surf is formidable in appearance, but actually is less harmful than other coral formations since the action of this surf keeps the coral comparatively smooth. Before crossing a barrier reef, select a point which is free from large cracks (called fissures), boulders, and loose rock. Use 30 pound tire pressure, and go slowly.

b. *Coral Head*: The coral head is usually an isolated, circular, drumlike patch up to 100 feet in diameter, frequently appearing inside lagoons. Since the water surrounding coral heads usually is smooth their presence will not be betrayed by surf. Coral heads may be detected by the change in color of water from a deep blue to light brown. Coral heads should be avoided whenever possible. Their surface is made up of rounded heads upon which the belly of the DUKW may easily become stuck.

c. *Fringing Reef*: The fringing reef extends out from the shore in the form of a flat ledge a few inches below the surface of the water. Its surface is composed of many sharp coral points, which can seriously damage tires unless they are inflated to 30 pounds air pressure and in addition low speed is maintained.

117. *Tire Pressure*: For all coral operations tires should be inflated to 30 pounds.

118. *Good Lookout*: It is important when approaching coral infested water to maintain a good lookout. During the day time the assistant driver should go forward and stand on the bow deck. He can steady himself with a short line made fast to the davit eye. In this manner he can see the coral much better than the driver, and can direct him to the right, left, slow down, etc., by hand signals. The water in coral areas is very clear and operators soon become expert in judging the depth of water and the character of coral reef.

119. *Pick Your Landing Point*: Select the most desirable landing point. It is important that large coral heads and fissures on the edges of reefs be avoided. No attempts should be made to land on a reef with an abrupt edge since the front wheels of the DUKW will not take hold. Avoid holes in the surface of the reef. When crossing a lagoon, isolated coral head clusters should be avoided by passing to either side.

120. *Drive Slowly*: Upon approaching a landing where coral or rock is suspected, set tires at 30 pounds, *place transmission in low range, first gear, and place propeller drive in overdrive (reverse) position.* This provides maximum propeller drive with low wheel speeds necessary to protect tires. Drive slowly, and if temporarily stuck *do not spin wheels* as this will damage tires. Wait for a sea to lift the DUKW and then apply power. Coral will cut like a knife unless these instructions are followed. Approaching slowly, the operator is less apt to damage the hull and chassis should he strike a coral head, and he is not as likely to get his DUKW jammed between two coral heads or in a fissure.

121. *Propeller*: The driver should disengage the propeller as soon as possible after the wheels have taken hold and should not wait until the DUKW has reached the beach. This is of greatest importance on DUKWs not with propeller guards.

122. *Night Driving*: Driving in darkness requires great caution. If possible, landing spots should be selected during the day, and marked by range lights at night. The lights should be carefully placed so that when the operator is running the range, that is, keeping the two lights in line, they will lead him to the most desirable point on the beach.

123. *Inspection For Damage*: After every rough landing over coral, inspection should be made of DUKW for damage. Coral may cut tires and do other serious damage without the crew having become aware of it. Particular attention should be given to the front springs, brake hose, tie rods, differential housings, breather tubes, shaft housing seals, inter-housing drain, tires, propeller and propeller shaft, and propeller guard on DUKWs fitted with same.

CHAPTER XI

PILOTING

124. *General*: A good working knowledge of the fundamentals of piloting is essential in the efficient water operation of DUKWs. Piloting is the technique of making use of visual observation, ranges, compass, charts and soundings in order to get from place to place while afloat.

125. *Currents*: In almost all water operations some current will be encountered. This current may be caused by tidal movement or by the proximity of a river. The speed and direction of the current must be allowed for when mooring, landing or when holding a course between two points. The easiest way to traverse the shortest distance between two points is by the use of ranges. (See Chapter IX, paragraph 113r).

126. *Under Water Obstructions*: The most difficult conditions under which DUKWs operate is that of driving on land covered by water. It is important therefore, to operate in deep water as far as possible until the landing point is reached. The location and depth of water over shoals, reefs bars and wrecks must be determined, and identified by reference to fixed points on shore, to buoys, or other markers in the water.

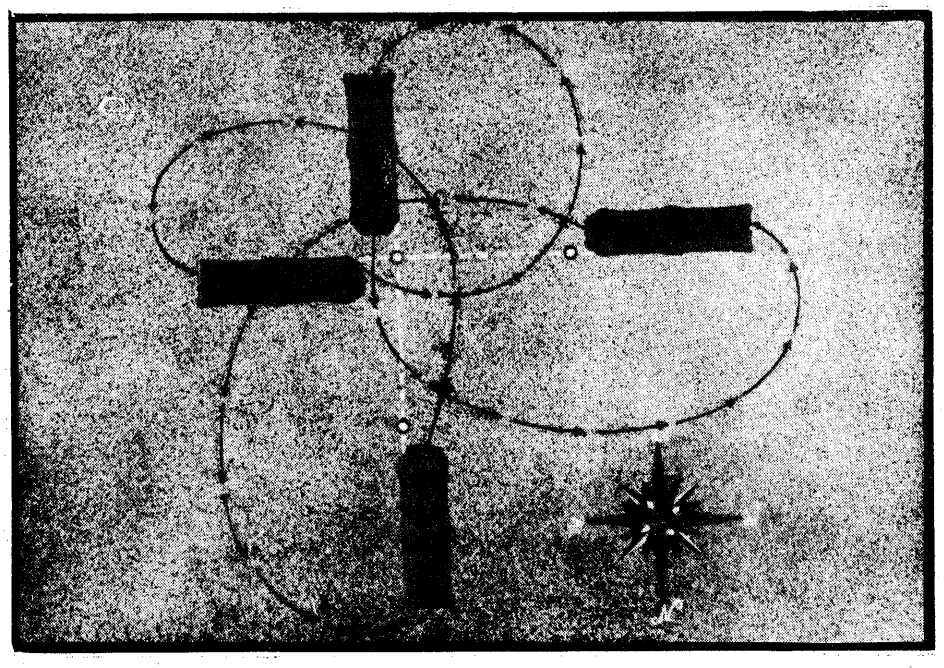
127. *Soundings*: Where charts are not available and where the tactical situation permits, reconnaissance of *underwater* conditions should be made. By travelling slowly in the water, depths up to eight feet can be measured by using the boat hook. It is also possible by this means to ascertain the consistency of the bottom, and be guided accordingly. Soft mud or extremely soft sand should be avoided.

128. *Tide*: The depth of water along the seacoast in almost all parts of the world varies according to a predictable 12 hour cycle which is called tide. There is normally a high tide twice each day. The difference between the depth of water at high tide and at low tide is the range of the tide. It is important to know the tidal range, also the times of high and low tide. Shoals and reefs which may safely be crossed at high tide may be dangerous at low tide.

129. *The Magnetic Compass*: a. In order to become oriented to the various key points indicated on chart or map, the magnetic compass is used. This compass, as installed in the DUKW, will be helpful only if kept in adjustment. The great amount of steel and the number of electrical parts close to the compass make frequent adjusting and checking necessary.

b. *Adjustment.* In adjusting the compass, it is necessary to mark out accurate North-South and East-West lines on a level portion of the beach. It is sufficient to have three stakes driven into the ground, a center stake and a north stake and a west stake, each about 40 feet away in the indicated direction from the center stake. (See figure.) The position of these stakes will be determined by using a pocket compass at least ten feet away from any metal objects. It is not satisfactory to use the DUKW compass, as it has built-in magnets and may give an erroneous heading even when the compass is removed from vehicle. After marking out the directions accurately, the DUKW should be placed along the North-South line heading directly north. The North-South compass magnet should be adjusted until the compass reads North. Next head the DUKW East, and

adjust East-West magnet until compass points East. Next head South. Compass should read South but if it does not, again use the North-South adjusting magnet and bring the compass *half-way* from its heading to South. Next head West. The compass should read West, but if it does not, adjust East-West magnet to bring the compass *half-way* from its heading to West. Repeat the above procedure in sequence of North, East, South and West headings, to make final adjustment. Then make a third check, this time without further adjusting the magnets, but carefully recording on deviation card the error in the compass at each of the four points checked. When the DUKW is lined up on the ranges, if the



Procedure for lining up directional stakes when adjusting the compass.

desired compass point on the DUKW Compass is *left* of the lubber line the error is *Easterly* and should be minus figure, and when the compass is *right* of the lubber line, the error is *Westerly* and should be a plus figure . For DUKWs equipped with Pioneer or Sherrill compasses, the adjustment is similar to above, but somewhat more complicated, and should be accomplished by following instructions of manufacturer, which are furnished with each unit.

130. *To Steer A Compass Course*: In some operations, the DUKW driver will be given a certain course to steer. To get his DUKW on this course, he will steer in such a direction that he can read the course he was given, on the side of the compass facing him. There is a small line, known as a lubber line on the side of the compass facing him. This will act as a marker. The compass card is divided into 360 degrees, but since the cards on small compasses are not large enough to show each degree, they are marked in tens of degrees. On the Hull compasses, they are not only marked in tens of degrees, they are numbered in the same system. For example, a driver given a course of 250 degrees to steer will steer his DUKW so that the 25th mark (one mark after 24, which is numbered) is opposite the lubber line.

131. *Right Of Way*: a. When landing, or going into the water, the DUKW afloat (landing) has right of way and the DUKW ashore (going onto the water) must keep out of the way.

b. When 2 DUKWs, or a DUKW and a boat, are meeting head on, each should turn slightly to its own right as needed to pass at a safe distance.

c. When 2 DUKWs, or a DUKW and a boat, are converging, the one that is being approached from its right side must keep out of the way of the other.

CHAPTER XII

DUKW CONTROL

132. *Assault Phase*: a. During the initial assault, DUKW Companies operate as separate units attached to elements of the assault force for the service thereof.

b. They will be combat loaded with troops, Shore Party equipment, guns and ammunition in accordance with prearranged schedul

c. In the assault, DUKWs with guns or other heavy equipment will be landed and immediately unloaded by "A" frames. DUKWs will then tow guns to their initial positions.

(1) Upon the landing of the normal prime movers, DUKWs are *automatically* released to DUKW Battalion Headquarters, and accordingly will report to DUKW Beach Control Point.

(2) DUKWs reporting to DUKW Beach Control Point from artillery firing positions will bring either a messenger or a sketch of the gun location to facilitate location thereof by the normal prime movers.

133. *Supply Phase*: a. Upon reporting to DUKW Beach Control Point, the assualt phase is ended for the DUKW, and thereafter all DUKW operations are coordinated and supervised by DUKW Battalion Headquarters, which will set up a Command Post in a suitable area.

b. No DUKW can be dispatched on a mission unless it is cleared through the DUKW Command Post.

c. *DUKW Command Post* duties are as follows:

(1) To establish liaison with higher authority and to act upon orders received from them.

(2) To obtain from higher authority the following information:
  (a) Locations and descriptions of ships to be unloaded.
  (b) Type of cargo to be handled from various ships by DUKWs.
  (c) Overlay showing dump locations.
  (d) Time unloading operations will begin.
  (e) Type and condition of road markings for both day and night operations.
  (f) System of ship lighting during hours of darkness.

(3) To be responsible for overall recommendations affecting DUKW operations arising from weather and other conditions.

(3) To be responsible for overall recommendations affecting DUKW operations higher authority can have accurate information on present and future DUKW availability.

(5) To establish control points at the following places:
  (a) At the beach.
  (b) On ships.
  (c) At the dumps.
  (d) At the DUKW assembly area, and to maintain close contact by radio, telephone or runner with these points.

d. *DUKW Beach Control Point* will be set up on that portion of the beach chosen for the entrance of DUKWs into the water, preferably at a separate point from the landing craft. The DUKW Beach Officer's duties will be:

(1) To make arrangements for the proper marking of the DUKW beach, and to set up front and rear range markers if they will aid DUKW operators in keeping a straight water course to and from the beach.

(2) To make arrangements for the laying and maintenance of beach matting as necessary.

(3) To check on the seaworthiness of DUKWs before entering the water, i.e. bilge plugs installed, hull drain valves closed, hatches closed and dogged down, all equipment on board, etc.

(4) To dispatch DUKWs to the ships at such a rate that there are never more than two DUKWs waiting for their loads at each hatch. If operational DUKWs are held ashore pending dispatch, they will form a "cushion" in a suitable area close to the Beach Control Point. Here crews can refuel their DUKWs, receive rations when necessary, and can perform their "During Operations Maintenance" under the supervision of a senior non-com.

(5) To insure that DUKW operators can identify the ship which they are to unload and know the recommended route to it.

e. *Ship Control Point* will be set up on every ship discharging into DUKWs. The first DUKW to be dispatched to a ship will take with it a DUKW officer, DUKW rigging assistants and DUKW mooring equipment. Their duties will be:

(1) To assist in rigging the ship in accordance with the approved DUKW mooring system.

(2) To be responsible for DUKW mooring equipment and to keep constant check on its condition.

(3) To decide on the manner of loading and amount of load given to the DUKWs.

(4) To establish close liaison with the TQM and the master of the ship, and recommend to them any actions which may accelerate the unloading, such as the making of a lee, and the shifting of anchorage when it will shorten the ship-to-shore distance.

(5) To supervise the coming alongside and mooring of the DUKWs.

(6) To inform DUKW Command Post continuously concerning details of the off-loading.

(7) In discharging DUKWs from LSTs or other ramp vessels while afloat, to stand at the head of the ramp and insure that all DUKWs enter the water in accorance with the approved technique. (Paragraph 193.)

f. *Dump Control Points* will be set up at each dump where DUKWs are being unloaded, or a DUKW officer can circulate between the dumps. His duties will be:

(1) To expedite the turn-around of DUKWs, and to work closely with dump officers in the use of fast unloading methods such as hog troughs and "A" frames.

(2) To inform the DUKW Command Post continuously concerning details of unloading. If DUKWs are being delayed considerably, thus slowing down ship unloading time, he should recommend to higher authority through DUKW Command Post that transfer points be set up. A transfer point should be close to the beach and should have means for the rapid transfer of loads from DUKWs into land trucks. (See paragraphs 164, 165.)

g. *DUKW Assembly and Bivouac Area* will be set up in an area considered safe from enemy aerial and ground attack. This area is primarily intended for non-operating DUKWs and their crews. The DUKW Officer's duties will be:

(1) To be responsible for the presence in the assembly area of all non-operating DUKWs and their crews.
(2) To supervise, with the cooperation of DUKW maintenance Officers, all DUKW maintenance, except "During Operations" duties.
(3) To make arrangements for food, latrines and billets for DUKW personnel.
(4) To inform the DUKW Command Post on the status of all DUKWs in the assembly area.
(5) To require the highest standards of passive air defense by dispersal and camouflage of vehicles and personnel.
(6) To require the highest standards of security against enemy attack.

134. *Small Operations*: In operations involving only a company of DUKWs or less, the duties of DUKW Command Post can be combined with those of DUKW Beach Control Point and can be conducted at the latter point.

CHAPTER XIII

OPERATIONAL ESTIMATES

135. *To Estimate the Number of DUKWs Needed at Each Unloading Shipside Position*:

a. Calculation:

1. Estimate the average time needed for a loaded DUKW to reach the beachhead dump, be unloaded, and return to the ship. This may be determined by a trial run, if necessary.
2. Divide this figure by the average loading time of the DUKWs at shipside.

b. Example:

1. Time needed to make a round trip — 60 minutes.
2. Divide by the average loading time at shipside — (5 minutes).
3. Result: 12 DUKWs needed for each position.

136. *To Estimate the Number of Hours Needed to Unload a Ship*: The number of DUKWs used in figuring estimates of this nature must not exceed the number that are available, nor can it exceed the number that can be kept working efficiently at ship's side.

a. Calculation:

1. Take the total number of DUKWs to be used in unloading a ship.
2. Multiply it by the number of round trips from dump to ship a DUKW can make per hour and
3. Multiply that figure by the average payload, then
4. Divide the result into the number of tons of freight to be unloaded.

b. Example:

1. Number of DUKWs to be used 37
2. Number of round trips a DUKW can make per hour 1
3. Average payload per DUKW 2.5
   Tons per hour 92.5
4. Tons of freight to be unloaded 9000
5. Answer: 9000. ÷ 92.5 = 97 hours operating time to unload.

CHAPTER XIV

ROUND THE CLOCK OPERATIONS

137. *General*: When unloading or other operations in which the DUKW Company is engaged cannot be completed in one 12 hour working day, the personnel of the company will be organized into two shifts and the work to be done divided between them. Each shift will set up with an administration, a control, a maintenance and an operations unit so that each shift may operate independently of the other.

138. *Maintenance*: Regardless of the length of operations, maintenance must be conducted as described in Chapter V. Scheduled preventive maintenance operations, however, should never with-hold from operations more than 18 percent of operating DUKWs at one time. The maintenance unit must have sufficient personnel on duty during all shifts to take care of emergency repairs. The weekly preventive maintenance will be done either night or day by the driver and assistant driver, since their vehicle will not be available for operation during that period. Daily preventive maintenance will be performed by the driver and assistant driver as indicated on the dashboard instruction plate.

139. *Operations*: If there is sufficient personnel available from the DUKW Company to have driver and assistant on a DUKW at the same time, the driver must be given assistance from an outside source. This assistance is most necessary when mooring and cargo handling at shipside. Three systems by which this assistance can be rendered are described below:

a. Personnel from Port Companies or other service troops can act as crews, one for each DUKW. They will at no times, however, be permitted to operate the DUKW.

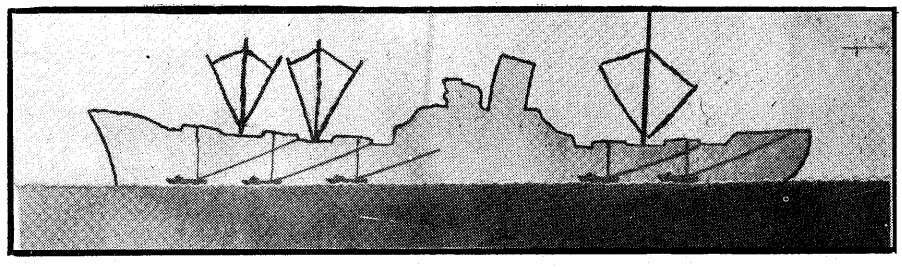
b. Inasmuch as the greatest need for the DUKW crew man is during the water operation, if there are not enough extra men to assign to each operating DUKW, a pool may be formed at the DUKW control point on the beach where a crew man can be picked up by each DUKW as it enters the water. On the return trip to shore he can dismount at the same point and be at the disposal of the next DUKW headed for the ship.

c. When it is not possible to get sufficient men for system *a* or *b* as outlined above, the minimum requirement is for a loading crew to be assigned at each loading position at shipside. These crews will perform the duties of securing the mooring hook and placing and securing the load in each DUKW in turn as it comes alongside, transfering from one DUKW to the next. It should be noted however, that this system is not practical except when the sea is smooth.

CHAPTER XV

MOORING AT SHIPSIDE

140. *General*: It is of particular importance that all ships discharging into DUKWs accurately follow out the details set forth in this section. The unloading operation involves a continuous sequence of mooring alongside by the DUKWs. In view of their small cargo space accurate and rapid positioning under booms is necessary.



Mooring Rig, Showing Spring Line and Messenger Lines

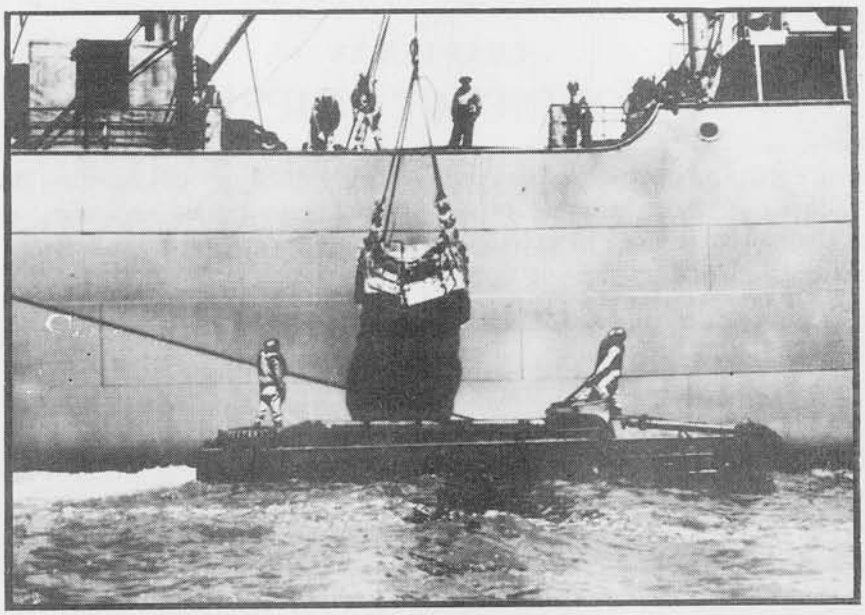
141. *Spring Line Mooring*: The DUKW will be moored at shipside by a single spring line 3½ to 4½ inches in circumference and about 100 feet long. This spring line will be secured on the deck of the ship. The forward end of the line carries a mooring hook which is engaged in the DUKW mooring eye. A messenger line of the same size as the spring line will be fastened to the spring line 4 feet back of the mooring hook and will lead to the deck of the ship directly above the mooring position. If necessary, the spring line will be parceled to prevent chafe at the ship's deck. Where the ship is rigged with a guest warp, it may be convenient to attach the individual spring lines to the guest warp rather than to lead them to the deck of the ship. When working with the guest warp, the individual spring lines can be considerably shorter. About 50 feet length will be sufficient. The messenger lines will also be rigged.

142. *Mooring Hooks*:

143. *Fender Protection*: If a ship has a guard rail or rough guards over hull outlets, rope or mat fenders should be rigged by the ship to protect the DUKWs. A floating log fender is very practical. If a ship has reasonably smooth sides, the DUKW's fenders should give sufficient protection.

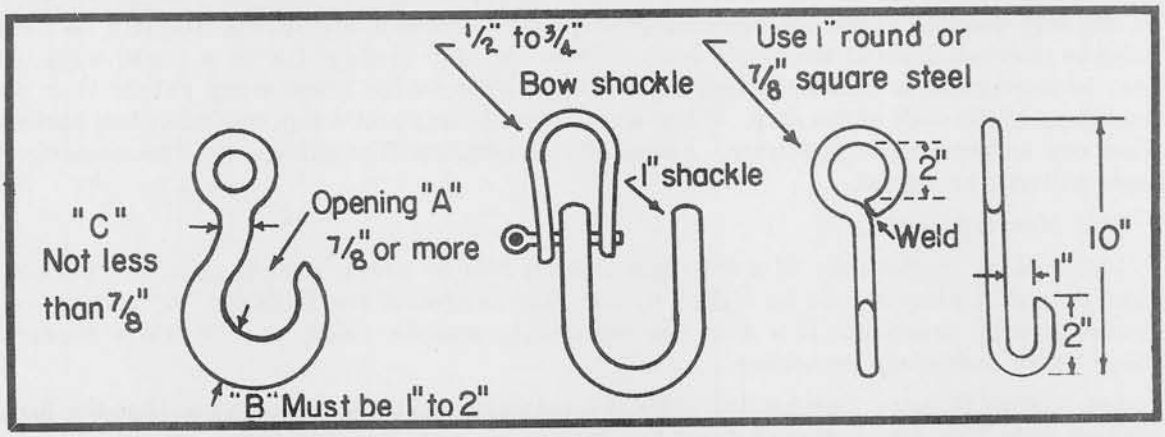
144. *Cargo Booms*: For loading DUKWs, cargo booms must be rigged so that the load centers only five feet outboard from the ship's side when hanging from outboard booms. Booms over the #1 hatch should rigged as far *aft* from bow flare as possible. Booms over the #5 hatch should be rigged as far *forward* from stern flare as possible. All booms should be rigged to keep DUKWs clear of dangerous hull obstructions, and to provide all possible space between adjacent berths. Double rigged hatches should be worked from opposite sides except when rough water necessitates operation from the lee side only. Spring lines must be adjusted so load comes down directly over the center of DUKW cargo space.

145. *Approaching Mooring Positions:*



Properly Moored With Stern Spring Line

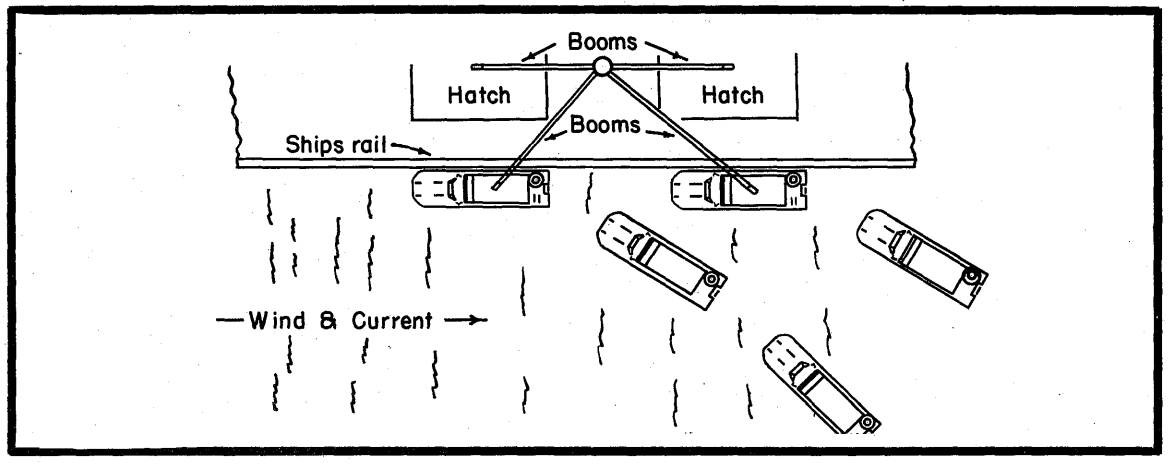
146. *Mooring:* When a DUKW approaches a ship to receive or deliver a load, it should take up a position not more than a hundred feet from the position where the DUKW expects to moor. Immediately upon receiving a signal to moor, the DUKW will approach



Alternate types of mooring hooks that may be used. To facilitate night operation, hooks should be painted with phosphorescent paint, or white paint.

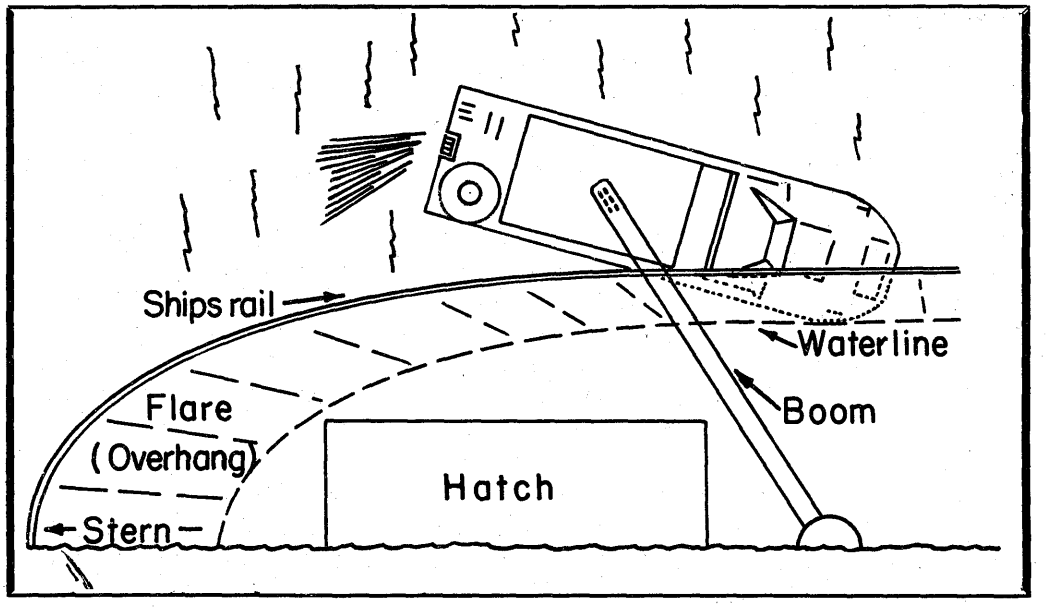
the mooring position at approximately a 45° angle from astern. See figure. As it approaches the mooring hook, the DUKW will be slowed down and turned parallel to the ship about one to three feet away from the ship's side. The assistant driver will reach the mooring hook from the aisleway and quickly hook it into the DUKW's mooring eye, with the point of the hook towards him.

147. *Holding Alongside*: When mooring near the bow of the ship, or in a very strong current, careful adjustment of the rudder is necessary to hold the DUKW close to the



Proper Approach to Mooring Position from Astern

ship's side. In such cases, the rudder must not be turned all the way from the ship, or the bow of the DUKW will be forced outwards by the current and waves. The steering wheel should be set so that the DUKW stays close and then lashed with a short length of line when necessary.



When There is Considerable Flare, Stern Must Be Swung Out to Receive Cargo.

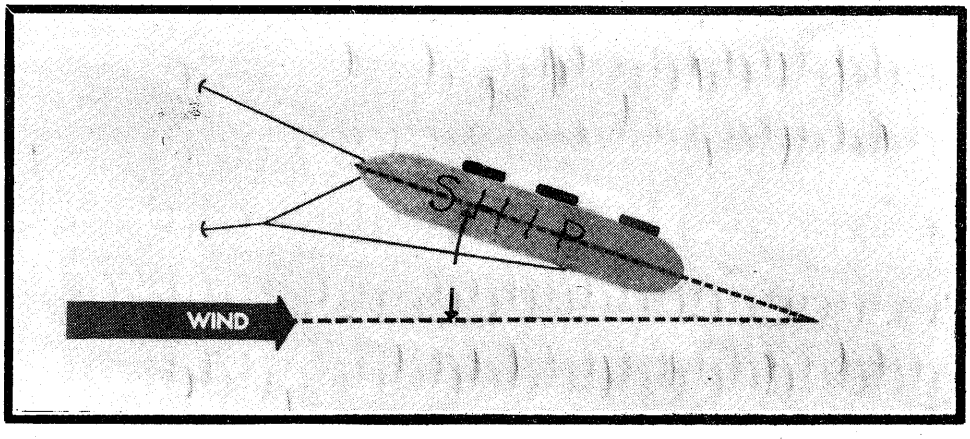
148. *Positioning Under Flare*: When there is considerable flare abreast the #1 and #5 hatches it will be necessary to steer the DUKW during loading, swinging the stern *out* to get under the load and to keep out from under the overhang (See figure.) In cases of extreme flare at #5 hatch particularly in rough water, it may be advantageous to lead

this spring line forward, engaging the hook in the inside bow lifting eye and using little or no power after picking up the hook. Under these conditions an additional stern line may be helpful but it will need constant attention due to its unfavorable angle.

149. *Double Mooring*: In smooth water such as exists in harbors, DUKWs can be moored in pairs. This system is particularly helpful where there is considerable flare, as abreast #1 and #5 hatches. The procedure is as follows:

a. Before coming alongside, two DUKWs tie up by lashing together their mooring eyes. They then maneuver like a twin motored boat and the inside DUKW secures the mooring hook to his mooring eye in the approved system.

b. When the DUKWs are moored the outside DUKW can shut off his motor and the inside DUKW turns the rudder and sets the hand throttle as usual. The crews of both DUKWs assist in the handling of the cargo.



c. When they are both loaded, they move away from shipside before separating.

d. It must be noted that this system is not practical in rough water.

150. *Making a Lee*: In extremely rough weather, the ship will do all possible to provide approximately a 20° lee (See figure).

151. *Working With Other Craft*: Where DUKWs and other types of craft are working on the same ship, it is desirable to divide the work by hatches, so that a hatch rigged for DUKWs will be available when DUKWs come for a load. In this connection it should be noted that LCM and LCVP can moor satisfactorily on gear rigged for DUKWs, but DUKWs can not operate effectively using mooring methods normally employed for LCM and LCVP. This is because the DUKW only pumps when propeller is being driven ahead and also because the DUKW has a weak reverse making it difficult to hold in position with the boat technique.

152. *Moor Against Current*: When the current or tide runs by the ship from stern to bow, due to the ship being aground or moored to a dock, the mooring rig will be reversed so that *DUKWs will come in head to the current.* In all cases, spring lines must be rigged to lead *aft from the DUKWs.*

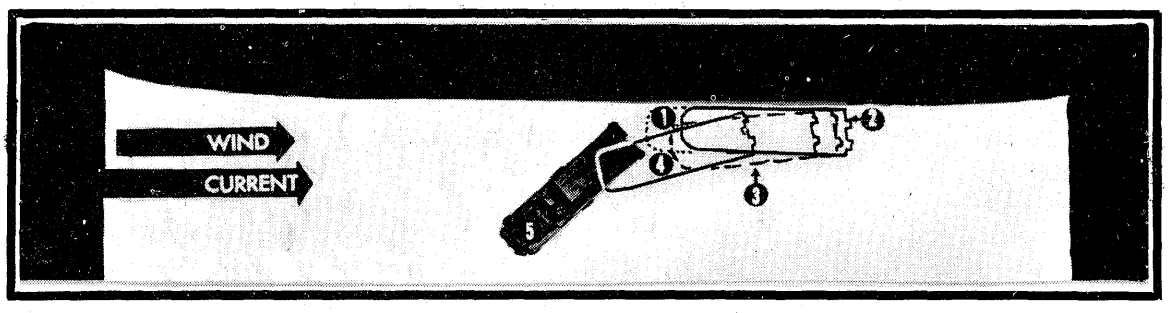
153. *Surf Plate and Rear Closure*: Whenever the DUKW is going to moor, the bow surf plate will be folded back. When the plate is set up it extends beyond the bow and bow fenders, and may be damaged. In addition, rear closure should be folded down before mooring.

154. *When Engine Stops*: If the engine stops and cannot be started while the DUKW is moored, the DUKW should cast off immediately, even if this necessitates cutting the

spring line with a knife or an axe. After drifting clear of the ship, the signal for assistance should be displayed and the DUKW should await tow. If no tow is in sight, the DUKW should anchor.

155. *The Procedure for Leaving a Mooring is as Follows*:

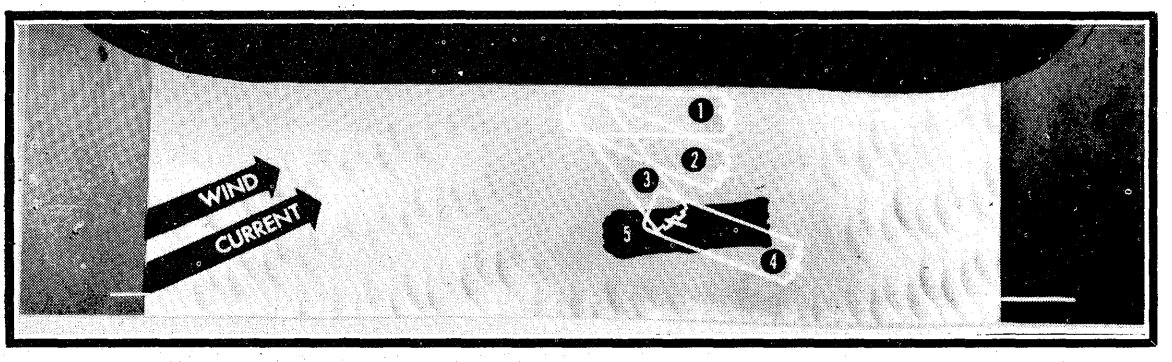
a. *Favorable Conditions*: Under favorable conditions, the clutch should be disengaged and the spring line unhooked as soon as it is slack. The bow should be pushed off (from the aisleway) and when the bow has swung away from the ship the clutch should be engaged to drive the DUKW ahead. Do not swing away sharply or the stern will hit the ship and pull the DUKW back alongside. See figure below.



Leaving Shipside Under Favorable Conditions.

(1) Moored alongside. (2) Drop back sufficiently to permit unhooking. (3) Push off by hand from aisleway before starting ahead. (4) Drive ahead, turning away gradually so stern does *not* swing against ship as this would tend to pull you on alongside again. (5) All clear—take desired course.

b. *Unfavorable Conditions*: If tide or other conditions make it impossible to leave the ship's side in the above manner, the steering wheel should be turned toward the ship before the DUKW is unhooked and the propeller should be driven ahead to swing the stern well clear. Then the DUKW should be unhooked and backed away with the propeller in reverse and the wheels in high transfer. When well clear, the DUKW should be turned away and driven ahead with the wheels disengaged. (See figure.)



Leaving Shipside under Unfavorable Conditions.

(1) Moored alongside. (2) Driving ahead, wheel turned *toward* ship forcing stern cut. (3) When this position is reached, unhook mooring line and back away. (4) When this position is reached turn DUKW *away* from ship and drive ahead. (5) All clear—take desired course.

CHAPTER XVI

LOADING CARGO AT SHIPSIDE

156. *Payload*: Payload weight must be governed by operating conditions. In determining payload, *all* personnel, personal gear, spare gasoline, oil, water, parts, dunnage, nets, pallets, and all items that are not part of a standard DUKW must be counted as part of the payload. The above persons and items usually weigh from 500 to 1500 pounds; 1000 pounds should be considered as average. Total payload should center about two feet forward of center of the cargo space and should normally not exceed 5000 pounds. However, under combat emergency and when conditions are such as indicated below under FAVORABLE Conditions or IDEAL Conditions, the payload may be between 5000 and 10,000 pounds. *More than* 10,000 *pounds, however, must never be carried.*

a. *Difficult Conditions*: Operating under DIFFICULT CONDITIONS, payload should not be over 5000 pounds. The term DIFFICULT will apply to all operations involving use of untried landing sites unless reconnaissance has definitely indicated conditions to be FAVORABLE. It also applies to surf at shore over three feet, wind over 15 miles per hour (white caps) and when the wave height at shipside is over three feet. In addition it applies to operations involving coral, very soft sand, steep landing, mud, steep hills, and land distance to dump over six miles.

b. *Favorable Conditions*: Operating under FAVORABLE Conditions, and combat emergency, payload may total 7500 pounds. The term FAVORABLE will apply to operations involving use of reconnoitered landings where reasonably smooth and firm terrain is available, where surf at shore is less than three feet, wind is less than 15 miles per hour (no white cap) and waves at the shipside are less than three feet. The route should be well marked. The landings on shore shall be definitely negotiable in low range second. The land distance to dump must be less than six miles, with moderate hills.

c. *Ideal Conditions*: Operating under IDEAL Conditions, and combat emergency, payload may total 10,000 pounds. The term IDEAL will apply to daylight operations over smooth, firm and gradually sloping landing, negotiable at a minimum of 30# tire pressure. Surf at shore must be less than two feet, the wind less than 10 miles per hour and waves at shipside less than one foot. Landing route to dump must be reasonably level and smooth and less than three miles long, and water trip less than one mile long.

157. *Load Markings*: To facilitate control of loading, there are three guiding lines on each side of the stern of most DUKWs which indicate the water lines resulting from loads recommended in paragraph 156. The lowest lines marked "Rated" are for DIFFICULT conditions, middle lines for FAVORABLE conditions and upper lines, marked "Danger", for IDEAL conditions. *Never* carry a load that puts the "Danger" lines below the water. DUKWs that do not carry these load markings should be so marked with non-lustrous yellow paint stripes one-quarter inch wide on the right side of the stern. The top lines marked "Danger" shall be painted five inches from the under side of the deck guard rail. The middle lines shall be three inches below the top lines. The bottom lines marked "Rated" should be three inches below the middle lines. The lines measured from the top of one line to the top of the next line.

158. *Dunnage*: Before receiving a load, if it is of a type that places considerable concentrated weight on a small portion of a cargo floor, dunnage must be used to protect the floor. In some cases, dunnage is used to protect the cargo, particularly when more than one layer is carried. Dunnage must also be used to block around cargo that might shift during water or land transit. Use dimensional timbers, pallets, nets, steel matting from air strips, boughs or whatever similar material is available. Use of dunnage must be more extensive in rough water as motion of DUKW and ship make cargo loads land more heavily in cargo compartment and increase the tendency for the cargo to shift.



First pallet crosswise—forward end of cargo space; Second pallet crosswise—close behind first; Third pallet fore and aft on top of first and second.

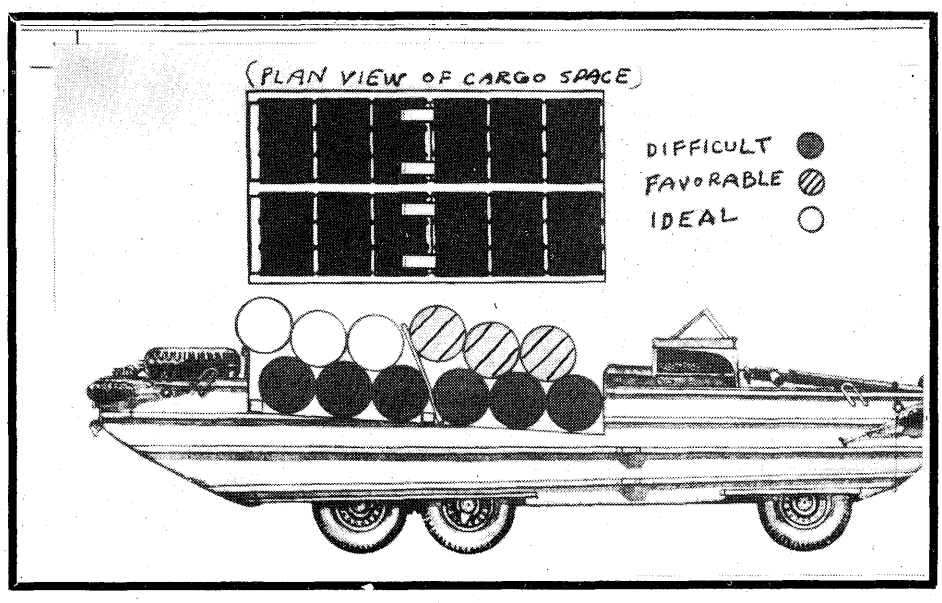
159. *Positioning of Cargo*: Normally, cargo weight should center approximately two feet forward of the middle of the cargo space. It should be lowered directly over the center of the cargo space. (See figure paragraph 141.) When cargo is of a type that completely fills the cargo space, it may not be possible to place the cargo forward of center, however. it is almost always possible to pile cargo higher at the forward end, also to place the heaviest objects at the forward end. Heavy cargoes must be placed forward of the center, otherwise the DUKW may ship water over the stern and be swamped. In addition, if too much weight is in the stern the water speed is reduced and, when on land, mobility and tire life are both reduced. Lateral position of cargo should be centered so DUKW will remain level.

160. *Normal Ship's Side Loading Procedures are Outlined Below*:

a. *Pre-palletized cargo*: The proper sized pallet for use with DUKW is 44" x 72". Weights should be as close under a top limit of 3000 pounds as possible. Three pallets can be stored crosswise in cargo space, providing a very seaworthy load. Tarpaulin can be placed directly over cargo space (without bows) in rough weather. Where width of pallets exceeds 44", pallets must be placed as in figure below, the third pallet being carried only when weight of pallets permit three under existing operating conditions and where the first two pallets are of a type that will not be damaged by stacking.

b. *Fuel Drums*: Fifty-five-gallon fuel drums weigh approximately 400 pounds each. Six or eight small pieces of dunnage are required in loading these drums. The drums should be handled by a cluster of six sets of chime hooks. (See paragraph 174.)

The first six drums should be set crosswise on their sides in the forward end of the cargo space. Immediately after unhooking, the drums should be rolled against forward cargo bulkhead, and small pieces of dunnage should be placed behind the rear drums to prevent them from rolling toward the rear part of the cargo space. The second cluster of six drums will be placed in the rear half of the cargo space. They should be rolled against the forward drums and blocked. This completes the load for DIFFICULT conditions. (See figure above). Under FAVORABLE conditions an additional cluster of six drums will be placed top of the drums at the forward end of the DUKW cargo space. It is extremely



Positioning of 55 *gallon drums under various conditions.*

important that suitable dunnage be wedged behind these drums to prevent them from rolling backward, particularly when climbing up on the beach or up a steep rise in the land operation. If the drums roll back they will smash the rear coaming and will be lost over the stern. Under IDEAL conditions, a fourth cluster of six drums may be placed at the rear end of the cargo space. To prevent them from rolling, they should be placed up against the rear coaming.

c. *Net Loads*: DUKWs will normally carry one, two or three net loads, depending on net load weights, and on operating conditions. If one net load only is to be carried, it should be placed in forward part of cargo space. If two net loads are to be carried, the first load should be placed in rear of the cargo space and the second in forward end. Any overhanging cargo should be allowed to overhang in forward end. When three net loads are to be carried, the first load should be placed in forward end, the second in rear, and third on top of first at the forward end. The third net will have to be carefully lashed so none of its contents will be lost.

d. *Projectiles*: 155 millimeter projectiles and other similar ammunition are normally loaded with clusters of from six to 12 hooks through lifting eyes in the nose of the projectiles. When loaded in this manner, considerable small broken dunnage or nets should be used to prevent the projectiles from rolling in transit. A heavy pallet having sides

approximately 24" high may be used in place of the cluster of hooks. If the pallets can be retained in the DUKW, only enough dunnage will be necessary to keep the projectiles from damaging each other.

e. *Boxed Ordnance Parts*: Dunnage is necessary for boxed Ordnance parts only as explained below. The boxes normally will be loaded singly or in groups. Rope slings will be used. Where enough slings are available, they should stay on the boxes during transit to dump for use in unloading. If there are not enough slings, 2 x 4s or similar size dunnage must be used in the DUKW to hold the boxes clear of the cargo floor to permit ship-side removal and dump application of slings. The heaviest boxes should be in the forward end of cargo space, and all boxes should be lashed or blocked so that they will not shift.

f. *Loose Pallet Loads*: Pallets are used for loose cargo that would be crushed in nets. Dunnage is not necessary. Where loads are heavy and enough pallets are on hand to permit it pallet loads may be carried intact. The first pallet will be placed at the forward end, crosswise if length will permit. One or two additional pallet loads should be placed behind the first one until the cargo space is full or the desired load is aboard. When pallet loads are sufficiently secure, and conditions permit, a second layer may be carried. Again the loading starts at forward end. Where pallet loads are light and where there is a shortage of pallets, the pallets should be loaded into the DUKW cargo space, and empty pallets sent up to the ship.

g. *Bombs*: DUKW's are well suited for handling bombs. Considerable valuable information can be found on this subject by referring to OS-939, Volume II, Bomb Handling. Additional details for handling various types of bombs are as follows: (Also see paragraph 176 for unloading details).

(1) 100 pound bombs, weight 145 pounds, packed in crates. No dunnage is necessary. They should be stowed lengthwise in cargo space, three rows each and eight abreast. For DIFFICULT conditions, the first row at forward end should be two deep, totaling 32 pounds and weighing 4650 pounds. For FAVORABLE conditions, first row should be three deep and second row two deep totaling 48 bombs, weighing 7000 pounds. For IDEAL conditions, first and second rows should be three deep, third row two deep, totaling 64 bombs and weighing 9300 pounds.

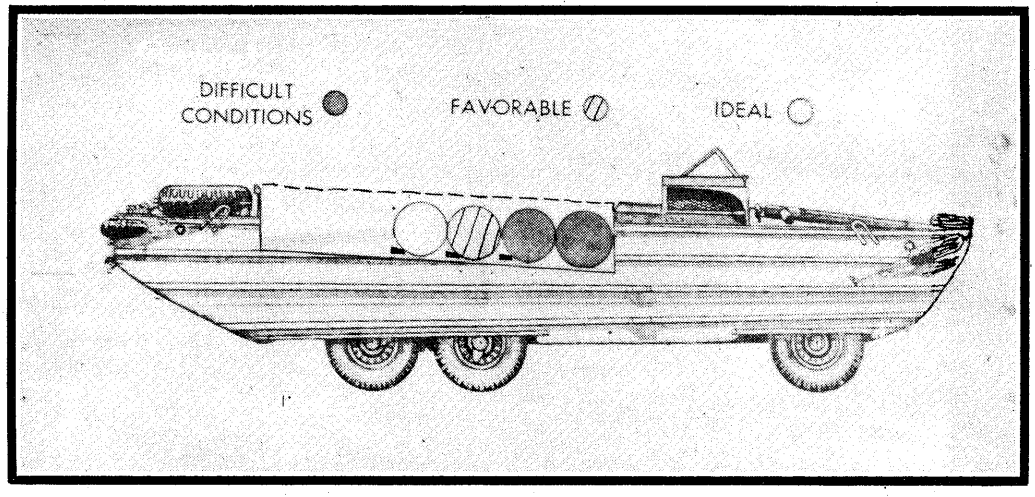
(2) 250 pound bombs, weight 250 pounds each. No dunnage is necessary. They should be stowed lengthwise in cargo space, four rows, each having five bombs, for DIFFICULT conditions, giving a total of 20 bombs and weighing 5000 pounds. For FAVORABLE conditions, there should be a second layer of four bombs on both first and second rows, giving a total of 28 bombs and 7000 pounds. For IDEAL conditions, each row should have a second layer of four bombs giving a total of 36 bombs and weighing 9000 pounds. Tail assemblies for these and all larger bombs are handled separately.

(3) 500 pound bombs, weight 528 pounds. Dunnage should be used to protect the floors and prevent the first layer from rolling. The bombs should be stowed lengthwise. For DIFFICULT conditions, load two rows of four bombs each at forward end of cargo space totaling eight and weighing 4225 pounds. For FAVORABLE conditions, an extra three bombs may be placed on top of the first and second rows, giving a total of 14, and weighing 7400 pounds. For IDEAL conditions, load four extra bombs lengthwise on floor at rear end of cargo space, total 18 bombs, 9500 pounds.

(4) 1000 pound bombs, weight 1000 pounds. Dunnage should be used to protect cargo floor and to wedge the bombs in place. For DIFFICULT conditions, load three

abreast lengthwise at forward end of cargo space. Then load two more on top of the first three. Total five, weight 5000 pounds. For FAVORABLE conditions, load three abreast lengthwise at forward end of cargo space and four abreast crosswise at aft end of cargo space. Total seven, weight 7000 pounds. For IDEAL conditions, add two on top of first three lengthwise at forward end. Total nine, weight 9000 pounds.

(5) 2000 pound bombs, weighing 2093 pounds. Place bombs crosswise. Use heavy dunnage to protect the floor and to wedge bombs securely, particularly to prevent their rolling back when the DUKW climbs out at the water's edge.



Positioning of 2000 pound bombs under various conditions.

(6) 4000 pound bombs, weighing 4152 pounds. Heavy dunnage must be used to protect cargo floor, and sufficient blocking must be made to cradle the bombs securely during transit. Under DIFFICULT conditions, one bomb will be placed diagonally in the cargo space, with its nose in the right forward corner, and the tail end of bomb against left coaming. Block heavily to prevent the bomb rolling or shifting. (See figure below).

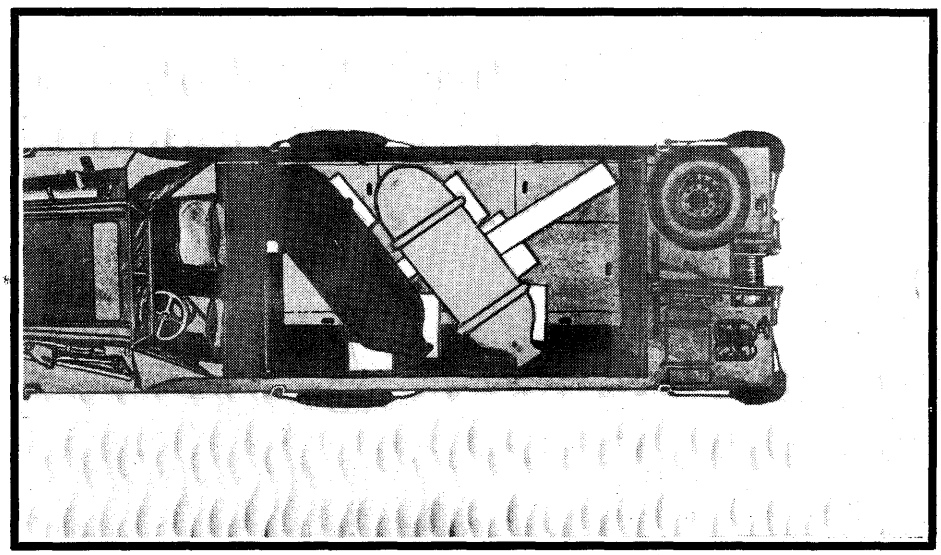
161. *Cargo Handling Duties of the Assistant Driver*: a. After hooking in the mooring hook, the assistant driver should stand on the stern, ready to guide the draft load from ship to proper position in the DUKW. The driver will assist from the *forward* end.

b. After unhooking the first load, the driver or the assistant driver will hook on any empty nets, pallets, slings, etc. from the previous trip so they can be lifted aboard ship for subsequent use.

c. After the DUKW has pulled away from the ship with a full load, the assistant driver will attend to securing the load, blocking and lashing any cargo that might shift, and shifting weights where possible to trim the DUKW level for its trip to shore.

d. On approaching the dump, nets should be arranged to expedite unloading. Slings should be adjusted and shortened as necessary and temporary lashing cleared away. These preparations will greatly expedite unloading at the dump.

e. On the DUKWs return trip to the ship, the assistant driver will utilize every opportunity to clean up bilge and cargo space, and to put through "During Operation" maintenance. Pallets, nets and slings should be moved clear of space where first load will be received from the ship.



Positioning of 4000 pound bombs under difficult and ideal conditions.

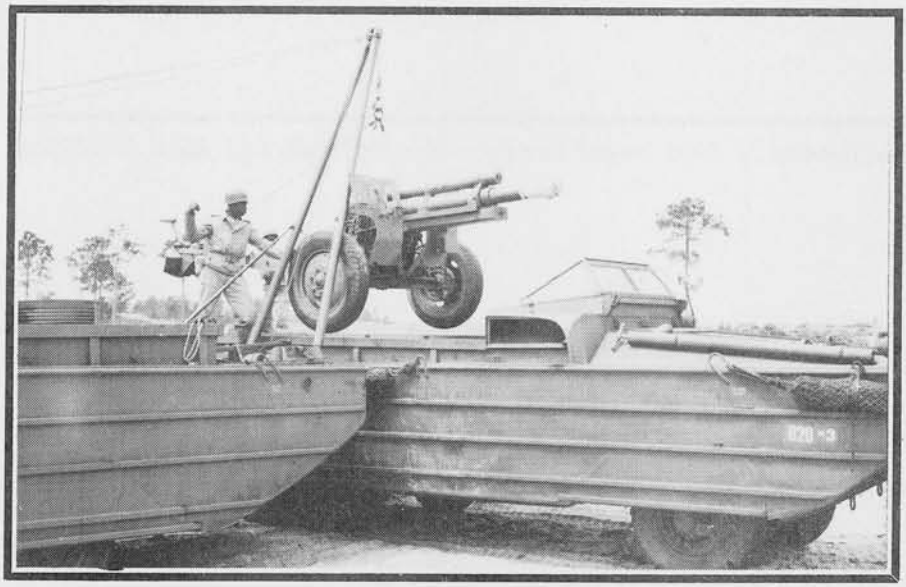
CHAPTER XVII

UNLOADING CARGO FROM DUKWs

162. *General*: To accomplish expeditious unloading, it is important to use the best available method. This will vary with each situation; DUKW company officers and non-commissioned officers must be prepared to offer advise and suggestions to Dump officers, which would expedite unloading. Thus DUKW turnaround time would be shortened, and ships unloaded faster. The most effective unloading methods are outlined below.

163. *Crane*: The crane will handle all cargo carried by the DUKW, it is a fast unloading aid, and saves man power.

164. *"A" Frame*: a. The "A" frames that may be attached to any DUKW will perform practically the same function as a crane. However, they are slower and should not be used unless cranes are not available.



Unloading a 105MM Howitzer with "A" Frame

b. The maximum capacity of an "A" frame is 5000 lbs. To lift this load, 1000 lbs. of cargo or personnel must be placed on the forward deck as ballast. Approximately 3500 lbs. is the maximum load that can be lifted with an "A" frame without ballast.

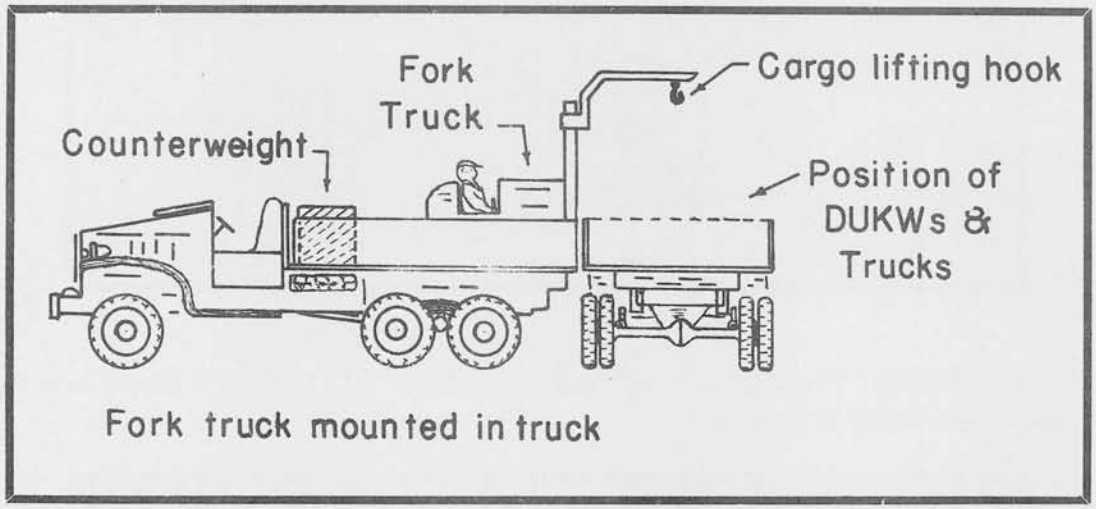
c. The "A" frame can handle cargo nets if chime hooks or spider bridles are used, hooked in down low on the sides of the net.

d. The winch drag brake must be kept in proper adjustment or the load being carried may drop without warning. (See paragraph 55.)

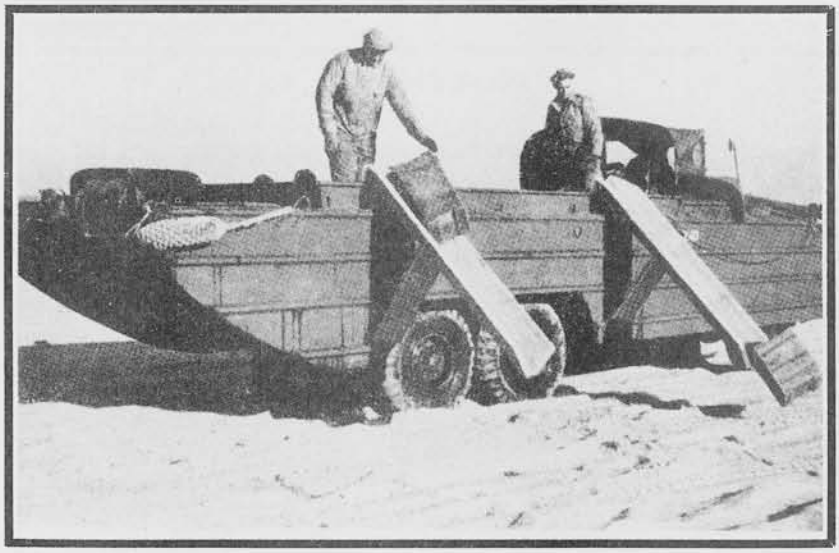
165. *Fork Truck Mounted in Truck*: This highly mobile, fast and self-contained unloading rig consists of a fork truck bolted to the bed of a 6 x 6 land truck. The fork truck faces the rear of the truck. At the front end of the cargo floor a 750 lb. counterweight

is installed. The finger lift of the fork truck is removed and replaced by an overhead five foot arm with a hook for lifting cargo slings at its outer end. (See figure below).

166. *Hog Trough*: Where there are small packages to be hand unloaded, Hog Troughs will be very useful. They can be made very easily by forming a "V" shaped trough out of two 2" x 12" planks, six feet long. The upper end is fitted with ¼" x 1½" strap hooks



to secure over the DUKW coaming. There is a three foot leg to support extended portion of the trough at a 45° angle, with the lower end about a foot clear of the ground. The three foot leg is braced against the lowest hull rub rail. The DUKW can be driven along slowly as packages are slid to the ground, giving dispersion and eliminating necessity of handling at base of trough. With two hog troughs, four men can unload 6000 pounds of cargo in less than two minutes.



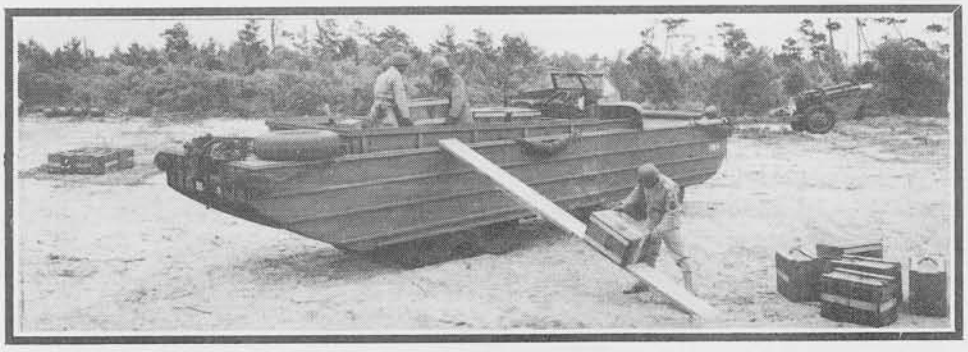
Unloading with "Hog Troughs"

167. *Barrel Skids*: Barrel skids made of two 4" x 4"s 10 feet long and secured 14" between inner edges, provide a useful method for hand unloading 55 gallon drums. The skid should be placed against the side of the cargo space and the drums slid edgewise over the coaming and down the skid.



Barrel Skids

168. *Plank Skids*: Plank skids measuring 2 x 12inches x 12 feet are a simple expedient for unloading square packages.



Plank Skids

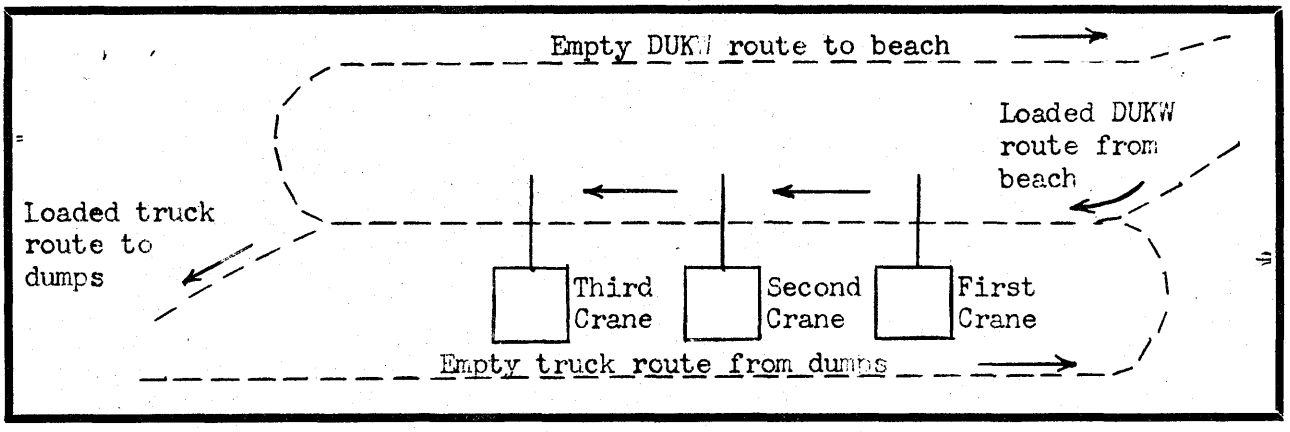
169. *Roller Runways*: Roller runways can be used in a manner similar to plank skids.



Hand Unloading Platform

170. *Hand Unloading*: Where enough men are available, very rapid unloading can be accomplished without any equipment by forming the men in one or two circles. A convenient working height can be obtained against the side of the DUKW by piling packages in the form of a platform.

171. *Normal Unloading Procedures*: a. *DUKW Transfer Point*: If the distance from beach to dump is greater than two miles, cargo should be transferred from DUKW to land truck at a transfer point close to the beach. If such DUKW is bringing in three drafts of cargo, three transfer rigs (cranes, "A" frames, or other lifting devices) should be installed at about sixty foot intervals. When a DUKW drives in, it stops at the first crane and has its top (or rear) draft picked up. It then proceeds on to the second transfer rig, a truck following in its path to receive its loads. Thus, DUKWs and trucks alternate through the transfer point.



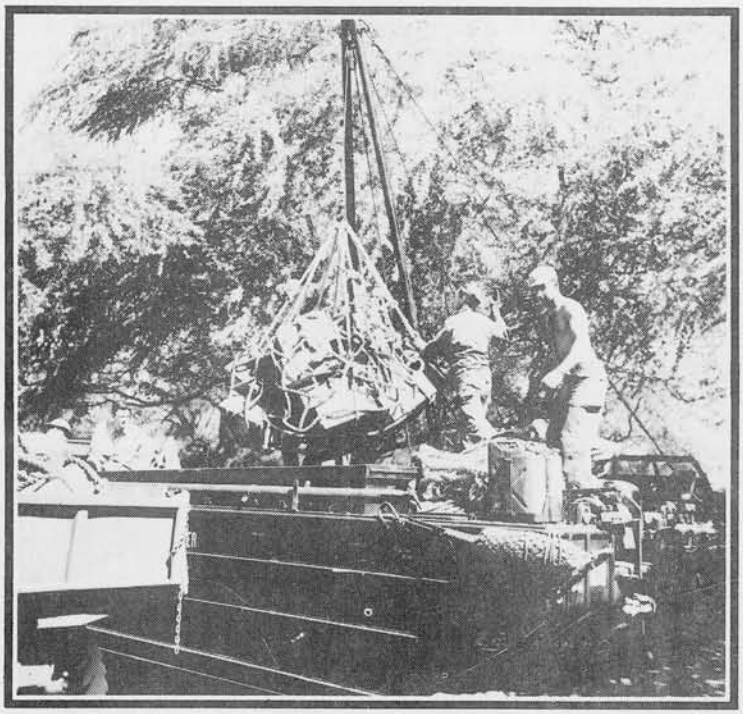
Transfer Point for Three Cranes, "A" Frames or Truck Mounted Fork Trucks

b. *Mixed Loads*: Where possible, mixed loads that involve going to more than one dump should be avoided. Also, loads that involve handling with several types of equipment in any one dump should be avoided.

c. *Return of Nets, etc*: Empty nets, slings, etc., must be returned to ships at the same rate as they come ashore loaded. Thus, if a DUKW receives three netloads of cargo from a ship, it must pick up three empty nets at the dump or transfer point, otherwise a shortage of nets on the ship may develop.

d. *Stopping Points*: Much time spent in backing and maneuvering will be saved at dumps and transfer points if the exact stopping points for DUKWs and other vehicles are clearly marked. The markers can be white tapes or painted stakes. By this means, cranes, "A" frames, etc. will be in exactly the right position to handle cargo in or out of vehicles.

172. *Unloading Palletized Cargo*: Palletized loads should generally be unloaded intact and not opened until time of actual use. They may be unloaded with a crane, fork truck mounted on a truck, or "A" frame. Use doubled tow chain for bridle if pallet wires wont meet lifting hook. For hand unloading, the straps on the pallets must be broken and the cargo discharged preferably with hog troughs, otherwise with plank skids, roller runways or hand unloading, with platform if helpful.

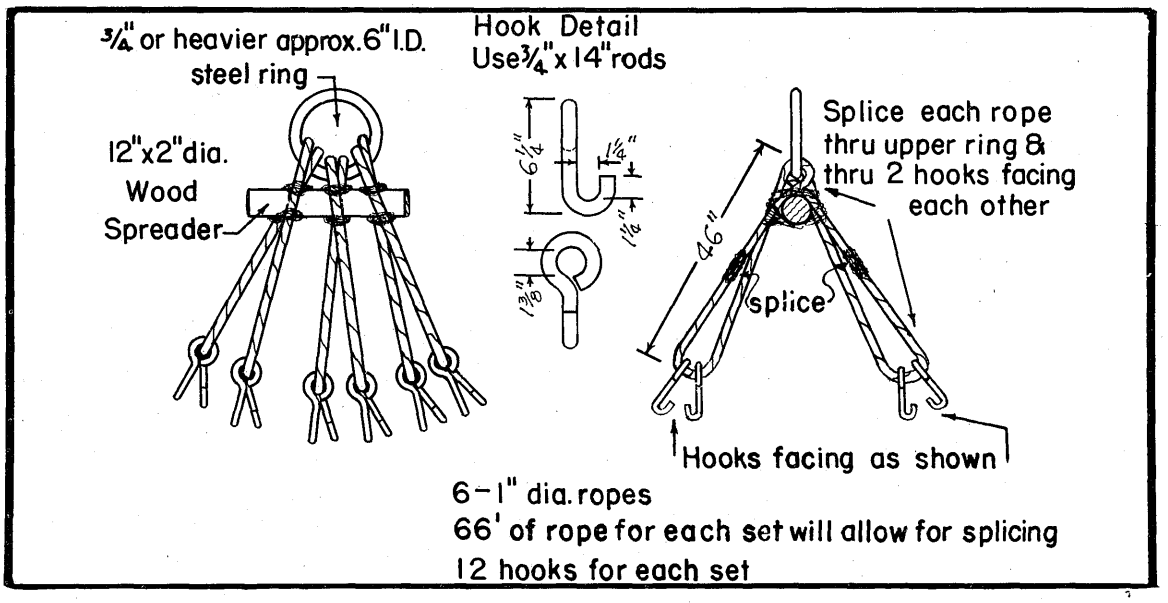


Using Chime Hooks to Lift Net Load of Ammunition

173. *Unloading Nets*: When discharging nets from a DUKW with "A" frames, or short cranes, it may be found that the height or drift of this equipment will be too short. Six Chime hooks or a six spider bridle with hooks that can engage the mesh of the nets will be found valuable for discharging such nets. (See paragraph 174).

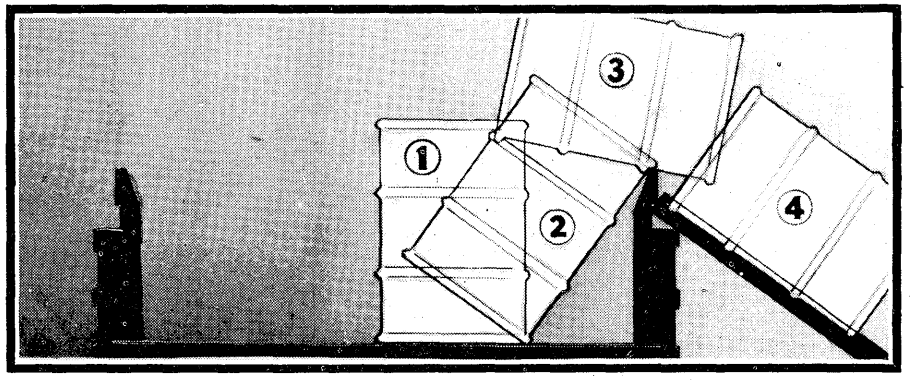


Six Drum Chime Hooks



174. *Unloading 55 Gallon Drums*: The quickest way to unload 55 gallon drums is by the use of chime hooks in conjunction with cranes, fork truck mounted on a truck, or "A" frames. For details of chime hooks see figures below and on next page.

If mechanical equipment is not available, barrel skids will provide a useful method for the hand unloading of these drums. (See paragraph 167). The skid should be placed against the side of the cargo space and the drums slid edgewise over the coaming and down the skid to the ground where they can be rolled into storage piles. Drums on the bottom of



Unloading 55 Gallon Drums Onto Barrel Skids

the cargo space must be placed on end about two feet from coaming, then leaned against the coaming and with two men lifting the low end, slide the drum up over the coaming and down the skid. (See figure below). Work close to rear end where cargo space is least deep.

175. *Unloading Projectiles*: Projectiles are best unloaded with crane or "A" frame if carried in pallets. Crane or "A" frame with cluster of 12 chime hooks is best where pallets are not used. Hog troughs are best for hand unloading.

176. *Unloading Bombs*: The best methods for bomb unloading depend upon the bombs being carried. The methods are outlined below:

(a) 100 lb. bombs should be hand unloaded with hog trough, or with "A" frame, or crane when in pallets.

(b) 250 lb. bombs should be hand unloaded with hog trough, or with "A" frame or crane when in pallets, or cluster of six hooks or bridles.

(c) 500 lb. bombs should be unloaded with "A" frame or crane, with bridles or slings, to pick up four bombs at a time, or with suitable pallets. The bombs can also be rolled up on skids over the side of the cargo space and dropped onto soft ground *if mechanical aids are not available.*

(d) 1000 lb. bombs should be unloaded with "A" frames or cranes, with bridle or slings to handle two bombs at a time. In an emergency where mechanical aids are not available, bombs may be rolled up on skids over the side and dumped onto soft ground.

(e) 2000 and 4000 pound bombs. Unloading will be accomplished with "A" frame or crane fitted with suitable bridle or slings. (See figure below).

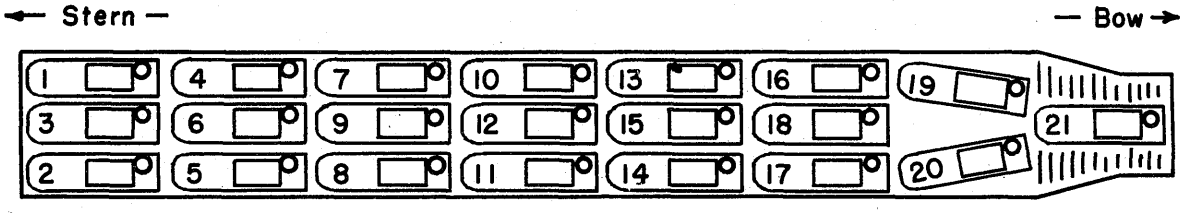


Bridle on 2000 Pound Bomb

CHAPTER XVIII

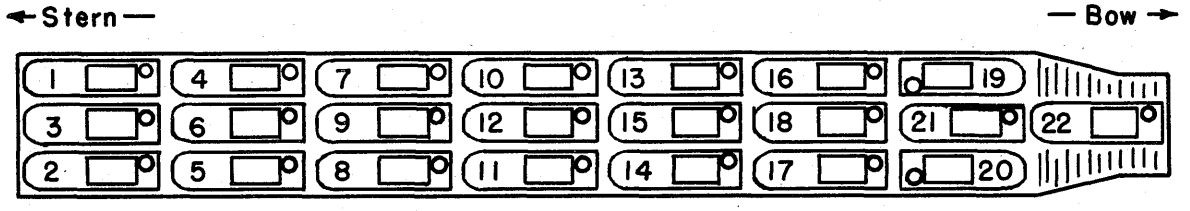
OPERATIONS WITH LSTs

177. *Initial Loading*: DUKWs should be driven aboard frontwards, the only exception being as mentioned in paragraph 178 below. Where possible, particularly when loading for a long trip, the *loading should be made from dry land.* This is necessary to prevent serious corrosion of brake mechanisms and other parts while the DUKW is stationary for a long period. DUKWs can also be driven up the ramp to the top deck on LSTs so fitted. The guides for the ramp to the upper deck should always be hung up out of the way when operating from the tank deck. In the normal unloading, the DUKWs leave the LST *stern* first.



21 DUKWs Loaded Frontwards, Showing Order of Loading

178. *Backing on Board*: If the loading plan places three DUKWs abreast immediately inside of the ramp opening (See Figure below) the last DUKW on each side should be *backed* on board to make it possible to get in and out of the corners near the ramp opening. DUKWs can be backed aboard easily on land, but afloat it requires smooth water and a skillful driver. It is most important that the center part of the ramp be clear of obstructions so that propeller guards will not be damaged on DUKWs so fitted, either when *backing on board* or *going off frontwards.* Also the pintle hook on the DUKW must be turned on its side to provide maximum clearance. The bolt thru the emergency ramp cable fitting at centerline of LST ramp, should be ground off as near to flush as possible. In all cases go on or off the ramp slowly, and when going off frontward, don't engage the propeller until *after* clearing the ramp.



Maximum of 22 DUKWs on Tank Deck, Showing Direction and Order of Loading

179. *Lashing*: The three bow shackles, and the stern pintle hook, plus the two fender eyes on each rear deck corner, are the most suitable lashing points. The two lifting eyes and one mooring eye on each side are strong for fore and aft lashings, but not good for side pulls. Do not use bow fairlead or either bow or stern davit eyes. Park the DUKWs in low range reverse and set hand brake.

180. *Tire Pressure*: Tires should be inflated to 40 pounds and individual valves shut (on DUKWs equipped with central tire control). Inspection should be made daily for leaking tires, and repairs effected when necessary. Individual valves should be opened to equalize tires (*after* inspection) and when necessary, tires inflated to maintain 40 pounds pressure.

181. *Maintenance*: (Also refer to Chapter V)

a. Gasoline tanks should be filled *before* loading.
b. After loading, bilges, including three drive shaft housings, should be drained, bilges cleaned and all plugs replaced and valves closed.
c. Run engine about 10 minutes every second day.
d. Operate propeller and winch drive shaft, briefly each time engine is run.
e. Perform "Weekly" maintenance as outlined on "Minimum Drivers Weekly Maintenance", paragraph 66. (Exclude land and water test runs). Do *not* drain any part of the fuel system, or replace any gasoline except when directed by company officers. At such times, LST deck fans must be running, and extreme care must be used to see that no gasoline is spilled.

182. *LST Marking*: During the unloading operations, much valuable time can be lost by the DUKWs going to the wrong LST. For that reason it is extremely helpful to have distinctive markings for each ship. Drivers must be thoroughly familiar with markings.

183. *Ramp Curbing Corner Guards*: The outboard corner of the ramp curb (see sketches on page 91) is very dangerous and can easily cut a hole in the bow of a DUKW when landing. It is extremely important that this corner be guarded. The simplest field expedient is to use one-third of a salvaged tire, fitting it over the corner, and wiring it securely thru small holes drilled in ramp curb, preferably with additional canvas or rope padding underneath the tire. A triangular shaped rope matting would also be helpful. A suitable type of removable curved steel guard to be used in conjunction with a tire is the best protection. (See sketch page 92).

184. *Ramp Obstructions*: Any obstructions that extend above the ramp cleats, or any appendages on ramp curbs, should be removed, and surface ground smooth to protect DUKW hull and tires. Inner face of ramp curb, and passageway into tank deck, should be kept clear of any obstructions. The bolt thru the emergency ramp cable, fitted to ramp center, should be ground off as nearly flush as possible.

185. *Distance from Shore*: Due to the slow speed of the DUKWs, it is imperative that the LSTs take station as near the shore as tactical situation will permit. By staying far off shore, danger in many cases will be increased, as the unloading period will be drawn out many times the period that would be necessary if a berth nearer shore were used. When strong currents must be negotiated there is a resultant loss in the DUKW's speed, placing more emphasis on nearness to shore, also suggesting initial unloading at a point up-stream from desired landing point. (See DUKW speed, paragraph 7e).

186. *Ramp Angle*: (See sketch next page). It is most important that the DUKW wheels or bow do not hit against the extreme lip of the ramp. To prevent this, the minimum sub-

mersion should be approximately four feet. In rough water, or when the LST is light forward, relatively steep ramp angles will be necessary to insure this submergence. On the other hand, a flat ramp angle makes landing and launching easier. Therefore, in smooth water, and when it is possible to ballast the LST forward tanks, the 48 inches depth over the lip of the ramp can be obtained with the ramp considerably above the bottom stop position.

187. *Ramp Cables, Shores and Doors*: Regardless of whether shores are employed or whether the ramp is set so it is down against the lower stop, it is important that either the hoisting cables or auxiliary cables (preferably covered with pipe) be kept tight to prevent the DUKW straddling one side of the ramp. It is also important that the doors be kept as close in to the sides of the ramp as possible to prevent a DUKW getting off the edge of the ramp *under* the support cables. Keep the DUKW wheel house covers securely in place and in good condition, as they help prevent wheel houses catching on the ramp cables.

188. *Keep Ramp Opening Clear of Personnel*: The curious crowd which normally collects in the ramp opening, tends to confuse the DUKW driver and frequently causes him to stop prematurely, perhaps in a dangerous position. The officer in charge of directing the landing (or launching) should stand clearly in the center. The rest of the opening should be kept absolutely clear.

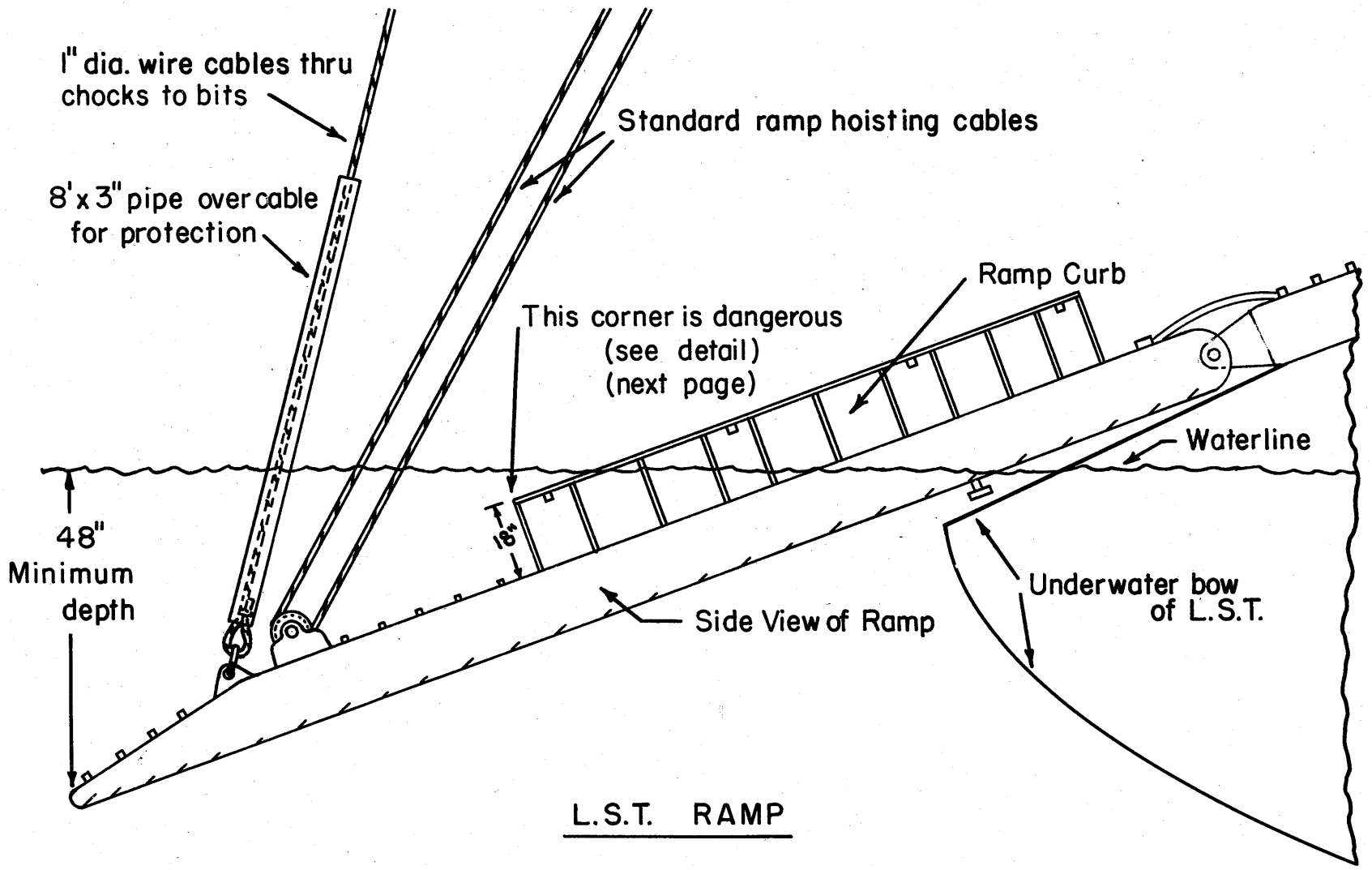
189. *Handling of Ship During DUKW Operations*: Due to the slow reverse speed of the DUKWs it is imperative that the LST have no headway when DUKWs are launching or landing. Where a strong current might take the ship out of position, operations could continue with the LST maintaining sternway up to two and one-half to three knots. In all cases, whether anchored or not, the LST engines should be used as much as possible to prevent yawing, and to eliminate cross currents or cross seas over the ramp.

190. *DUKW Loading*: The *total* payload should center approximately two feet forward of the center of the cargo space. It should not be more than 5000 pounds where conditions are unknown or where conditions are known to be difficult. Under combat emergency, where conditions are favorable, 7500 pounds may be carried. For ship launching operations, total payload should never exceed 7500 pounds. (See paragraph 156).

191. *Control*: No DUKWs will be launched from or land on the LST without clearance from the ship's officers. The actual direction of the DUKW at time of launching or landing will be by an officer of the DUKW Company, who will be stationed at the head of the ramp on the tank deck.

192. *Pre-Launching Check*:

a. Tire pressures correct for expected landing conditions.
b. Supply of gasoline, oil and water, including spare supply.
c. Weight of payload not excessive for conditions as they exist.
d. That load is properly placed and secured.
e. Inside the hull clean and dry, *all plugs in place and drain valves closed.*
f. All DUKW standard equipment and tools are on board and in place.
g. Hull is free from leaks. *Hold for repairs when necessary.*
h. Cab top removed, windshield down, bow surf plate folded down on deck.
i. Bow hatch, engine hatch, auxiliary air intake, rear hatch and two winch cable fairleads in coaming all tightly shut.

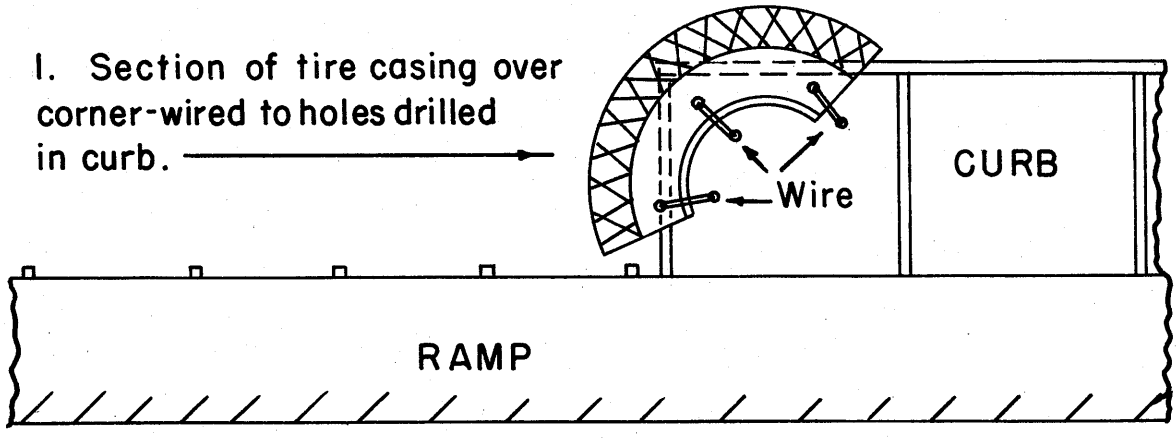

1" dia. wire cables thru chocks to bits
8' x 3" pipe over cable for protection
Standard ramp hoisting cables
Ramp Curb
This corner is dangerous (see detail) (next page)
Waterline
48" Minimum depth
T 18"
Side View of Ramp
Underwater bow of L.S.T.

L.S.T. RAMP

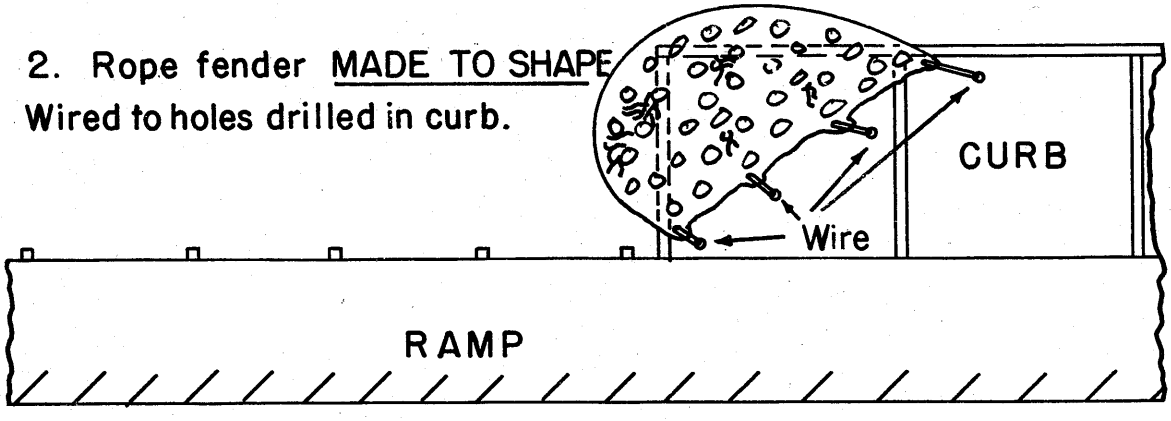
DETAILS OF

L.S.T. Ramp Curb Corner Protection, for use with DUKWs.
Guards and bumpers must be removed to seal Ramp.

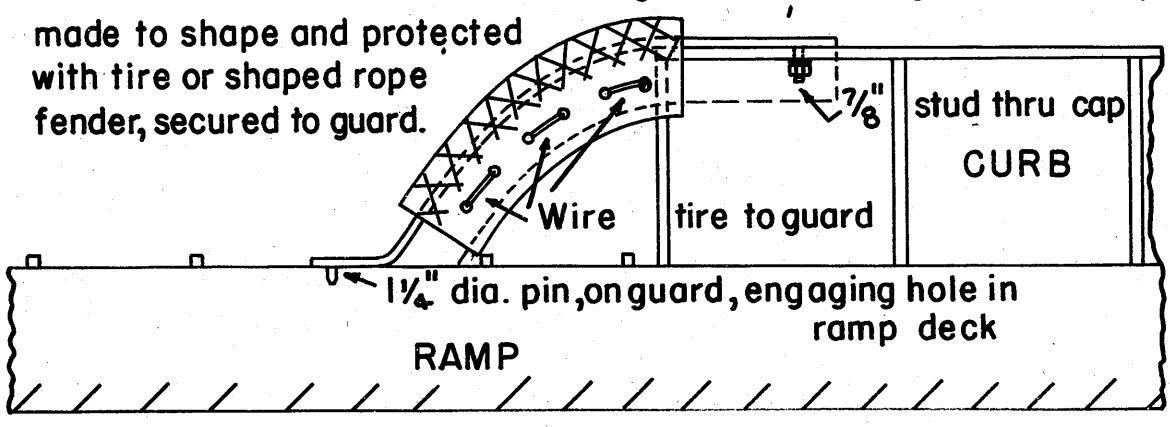
1. Section of tire casing over corner-wired to holes drilled in curb. ——→



2. Rope fender MADE TO SHAPE Wired to holes drilled in curb.



3. Removable Guard of 5"x½" angle or similar angle or channel, made to shape and protected with tire or shaped rope fender, secured to guard.



j. Rear closure set up—except in case of 105mm Howitzer or special loads that prevent its being set up, in which case cargo tarp must be rigged tightly around rear coaming to keep out water when backing down the ramp.

k. When loaded, cargo tarp must always be rigged over at least the rear half of cargo space. In rough weather cargo tarp must completely cover cargo space.

l. Engine well warmed up—cooling passages all clear.

m. *Driver understands his instructions and objectives.*

193. *Launching*: At the actual launching, the following details should be carefully followed:

a. Personnel in DUKWs temporarily crowd forward to lighten the stern while descending the ramp.

b. Front wheels engaged and transfer case in low range.

c. Transmission in reverse. (First speed for forward launching).

d. Propeller drive in reverse (overdrive) position. For *forward* launching propeller should *not* be engaged until stern of DUKW clears the ramp.

e. Bilge pump manifold right rear valve open. All others shut.

f. Set pintle hook crosswise—necessary only for forward launching.

g. Release emergency brake.

h. Do not depress clutch after starting down ramp. Engine is the best possible control of your speed. To guard against inadvertantly depressing clutch, place left foot *on floor alongside the pedal.*

194. *DUKW Speed*: A Dukw in first-class operating condition will make 6.5 *land miles* per hour traveling light and in smooth water. From this you should deduct one-tenth of a mile for each 1000 lbs. of load carried, also one-tenth of a mile for each foot of wave height, and probably three-tenths for possible mechanical deficiencies (slow governor, lame engine, bent propeller, etc.) These figures should help in laying out a course to the shore or to control boats.

195. *DUKW Preparation for Landing on LST*: When approaching the LST preparatory to landing, the driver should check the following:

a. Bilge pumped as dry as possible.

b. Rear closure up. When loaded, tarpaulin rigged tightly over at least rear half of cargo space.

c. Tire pressure 25 pounds.

d. If loaded, that load is properly placed and secured.

e. Keep about 50 yards in front of LST ramp, and be alert to receive signal to land.

196. *DUKW Landing on LST*:

a. Lower bow surf plate and windshield when you get signal to land.

b. Engage transfer case in low range.

c. *Check that front wheel drive is fully engaged.*

d. Shift transmission to first speed.

e. Shift propeller control to reverse (overdrive) position.

f. Approach the ramp *keeping directly in line.* If the LST is swinging, allow for the swing—lead it by heading enough towards the side to which it is swinging, so that the DUKW will be directly in front when the ramp is reached. Step on the gas when

a turn is to be made. Turn the steering wheel in time, also straighten out ahead of time or the DUKW will swing too far. If the DUKW strikes the cables, slip the clutch until the DUKW bounces back sufficiently to enable the bow to get on the ramp. Do not reverse unless so directed by the officer controlling the landing from the tank deck of the LST.

g. When on the ramp, steer down the center and do not stop unless directed, until on the down grade inside.

197. *After Landing on the LST*:

a. Move DUKW to position as directed.

b. Deliver any messages from shore. Make known any special need so materials can be secured without delay.

c. Drain hull and close valves.

d. Get necessary fuel, water or oil. Do not fuel on tank deck without permission.

e. *If landing was rough, inspect carefully for damage and make any necessary repairs.* Rags, wooden wedges or plugs and seam compound will serve when it is out of the question to weld. A tarp can be securely lashed over a fairly large hole to permit safely reaching better repair facilities.

198. *Speed Up DUKW Operating Cycles*: With the exception of driving slowly down the steep part of the ramp, all phases of DUKW operations should be accomplished without delays. Some 75 to 300 DUKW round trips will be needed to unload the LST. Each round trip has a number of key points from which wasted time can be eliminated. When one DUKW is going down the ramp, the next should be moved quickly to the top of the ramp so it is ready to follow at a 10 to 15 second interval. When one DUKW is landing the next DUKW should be brought in close so that as soon as the landing DUKW is in a safe place, the next will reach the ramp. If a rendezvous circle is used, it should be kept small and close. Where there is current, the circle can be dispensed with and the DUKWs can stay in position driving slowly ahead, watching for their turn to land. The importance of saving a minute here and there on each DUKW trip is vital.

199. *Landing Alongside*: On LSTs carrying pontoons it is important that DUKWs be kept away from the dangerous areas from which the DUKWs might get forced under the pontoons. Thus if the LST is anchored by the stern or is making sternway, landings should not be made at the stern, as it is easy to be forced under the pontoons, which may then do serious damage to the personnel and equipment. However, landings at either side of the bow would be perfectly safe, provided the doors are kept in close to the ramp. On the other hand, if lying to a bow anchor, or mooring ahead, the stern would be the safer position to land.

200. *Fueling*: The first trip to shore should be started with a full gasoline tank and two full five gallon gasoline cans on rear deck. The maximum fuel consumption should be under seven gallons per hour, the normal average approximately half that figure. When on shore, if the tactical situation permits, gasoline should be put in the tank from the extra five gallon cans or from any other available source. In order to save time and bottle-necking a supply of filled five gallon cans should be available on shore, also on the LST. It is not advisable to pour in the gasoline on the tank deck of the LST unless it is absolutely necessary. Then it is important that ventilation fans are running and that every precaution is taken to avoid spilling fuel. Each time a DUKW lands on the LST, it should leave any empty five gallon cans and pick up in exchange cans that have been pre-

viously filled. It is advisable that the five gallon cans be filled on the weather deck of the LST. When sea conditions will permit, fueling can also be accomplished by a hose overside to the most sheltered landing place alongside the LST.

201. *Handling Ammunition*: When ammunition is carried on the tank deck under the DUKWs, after the DUKWs have gone overboard for their initial trip to shore, the dunnage should be removed from one side to the center line, leaving enough dunnage so that the DUKWs returning to load can drive in, in column, using the side from which the dunnage has not been removed. Ammunition should then be loaded on the DUKWs. This can be expedited by having a pile stacked in advance next to each position where a DUKW will be parked. The greatest emphasis must be laid on loading the last DUKW aboard as it must be the first to leave. The number of men in the loading crews should be graduated down for successive DUKWs, the largest crew loading the last DUKW aboard, and the smallest crew loading the first DUKW aboard. Assuming six DUKWs arrive for a load of ammunition and the first DUKW boards the LST at 0900, the DUKWs should enter not over thirty seconds apart, placing the sixth DUKW on board at 0902:30. Assuming five minutes to load the sixth DUKW, it then leaves at 0907:30. Assuming the DUKWs leave at thirty second intervals, there will have been six, seven, eight, nine and ten minutes for loading DUKWs five, four, three, two and one respectively. In an ideal operation, if the round trip, including loading and unloading can be made in an hour, and if the LST carried 24 DUKWs, a group of six would be loaded by the LST once every 15 minutes. There would be 24 trips leaving each hour and assuming three and one-half tons average load, that would be 84 tons per hour. The ideal set-up would have six DUKWs loading on the LST, six loaded DUKWs half way to the shore destination, six DUKWs unloading at destination and six empty DUKWs half way back to the LST.

202. *Miscellaneous Cargo*: Jeeps or M-29-Cs can be loaded by being driven up over the stern of a DUKW on temporary ramps 12 feet long. Ten foot ramp must be used in the DUKW cargo compartment and DUKWs rear deck and rear coaming must be amply protected with dunnage. A DUKW with an "A" frame could be used on the top deck to lower heavy loads through the main hatch on to vehicles on the tank deck. However, this should only be done where there is no other expedient available, as it is slow and ties up one otherwise needed vehicle. Two LST ammunition davits can be used, one at each forward corner of the main hatch.

203. *LSD Operations*: The details of operating with LSTs are generally applicable to LSD operations. An important exception is that where the tactical launching will be made by flooding, the DUKWs should be put aboard facing the stern, so they can swim out driving frontwards. Note that the tank deck of the LSD can accomodate 47 DUKWs.

204. *LSV Operations*: The details of operating with LSTs are generally applicable to LSV operations. A four inch extra heavy pipe tripod eight feet high should be welded on the LSV ramps to protect each outer sheave. This tripod should be heavily wrapped with rope to provide a cushion. A removable section of five inches by one-half inch angle should bridge the cut out section of the ramp curb on each side. Twenty-nine DUKWs can be loaded on the vehicle deck of LSVs up to LSV #3, and 31 on the later ships, all facing the bow. Additional DUKWs can be carried on the main deck and launched by the main derrick.

205. *LSM Operations*: The extreme corner of ramp curb on each side should be burned off on an 18" radius, recapped and then protected with sections of tire which can be permanently wired in place. The LSM can carry 9 DUKWs all driven aboard frontwards. The details of operating with LSTs are generally applicable to LSM operations.

CHAPTER XIX

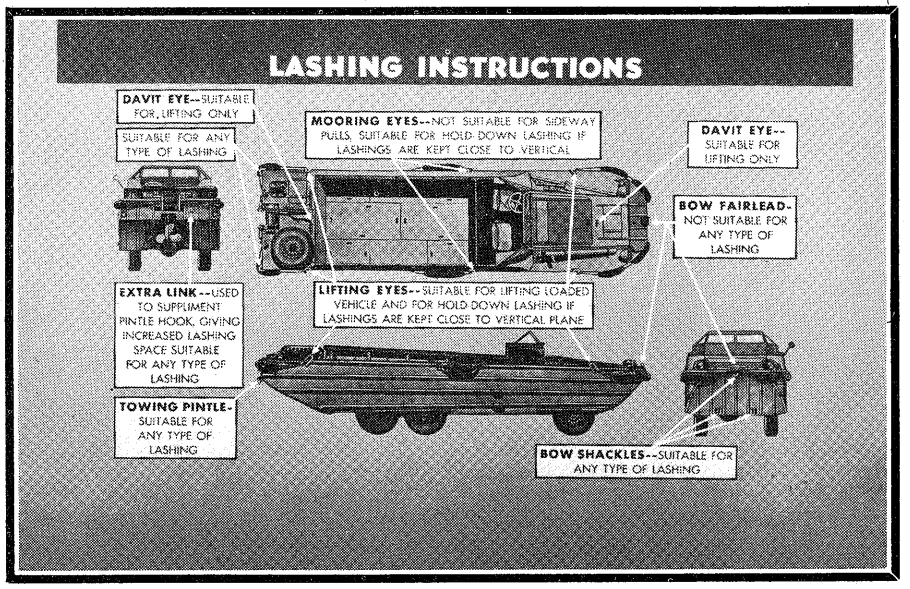
COMBAT SHIPMENT on APAs or AKAs

206. *Davit Eyes*: (See figure below). All DUKWs are fitted with davit eyes having same spacing as LSVP, and can be carried on any davits that can accomodate LCVP. Davit eyes spaced 22 feet five inches are designed to carry fully loaded DUKWs.

207. *Sling Lifting Eyes*: (See figure on next page). In addition to davit eyes, all DUKWs have four eyes for use with 16 foot (or greater) equal length four legged lifting bridle of not less than five-eighths inch diameter plough steel wire. These eyes are also designed to lift a fully loaded DUKW. DUKWs can be carried on deck or in any suitable hold, where ten ton booms are available.

208. *Weights and Load*: A DUKW with all standard equipment but *without payload* will weigh not more than 15,000 pounds. Load on after davit fall will not exceed 7750 pounds and load on forward davit fall will not exceed 7250 pounds. *Payload which must not exceed 7500 pounds for any ship launching operations,* will impose approximately two-thirds of its weight on after davit fall, and approximately one-third on forward fall.

209. *To Enlarge Davit Eyes*: If DUKW davit eyes are not large enough to receive davit hooks, shackles can be fitted in the davit eyes. These shackles, if used, should be made to stand upright, unsupported, by wrapping marline or rope yarns around between the deck and the shackles. This will greatly facilitate hooking and unhooking. In many instances, it will be helpful to slide the anchor five or six inches toward the stern to get it clear of the rear davit eye. When this is done, the anchor lashing straps should not be removed but merely loosened, so that the anchor cannot fall off the rear deck. In some



cases, where the davit hook will not fit in the davit eye, removal of the three-eighths inch thick caution plate on the deck will provide sufficient additional room so that the hook will fit.

210. *Chocking Blocks and Gripes*: When carrying the DUKWs in davits swung outboard, *chocking blocks,* should be fitted against the full height of *DUKW's* side. The block face must be at least six inches wide and be padded to protect the paint. The blocking should be arranged so that it will not press against the light metal shields which cover the wheels. Griping should be from the center forward shackle and after towing pintle hock. Gripes leading completely around the DUKW hull should be avoided as should gripes leading to davit eyes. The cast iron fairlead in the bow is not strong enough to use for lashing.

211. *Securing on Deck*: If the DUKWs are carried on deck or in the hold, carry their weight on tires inflated to 40 pounds. Lash the DUKWs down from their bow shackles and stern pintle hook or two eyes on rear corners. Lashing may be rigged from the four lifting eyes or the two mooring eyes, but should be kept close to vertical plane of side to avoid lateral pull. Do not use bow fairlead or two davit eyes. Leave the DUKW in low range reverse with the hand brake set.

212. *Maintenance*: For maintenance, refer to Chapter V.

213. *Launching Checks*: For pre-launching checks, refer to paragraph 192.

CHAPTER XX

OPERATIONS WITH 105MM HOWITZER

214. *Non-Combat Wheels*: For transportation in a DUKW, it is desirable that a 105 Howitzer be fitted with the non-combat wheels and tires. This permits Howitzer wheels to rest on cargo floor, using standard DUKW-105 Howitzer wheel chocks as described in paragraph 216. Overall height is approximately nine feet when on land.



Non-combat Wheeled 105 Howitzer in DUKW

215. *Combat Wheels*: A combat-wheeled 105 Howitzer may be carried, but has the disadvantages of increasing overall height by at least 10 inches, which diminishes the amount of cargo that can be placed on the tank deck of LST below the loaded DUKWs. In addition the DUKW coaming must be hammered out in way of both Howitzer hubs which are

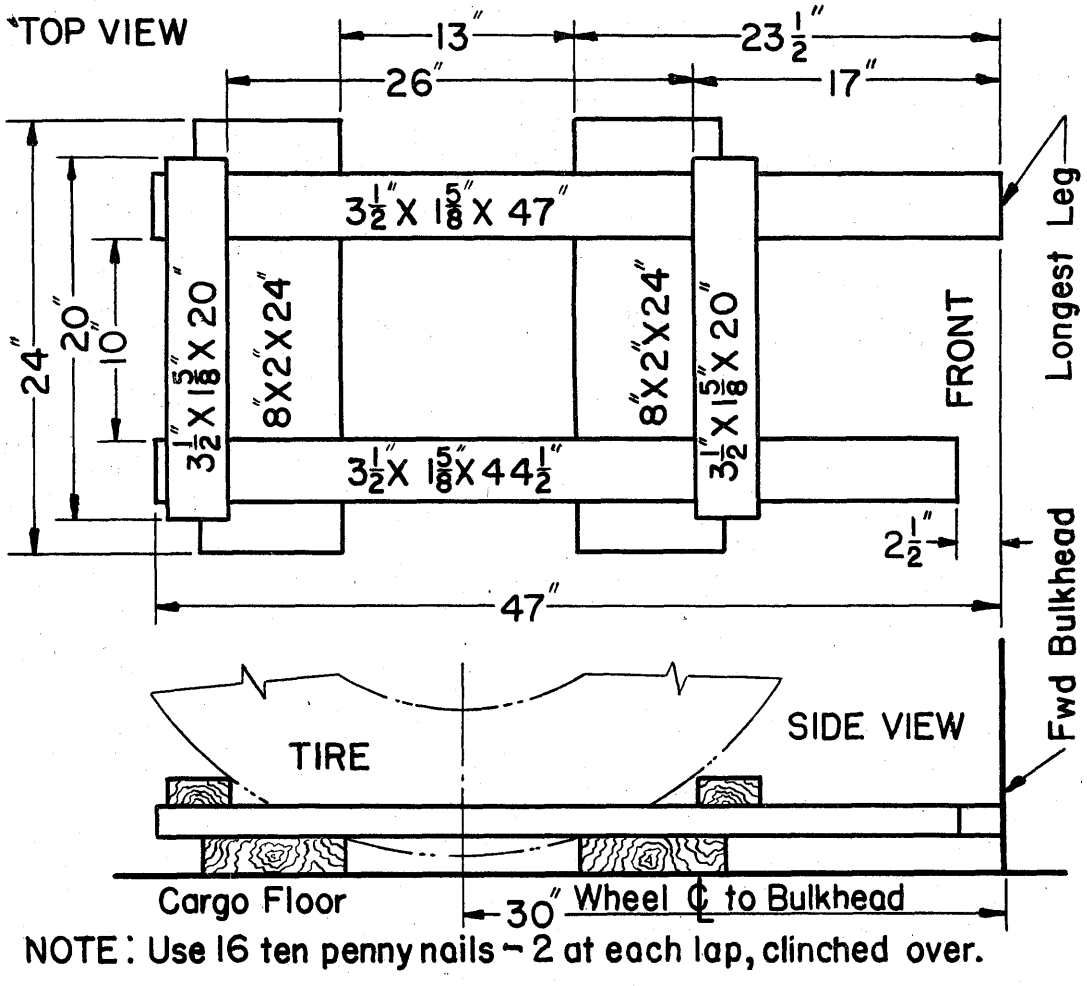


Combat Wheeled 105 Howitzer in DUKW

four inches wider than the space between coamings. The standard DUKW-105 Howitzer wheel chocks must be placed upside down on 6 inch blocks to raise the wheels ten inches above the normal position *on* the cargo floor. The overall height thus becomes at least nine feet, ten inches when on land.

216. *Wheel Chocks*: Two standard DUKW-105 Howitzer wheel chocks are needed for each DUKW. They may be used for any wheeled load, serving to distribute the tire load and thereby protecting the cargo floor. At the same time they help chock the load in place.

217. *Position of Wheel Chocks*: a. *With non-combat-wheeled Howitzer.* Place one wheel chock right side up in each forward corner of cargo space. Longest leg should touch forward cargo bulkhead, and main cross members should touch hull sides. Gun tires will then rest in position shown in side view sketch above.

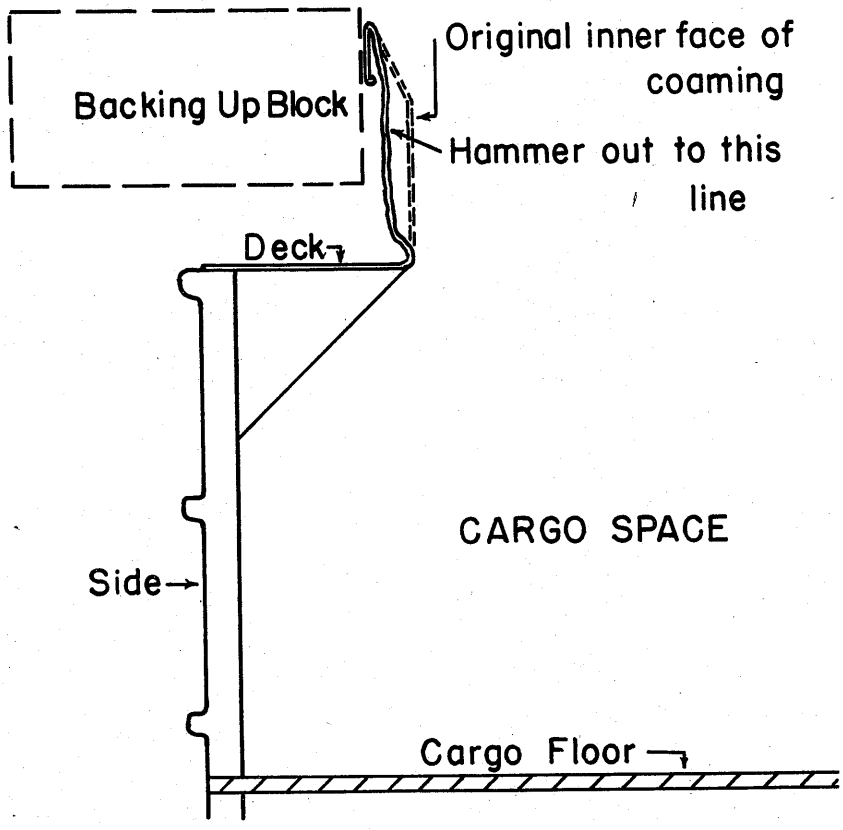


Wheel Chocks for 105 Howitzer

b. *With combat-wheeled Howitzer,* wheel chocks must each be placed upside down on six inch by ten inch by 4 foot, or equivalent blocks. The longest leg must still be against forward bulkhead, and the main cross members against the side coaming below deck extension.

218. *Coaming Alteration for Combat Wheeled 105 Howitzer*: The Howitzer axle should center 30 inches behind forward bulkhead. To provide for lowest reasonable position of wheels in cargo space, as outlined in foregoing paragraph, the inner bevel of the coaming must be flattened out to provide about two inches more clearance on each side. This can be accomplished easily by holding a block (such as six inches by ten inches by four feet wheel rest) endwise against the outside of the coaming, and then hammering with the back of the axe over a length of about 12 inches (centering 30 inches behind forward bulkhead).

SECTIONAL VIEW



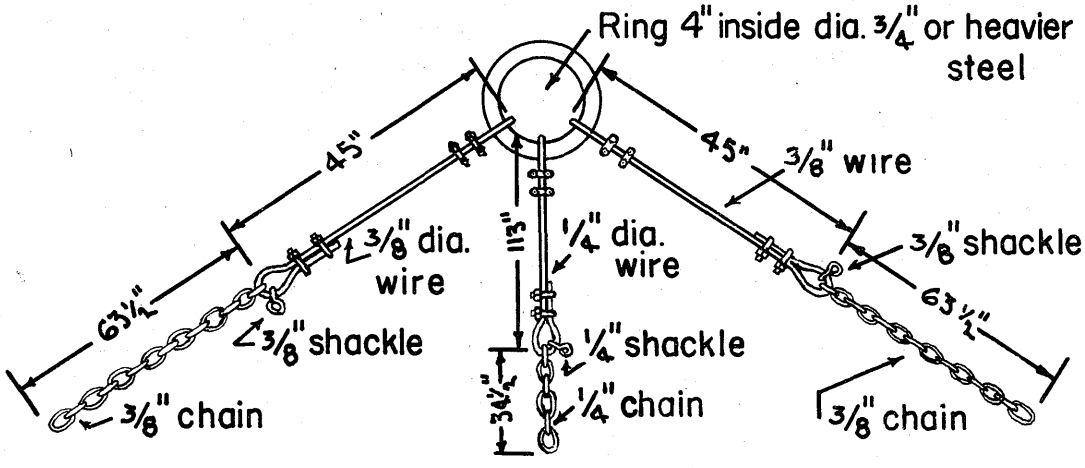
Details of Coaming Alteration.

219. *Trail Rest*: A folded cargo net or camouflage net should be placed on center of rear deck, against rear coaming. Thickness should be sufficient to keep trails about two inches above rear coaming.

220. *Rear Closure*: Canvas type should be attached to coaming but rolled down on rear deck. Plywood type should be removed and placed on cargo floor.

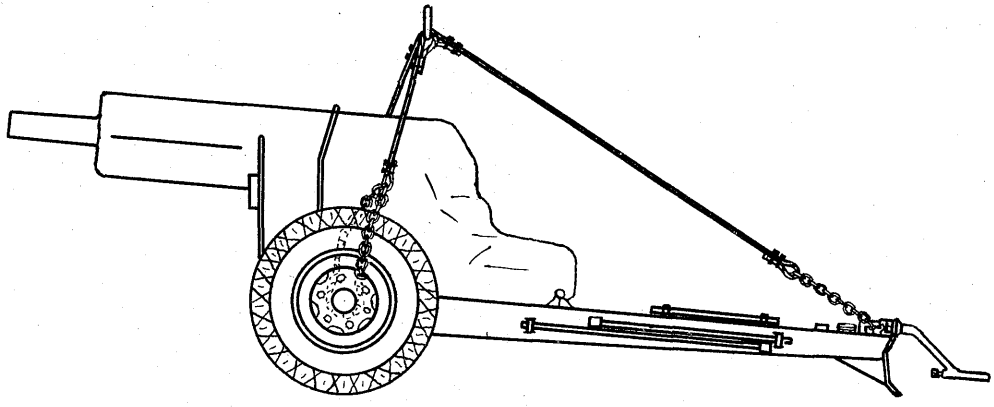
221. *Loading*: To place the Howitzer in the DUKW, and to remove it, another DUKW with an "A" frame, or a suitable crane is necessary. In emergency, the Howitzer could be removed by backing up to suitable steep bank or loading platform, then pulling gun out over ramps and dunnage in cargo space and on rear deck.

222. *Howitzer Slings*:



When placing clamps on wire, the saddle should be on the long part of the wire, the "U" bolt over the short end. (See paragraph 107.) Nuts should always be checked for tightness before using sling.

223. *Rigging Sling*: The sling should be rigged on this Howitzer as below:



Side chains lead outside tire, thru hole near top of wheel, inside wheel, under axle between brake and wheel, then up inside tire to shackle into cable. Rear chain leads thru lunette stem as in sketch above.

224. *Number of Howitzer Slings*: There *must* be a sling with each "A" frame, or preferably a sling with each Howitzer.

225. *Telescope Mounts*: The sling as described and rigged in paragraph 222, will clear telescope mount. It is advisable to tip the left hand telescope mount all the way forward and inboard. The sling is short to allow the Howitzer to be lifted clear with the 12 foot, five inch standard "A" frames.

226. *Winch Drag Brake Test*: Before attempting to load or unload a Howitzer (or any heavy load) with the "A" frame, the winch drag brake should be tested and adjusted if necessary. When the winch power take off in the driver's compartment is in neutral, and the winch jaw clutch on the rear deck is in the disengaged position, the winch shaft should rotate freely in the "forward" direction, but should be noticeably stiff in reverse. Make the test in the rear hatchway. With clean hands and clean shaft, it should be relatively easy to rotate the shaft forward with one hand. In the reverse direction it should be *just possible* with *one hand,* but still reasonably easy with *two* hands. Don't set the drag brake too tight or it will overheat and be damaged. Whenever any long amount of cable is to be paid out, release jaw clutch and pull out by hand, to save wear on drag brake.

227. *Lashing Howitzer in DUKW*: (See figure on next page) When the Howitzer has settled firmly in wheel chocks, set brakes tightly. Next secure a one inch diameter rope 50 feet long (two in each DUKW) with a bowline to the left mooring eye. Lead the rope thru under lunette stern (where rear leg of Howitzer sling is attached), another forward thru right mooring eye. Lead the rope back under lunette stern, and set tight by lashing around all three parts, using a rolling hitch. Next lock the lunette in the bow position and hook in the winch cable, and set it just tight. Then be sure winch jaw clutch is *locked* in *engaged* position, and winch power take off level (in driver's compartment) is locked in *neutral.*

228. *Additional Loads*: (See paragraph 156) The weight of the Howitzer will be between 4400 and 4900 pounds. That represents a complete load for "Difficult" conditions. However, to make the load effective, it is desirable to carry the gun crew and a small amount of ammunition, on the assumption that conditions will be "Favorable." In any case, it is most important not to let any unnecessary material be added to load, as it will jeopardize the chances of getting the Howitzer ashore.

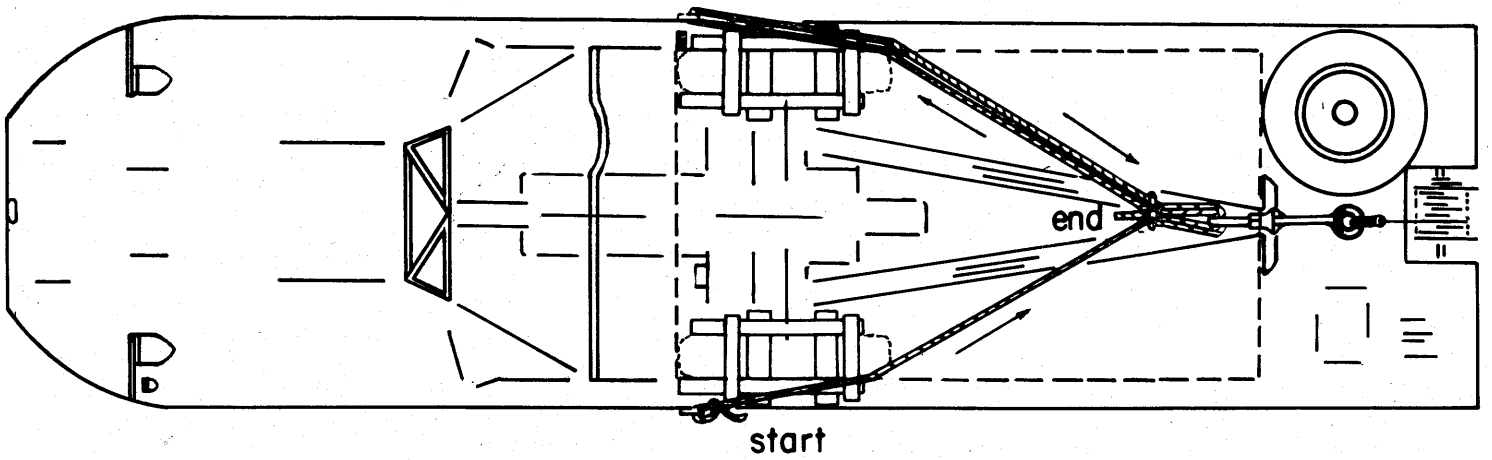
229. *Position of Ammunition*: To save weight and space, the rounds should be removed from crates and cloverleaves, and be carried in their sealed individual cartons. These should be placed equally *below* the four corners of the cargo space, in which position they are afforded the maximum protection.

230. *Position of Personnel*: Gun shields should be fully set up, and all personnel except driver and assistant should remain as low as possible in cargo space close behind gun.

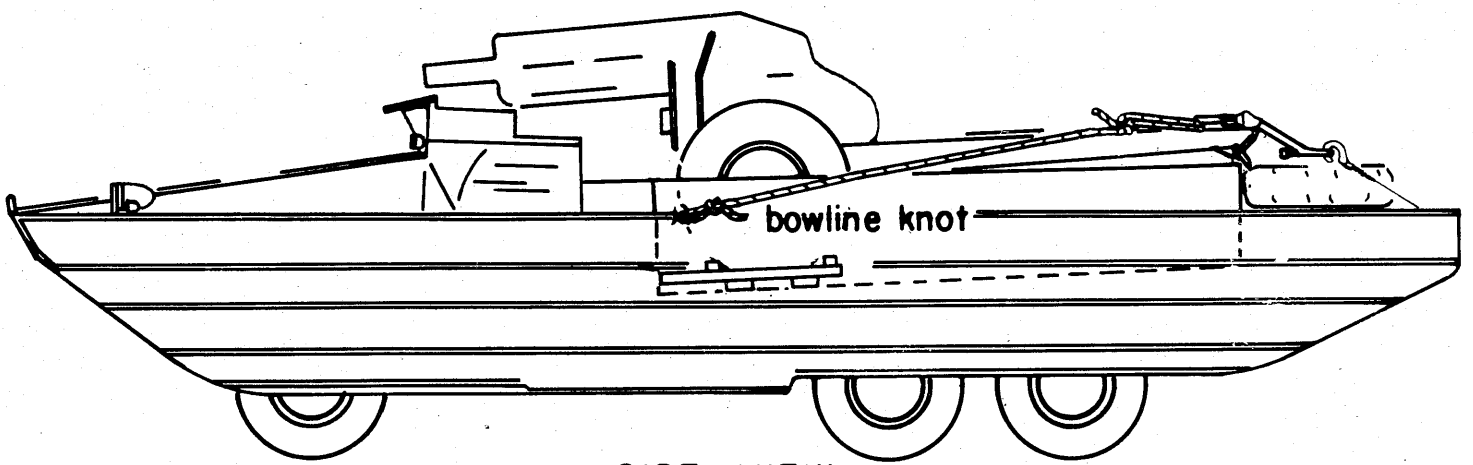
231. *Use of Tarpaulin*: The tarp should be rigged over the trail and tightly across rear coaming. The rear bow should not be used, but the second and third bows (counting the rear bow as #1) should be in place. The tarp must always be over these two bows before backing down the LST ramp. The remaining space forward should be tightly covered if rough water, high surf or rough coral is to be encountered.

232. *Unloading Procedure*: Pick the first reasonably level spot that will provide room for the operation, where there is reasonable cover and where the unloading will not block the roadway. Remove all lashings from the Howitzer and check sling carefully. Depending on the height of the "A" frame and the actual weight of the Howitzer, from one to six men

LASHING 105 HOWITZER IN DUKW



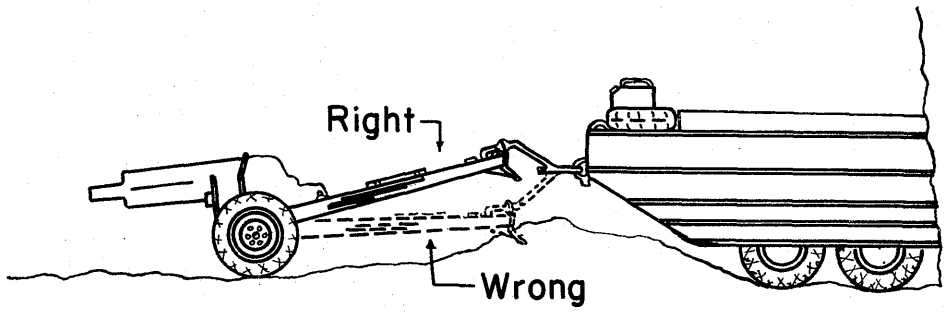
TOP VIEW



SIDE VIEW

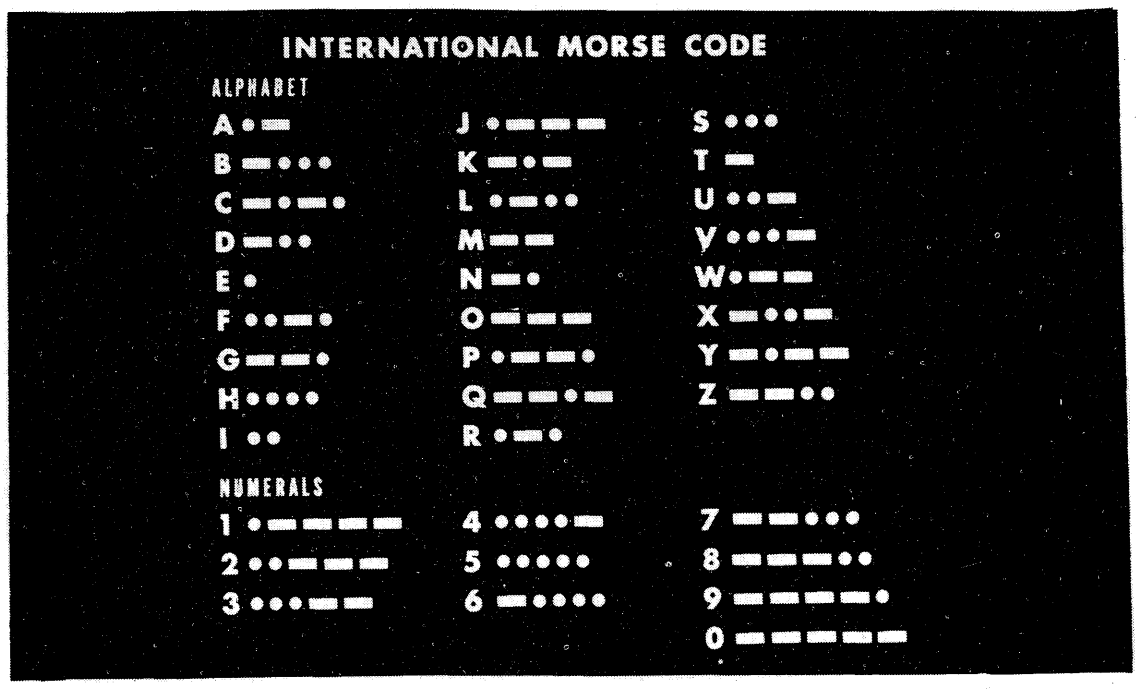
will be needed for temporary ballast on bow of "A" frame DUKW. If necessary, *all* personnel except the drivers of the "A" frame DUKW and the DUKW being unloaded can get on bow of "A" frame DUKW. As soon as the DUKW is clear the unloaded DUKW should pull forward. Remove sling. Release the Howitzer brakes. If ground is soft, rig lashing rope on axle, so DUKW can *tow* Howitzer clear of "A" frame so next DUKW can get under without delay. If ground is firm and level, gun crew can roll Howitzer clear—then turn it around.

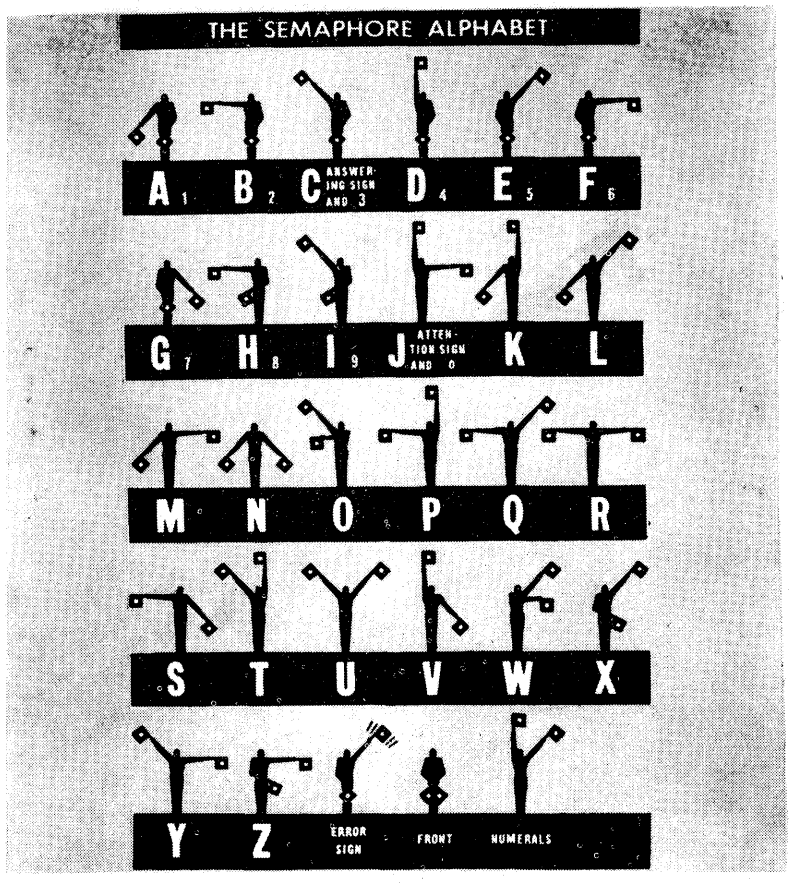
233. *Position of Travel Lock and Lunette*: Throughout the loading into the DUKW, transporting and unloading, the Howitzer should be locked in traveling position. The lunette should be in the down position, which position should be used when limbering to the DUKW. When the Howitzer is trailed with the lunette incorrectly placed in the high position, the trail spade is apt to catch in high spots. (See figure below).



Positioning Lunette.

234. *Firing the 105 Howitzer from a DUKW*: By utilizing Harness T-1, described in T.B. 9x-67, it is possible to fire the 105 Howitzer from a DUKW, either afloat or on land. The full traverse and elevation of the Howitzer can be utilized. Firing afloat will only be effective with the use of a highly trained gun crew, and under extremely favorable conditions or from sheltered waters.


INTERNATIONAL MORSE CODE
ALPHABET
A •—
B —•••
C —•—•
D —••
E •
F ••—•
G ——•
H ••••
I ••
J •———
K —•—
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NUMERALS
1 •————
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3 •••——
4 ••••—
5 •••••
6 —••••
7 ——•••
8 ———••
9 ————•
0 —————


THE SEMAPHORE ALPHABET
A 1 B 2 C ANSWERING SIGN AND 3 D 4 E 5 F 6
G 7 H 8 I 9 J ATTENTION SIGN AND 0 K L
M N O P Q R
S T U V W X
Y Z ERROR SIGN FRONT NUMERALS

APPENDIX "B"

The following references apply to DUKW operation as listed:

TM 9–802—Operating and Maintenance
Current edition dated 1 September 1943
New edition expected with late 1944 date

TM 9–1802A—Ordnance Maintenance—covers power plant
Current edition dated 15 July 1943

TM 9–1802B—Ordnance Maintenance—covers power train
Current edition dated 23 November 1943

TM 9–1802C—Ordnance Maintenance—covers hull and water drive
Current edition dated 21 December 1943

TB–ORD–5—Emergency Field Maintenance
Dated 31 December 1943
New TB expected with late 1944 date

SNL G–501—Standard Nomenclature—parts list
Current edition dated 1 July 1944

FM 55–150—Transportation Corps Field Manual
Current edition dated October 1943
New edition expected with late 1944 date

Lubrication Order 505
Current edition dated November 1943
New edition expected with late 1944 date

UNCLASSIFIED

APPENDIX "C"

Check List of Special Equipment to be Carried in DUKWs

5 gal. cans (2 gas on rear deck and 1 oil and water inside) 4 in each DUKW

Flexible extension spout for above cans.....1 in each DUKW

12 foot by 12 foot cargo nets.....2 in each DUKW

Mooring lines (100 feet of 4 inch circ. rope with hook and 40 foot 4 inch circ. messenger).....1 in each DUKW

Semaphore flags (pair).....1 in each DUKW

TM 9–802 (Latest available).....

SOP for POA—October 15, 44.....

Lube. Order #505 (Latest available).....

"A" frames complete.....1 in every 4th DUKW

Howitzer slings.....1 in each "A" Frame DUKW

Chime hooks (set for 6 drums).....1 in each "A" Frame DUKW

Barrel skids.....1 in every 4th DUKW

Hog troughs.....1 in every 4th DUKW

Stretcher rocks to go on coaming (set of 4).....1 in every 5th DUKW

Radios (SCR-510).....7 per Company

DUKW lifting slings.....1 in every 10th DUKW

Howitzer wheel chocks.....As required by mission.

UNCLASSIFIED