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**CONFIDENTIAL**  
**RESTRICTED**

**TM 9-802**

**WAR DEPARTMENT**

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**TECHNICAL MANUAL**

**TRUCK, AMPHIBIAN, 2½-TON,  
6 x 6, GMC DUKW-353**

**OCTOBER 15, 1942**

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TECHNICAL MANUAL )  
No. 9-802 )

WAR DEPARTMENT  
Washington, October 15, 1942

**TRUCK, AMPHIBIAN, 2½-TON, 6 x 6**

Prepared under the direction of  
the Chief of Ordnance  
(with the cooperation of the Yellow Truck and Coach  
Manufacturing Company)

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**PART I**  
**OPERATING INSTRUCTIONS**

**Section I**

**INTRODUCTION**

	<b>Paragraph</b>
Purpose and scope .....	1
Content and arrangement of the manual.....	2
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**1. PURPOSE AND SCOPE**

TM 9-802 dated October 15, 1942, is intended to serve temporarily (pending the publication of a revision now in preparation which will be wider in scope) to give information and guidance to the personnel of the using arms charged with the operation and maintenance of this materiel.

**2. CONTENT AND ARRANGEMENT OF THE MANUAL**

Sections I through IX contain information chiefly for the guidance of operating personnel. Sections X through XXXVIII contain information intended chiefly for the guidance of personnel doing maintenance work.

**3. REFERENCES**

Section XXXIX lists all Standard Nomenclature Lists, Technical Manuals, and other publications for the material described herein.

Section II

**GENERAL DESCRIPTION AND CHARACTERISTICS**

	Paragraph
General description .....	4
Identification .....	5
Characteristics .....	6
Tabulated data .....	7

**4. GENERAL DESCRIPTION (Figs. 1 and 2)**

a. Vehicle described in this manual is known as Truck, Amphibian, 6x6, DUKW-353, and is designed for amphibious service—operation on land or water. Vehicle has automotive characteristics of a 6 x 6 conventional truck, and in addition is equipped with an integral water-tight hull designed in such a manner that truck chassis and drive units are attached to and in body of hull. For land operation, vehicle utilizes six driving wheels driven by conventional six cylinder valve-in-head engine through transmission, transfer case, and propeller shafts. For water operation, vehicle is propelled with a water propeller powered from engine through transmission and a water propeller transfer case. As a truck, front wheels are steered with conventional steering gear assembly. When operating in water, vehicle is steered with combined use of front wheels and a rudder which is interconnected to and operated by the steering gear column.

**5. IDENTIFICATION**

a. Vehicle may be identified by six driving wheels, “boat” shaped body or hull, and low silhouette cab and cargo compartment. Springs and driving axles are attached to bottom of hull and suspend in water when in use as a boat. Water propeller and rudder are mounted in tunnel at rear.

**b. Identification Plates**

(1) **Vehicle serial number plates.** Vehicle serial number plate, Fig. 3, includes vehicle nomenclature, model, pay load, etc., as shown in illustrations.

(2) **Publication plates.** Publication plate, Fig. 4, gives the TM number of the technical manual and parts list to use with these vehicles.

(3) **Engine serial number.** Engine serial number plate, Fig. 5, is mounted on left-hand side of engine lower part of cylinder block and includes information as shown in illustrations.

**6. CHARACTERISTICS**

**a. Hull Structure**

(1) Welded steel hull is built to accept chassis frame and power

TRUCK, AMPHIBIAN, 2 1/2-TON, 6 x 6

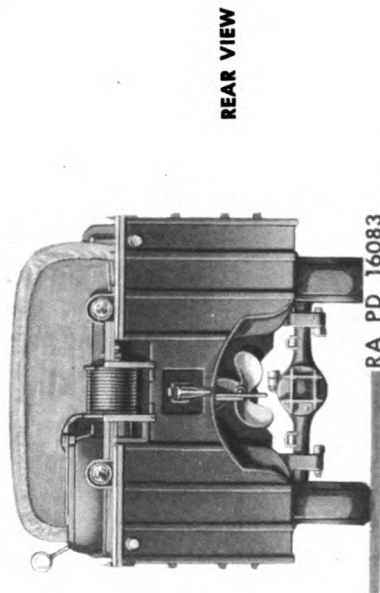
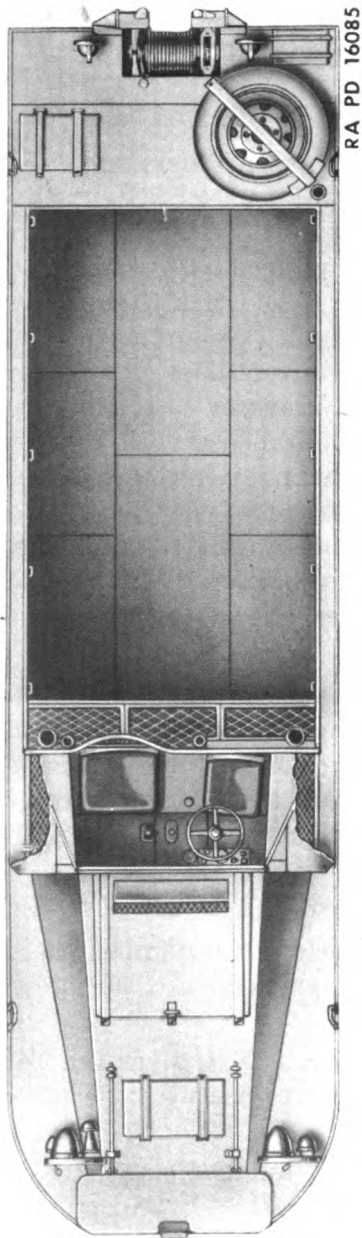
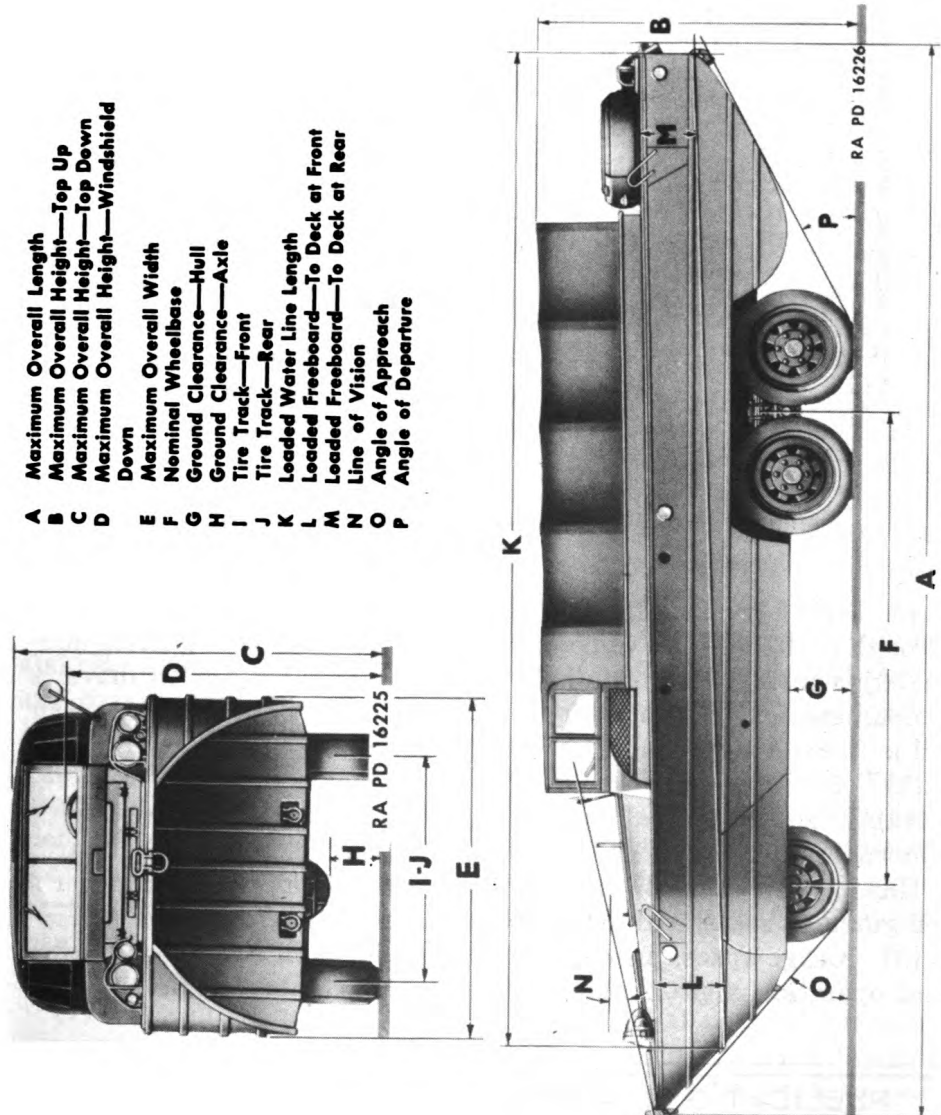


Figure 1 — Plan and Rear View of Vehicle

**GENERAL DESCRIPTION AND CHARACTERISTICS**



- A Maximum Overall Length
- B Maximum Overall Height—Top Up
- C Maximum Overall Height—Top Down
- D Maximum Overall Height—Windshield Down
- E Maximum Overall Width
- F Nominal Wheelbase
- G Ground Clearance—Hull
- H Ground Clearance—Axle
- I Tire Track—Front
- J Tire Track—Rear
- K Loaded Water Line Length
- L Loaded Freeboard—To Deck at Front
- M Loaded Freeboard—To Deck at Rear
- N Line of Vision
- O Angle of Approach
- P Angle of Departure

**Figure 2—Front and Side View of Vehicle Showing Dimensions**

**TRUCK, AMPHIBIAN, 2 1/2-TON, 6 x 6**

NOMENCLATURE - AMPHIBIAN TRUCK 2 1/2 TON 6 X 6	
SUPPLY ARM OR SERVICE MAINTAINING TRUCK	
ORDNANCE DEPARTMENT	
MAKE GENERAL MOTORS TRUCK MODEL DUKW353	
SERIAL NO. <input type="text"/>	DEL. DATE <input type="text"/>
GROSS WEIGHT <input type="text"/>	LBS.
MAXIMUM PAYLOAD <input type="text"/>	5000 LBS.
MAXIMUM TRAILER LOAD <input type="text"/>	LBS.
RECOMMENDED BY MANUFACTURER	
OCTANE RATING OF GASOLINE <input type="text"/>	70 MIN
OIL ABOVE FREEZING <input type="text"/>	SAE 30
OIL BELOW FREEZING <input type="text"/>	10 W
YELLOW TRUCK & COACH MFG. CO	
PONTIAC	MICHIGAN

RA PD 16222

**Figure 3—Vehicle Serial Number (Nomenclature)**

plant. Spring suspension and driving axles are attached to and through bottom of hull to frame with bolts and attaching parts adequately sealed at hull. The hull is decked forward of open driver's compartment, to rear of rear wheels, and along both sides. A crash rail is installed all around hull at deck height.

(2) Two-man cab or driver's compartment is open type with removable canvas top and open back. Compartment is equipped with removable curtains at each side. Windshield folds either forward, or tilts upward and outward. Compartment is equipped with driver's and gunner's seats, with entrance from the rear or over side.

(3) Cargo space, provided at rear of cab, will accommodate for land operation approximately 25 men and equipment or approxi-

PUBLICATIONS APPLYING TO THIS VEHICLE	
OPERATORS MANUAL	TM 9-802
MAINTENANCE MANUAL	TM 9-1802
PARTS LIST	SNL G-501

RA PD 16234

**Figure 4—Publications Plate**



## GENERAL DESCRIPTION AND CHARACTERISTICS

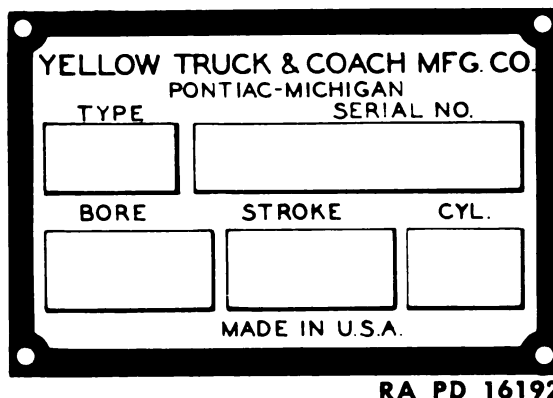


Figure 5—Engine Serial Number Plate

mately 5000 lbs. pay-load. Hatches in rear deck and floor provide access to tool and storage holds, also rudder operating mechanism and rear winch shaft. Two hatches in bow permit access to engine, accessories, and forward compartment.

**b. Power Plant and Transmission**

(1) Engine, mounted on frame and accessible through main hatch in front deck, is six-cylinder, valve-in-head type with 269.5 cu. in. piston displacement. Power plant is removable through hatch.

(2) Main transmission has five speeds forward and one reverse with direct drive in fourth and over drive in fifth. Power take-off for tire pump and winch is mounted on left side of transmission.

(3) Two-speed transfer case permits drive of rear axles, or front and rear axles, depending upon position of manual shift levers. Axles are driven through conventional propeller shafts and universal joints, which operate in water-tight housings.

(4) Water propeller transfer case, mounted in drive line between transmission and transfer case, permits engagement or disengagement of water propeller. Water propeller is driven through propeller shafts and universal joints. Shafting is equipped with marine type stuffing box to prevent water leakage where it passes through hull into propeller tunnel.

**c. Miscellaneous**

(1) **Winch.** Shaft driven winch, mounted at rear, is driven by transmission power take-off. Winch is controlled by shift lever in cab and jaw clutch on winch. Chocks and guides for front or rear operation of winch cable are provided on hull.

(2) **Bilge pumps.** 60-gallon per minute self-priming rotary pump, power driven by water propeller shaft, is connected through manually controlled selector manifold to the four lowest parts of hull. 160-gallon per minute centrifugal pump, also power driven by water propeller shaft, discharges from main part of hull when bilge water exceeds capacity of rotary pump. 50-gallon per minute hand pump is furnished for emergency use.



**GENERAL DESCRIPTION AND CHARACTERISTICS**

Number of cylinders ..... 6  
 Bore ..... 3-25/32 inches  
 Stroke ..... 4 inches  
 Piston displacement ..... 269.5  
 Weight (without accessories) ..... 525 lbs.

**(5) Maneuverability**

Minimum turning circle diameter (land)  
 (a) Left turn ..... 72 feet  
 (b) Right turn ..... 70 feet  
 Minimum turning circle diameter (water)  
 (a) Left turn ..... 42 feet  
 (b) Right turn ..... 39 feet  
 Angle of approach ..... 38 degrees  
 Angle of departure ..... 26½ degrees  
 Vertical object ..... 18 inches  
 Maximum grade descending ability ..... 60%  
 Maximum grade ascending ability ..... 60%  
 Land cruising range without refueling—5,000# load—  
 (average conditions) @ 35 m.p.h. .... 400 miles  
 Maximum allowable land speed ..... 50 m.p.h.  
 Maximum water speed ..... 6.4 m.p.h.

**(6) Performance**

**Acceleration (land)**

From standstill to 5 m.p.h. in High first 1.2 secs.  
 From standstill to 10 m.p.h. in High second 3.3 secs.  
 From 20 m.p.h. to 40 m.p.h. in High fourth 29.0 secs.

**Maximum land speed @ 2,750 engine r.p.m.**

	Low	High
Reverse .....	3 m.p.h.	7 m.p.h.
First .....	3 m.p.h.	7 m.p.h.
Second .....	5 m.p.h.	11 m.p.h.
Third .....	10 m.p.h.	22 m.p.h.
Fourth (direct) .....	18 m.p.h.	40 m.p.h.
Fifth (over-drive) .....	22 m.p.h.	50 m.p.h.
Max. governed speed .....		50 m.p.h. @ 2750 engine r.p.m.

**Maximum water speed (5,000# load, full throttle—smooth water)**

	Speed
Second (full throttle) .....	6.4 m.p.h.
Third (full throttle) .....	5.4 m.p.h.
Third (one-quarter throttle) .....	4.2 m.p.h.
Fourth and fifth—(over-drive) transmission is not used when operating water propeller.	

Section III

**CONTROLS AND OPERATION**

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Driver's general instructions .....	8
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Vehicle nomenclature and terms.....	10
Oil, gas and water supply.....	11
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Stopping vehicle—on land .....	17
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Landing from water .....	21
Anchoring, mooring, and towing.....	22
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Winch operation—land and water.....	24

**8. DRIVER'S GENERAL INSTRUCTIONS**

**a. General.** Information and instructions outlined in this section embrace not only the essential factors of driving this vehicle on land as a conventional truck, but also include unique and important instructions for operation of vehicle in amphibious service. Operation of an amphibious vehicle of this type requires basic training in truck driving, together with a knowledge of water operation fundamentals.

**b. Land Operation.** Driving the vehicle as a "land" truck requires the knowledge of all the fundamentals of operating a conventional 6 x 6 truck. In addition, the driver must take into consideration certain characteristics of this vehicle. In addition, driver should consider special characteristics of the vehicle such as width, height, length, front and rear overhangs, visibility and weight.

**c. Water Operation.** Experience as a driver of a 6 x 6 truck is the basis of amphibious service training; however, operating personnel should be familiar with instructions applicable to water operation before attempting to operate the vehicle in water.

**d. Caution and Instruction Plates.** Various caution and instruction plates are placed in driver's compartment. These plates are illustrated in Figs. 6 and 7.

**CONTROLS AND OPERATION**

**AUX. COOLING AIR INTAKE**  
 CONTROL AT CENTER OF DASH  
 PUSH DOWN TO OPEN

OPEN WHEN POSSIBLE TO HELP  
 ENGINE COOLING WHENEVER ENGINE  
 TEMPERATURE IS ABOVE 170°

**CAUTION** ALWAYS CLOSE TO KEEP  
 ENGINE DRY DURING ROUGH WATER  
 OR STEEP WATER ENTRY

RA PD 16235

AUXILIARY AIR INTAKE INSTRUCTION PLATE

**MAXIMUM PERMISSIBLE ROAD SPEEDS  
 IN THE FOLLOWING GEAR POSITIONS**

TRANSMISSION IN	TRANSFER CASE AUX. RANGE IN	
	HIGH RANGE	LOW RANGE
OVERDRIVE	50	22
DIRECT	40	18
THIRD	22	10
SECOND	11	5
FIRST	7	3
REVERSE	7	3

BASED ON 2750 R.P.M. MAX. ENGINE SPEED

RA PD 16236

MAXIMUM SPEED CAUTION PLATE

**TO ENGAGE MARINE PROPELLER - DEPRESS  
 CLUTCH & FOOT BRAKE - THEN PULL UP CONTROL**

USE ALL WHEELS, ENTERING & LEAVING WATER  
 DISENGAGE WHEELS FOR MAX. WATER PERFORMANCE

APPROX. LOADED SMOOTH WATER PERFORMANCE

2ND GEAR, FULL THROTTLE - 8.4 M.P.H. - 0.8 M. P. GAL.  
 3RD GEAR, FULL THROTTLE - 5.4 M.P.H. - 1.4 M. P. GAL.  
 3RD GEAR, 1/4 THROTTLE - 4.2 M.P.H. - 2.3 M. P. GAL.

MAX. REVERSE, FULL THROTTLE, ALL WHEELS, HI-RANGE

**CAUTION-DISENGAGE PROPELLER WHEN OUT  
 OF WATER** EXCEPT IF PUMPING BILGE - THEN ONLY  
 WITH TRANSMISSION IN SECOND GEAR

RA PD 16237

WATER PROPELLER INSTRUCTION PLATE

**Figure 6—Caution and Instruction Plates**

TRUCK, AMPHIBIAN, 2 1/2-TON, 6 x 6

<p><b>WINCHING CAUTIONS</b></p> <p>WHEN WINCHING THIS VEHICLE ALWAYS ASSIST WINCH WITH WHEELS IN LOWEST GEAR AS CABLE COMES TIGHT.</p> <p>WHEN POSSIBLE INCREASE PULLING POWER BY DOUBLING CABLE WITH SNATCH BLOCKS.</p> <p>ALWAYS KEEP CABLE WOUND TIGHTLY AND EVENLY. KEEP CABLE WELL PROTECTED WITH GREASE &amp; WINCH COVER.</p> <p>SHEAR PIN AND SPARES ARE BELOW REAR DECK NEAR WINCH.</p>	<p><b>ENGAGE FRONT AXLE</b> FOR ALL OFF THE ROAD &amp; WATER OPERATIONS, ALSO STEEP GRADES, HEAVY PULLING, SNOW &amp; ICE.</p> <p><b>DISENGAGE FRONT AXLE</b> FOR ALL FAVORABLE LAND OPERATIONS</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 25%;">WINCH</th> <th style="width: 25%;">TRANSMISSION</th> <th colspan="2" style="width: 50%;">TRANSFER CASE</th> </tr> <tr> <td style="text-align: center;">                 WIND LOOSE CABLE                  (H)                  N                  L HEAVY PULLING                  N                  (R) UNWIND CABLE             </td> <td style="text-align: center;">                 (2) (5) (R)  (N)   (3) (4) (1)             </td> <td style="text-align: center;">                 AUX. RANGE                  ● LOW                  ○ N                  ● HIGH             </td> <td style="text-align: center;">                 FRONT AXLE                  ● IN                  ○ OUT             </td> </tr> </table>	WINCH	TRANSMISSION	TRANSFER CASE		WIND LOOSE CABLE (H) N L HEAVY PULLING N (R) UNWIND CABLE	(2) (5) (R)             (N)       (3) (4) (1)	AUX. RANGE ● LOW ○ N ● HIGH	FRONT AXLE ● IN ○ OUT
WINCH	TRANSMISSION	TRANSFER CASE							
WIND LOOSE CABLE (H) N L HEAVY PULLING N (R) UNWIND CABLE	(2) (5) (R)             (N)       (3) (4) (1)	AUX. RANGE ● LOW ○ N ● HIGH	FRONT AXLE ● IN ○ OUT						

RA PD 16239

WINCH, TRANSMISSION AND TRANSFER CASE INSTRUCTION PLATE

<p><b>BILGE PUMP MANIFOLD VALVES</b> PULL UP TO OPEN</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 12.5%;">LEFT REAR</th> <th style="width: 12.5%;">CENTER</th> <th style="width: 12.5%;">MANIFOLD DRAIN</th> <th style="width: 12.5%;">FRONT</th> <th style="width: 12.5%;">RIGHT REAR</th> </tr> </table> <p>TO PUMP-OPEN ONLY ONE VALVE AT A TIME NORMALLY CENTER COMPARTMENT</p> <p><b>COLD WEATHER CAUTION</b> OPEN HOT AIR DISCHARGE TO BILGE, PUMP EACH LINE DRY, THEN OPEN ALL FIVE VALVES. BE SURE THAT MANIFOLD DRAIN, ALSO PERMANENT DRAIN HOLE IN CENTRIFUGAL PUMP ARE NOT CLOGGED</p> <p><b>TO DRAIN ENGINE COOLING SYSTEM</b> REMOVE RADIATOR CAP AND OPEN THE FOLLOWING THREE PETCOCKS: ONE ON LEFT REAR SIDE OF ENGINE ONE ON FRONT OF RADIATOR CORE ONE ON BOTTOM OF SURGE TANK</p>	LEFT REAR	CENTER	MANIFOLD DRAIN	FRONT	RIGHT REAR	<p><b>TIRE PRESSURES</b></p> <p>REDUCE PRESSURE TO CROSS SOFT GROUND OR SAND INCREASE PRESSURE FOR HARD GROUND OPERATION ALWAYS KEEP ALL TIRES AT EQUAL PRESSURE BEFORE WATER ENTRY SET TIRES FOR ESTIMATED CONDITIONS AT NEXT LANDING-IF UNCERTAIN, REDUCE TO 12#</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="4">RECOMMENDED PRESSURES FOR 10 PLY 11.00-18 DESERT TIRE</th> </tr> <tr> <th>TYPE OF OPERATION</th> <th>TIRE PRESS.</th> <th>MAX. SAFE LAND SPEED</th> <th>MAX. SAFE DISTANCE</th> </tr> <tr> <td>HARD SURFACES ONLY</td> <td>40#</td> <td>50 M.P.H.</td> <td>UNLIMITED</td> </tr> <tr> <td>AMPHIBIOUS-FAVORABLE LANDING SITE</td> <td>30#</td> <td>40 M.P.H.</td> <td>30 MILES</td> </tr> <tr> <td>AMPHIBIOUS-UNFAVORABLE LANDING SITE</td> <td>22#</td> <td>30 M.P.H.</td> <td>10 MILES</td> </tr> <tr> <td>SOFT SAND OR UNCERTAIN LANDING SITE</td> <td>12#</td> <td colspan="2">INFLATE ON REACHING HARD GROUND</td> </tr> </table> <p><b>TO ENGAGE TIRE PUMP</b></p> <p>DEPRESS CLUTCH, SHIFT TRANSFER CASE TO NEUTRAL, THEN PULL UP CONTROL &amp; RELEASE CLUTCH RUN ENGINE HALF SPEED ONLY FOR MAXIMUM PUMP OUTPUT <b>CAUTION</b>-DRAIN AIR TANK AFTER PUMPING AND IN COLD WEATHER</p>	RECOMMENDED PRESSURES FOR 10 PLY 11.00-18 DESERT TIRE				TYPE OF OPERATION	TIRE PRESS.	MAX. SAFE LAND SPEED	MAX. SAFE DISTANCE	HARD SURFACES ONLY	40#	50 M.P.H.	UNLIMITED	AMPHIBIOUS-FAVORABLE LANDING SITE	30#	40 M.P.H.	30 MILES	AMPHIBIOUS-UNFAVORABLE LANDING SITE	22#	30 M.P.H.	10 MILES	SOFT SAND OR UNCERTAIN LANDING SITE	12#	INFLATE ON REACHING HARD GROUND	
LEFT REAR	CENTER	MANIFOLD DRAIN	FRONT	RIGHT REAR																										
RECOMMENDED PRESSURES FOR 10 PLY 11.00-18 DESERT TIRE																														
TYPE OF OPERATION	TIRE PRESS.	MAX. SAFE LAND SPEED	MAX. SAFE DISTANCE																											
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AMPHIBIOUS-UNFAVORABLE LANDING SITE	22#	30 M.P.H.	10 MILES																											
SOFT SAND OR UNCERTAIN LANDING SITE	12#	INFLATE ON REACHING HARD GROUND																												

RA PD 16238

BILGE PUMP AND TIRE PRESSURE INSTRUCTION PLATE

## CONTROLS AND OPERATION

### 9. TROUBLE-SHOOTING

a. Trouble-shooting tables included in other sections of this manual should be thoroughly studied by driver and crew. These tables will enable the crew to recognize even gradual changes in the mechanical condition of various units, and will thus encourage corrective service before failure. Knowledge of various trouble symptoms, causes, and remedies will enable driver and crew to apply emergency measures when operating under critical and adverse conditions.

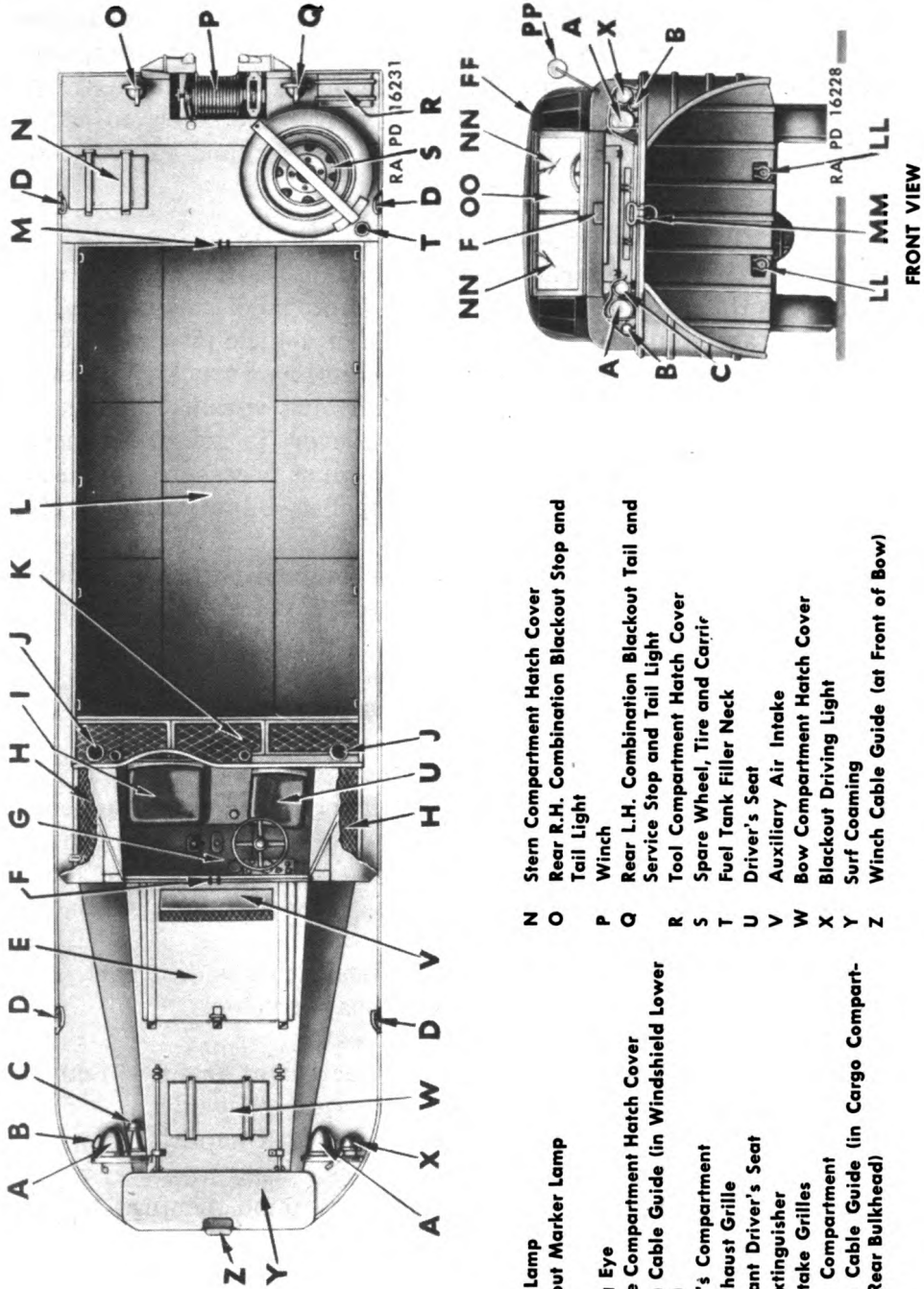
### 10. VEHICLE NOMENCLATURE AND TERMS

a. There are many parts of an amphibious truck which are different than those generally encountered on a "land" truck. In addition, terms are employed in the operation of vehicle in water which are not generally used when operating vehicle as a truck. Wherever possible, use of marine terms when describing various component parts of vehicle have been avoided. However, in some instances, nomenclature generally applied to a boat must necessarily be used, particularly when describing water propeller, bilges, rudder, etc. Reference should be made to Fig. 8.

c. **Definition of Terms.** Following table defines various operating terms and nomenclature used in describing vehicle and its operation throughout this manual.

Name or Term	Definition
Aft . . . . .	At, toward, or near stern or rear of vehicle.
Answer the helm . . . . .	Respond to the steering apparatus.
Anchor . . . . .	An instrument, generally equipped with two hooks or flukes, which is used to anchor or hold vehicle in one place in water.
Ballast . . . . .	Heavy material generally placed in hold of boat to improve stability.
Beam . . . . .	The extreme width of boat at its widest part.
Bow . . . . .	The forward part of a boat or vehicle.
Bilge . . . . .	The bottom of hull or boat.
Breast line . . . . .	A line running directly across at front or rear as used when towing or mooring alongside.
Bulkhead . . . . .	A partition or wall separating compartments.
Chocks . . . . .	A guide for ropes or cables.
Coaming . . . . .	A raised section, generally around openings, to prevent entry of water.
Dock . . . . .	A landing place for boats.
Draft . . . . .	The distance from the surface of the water to the deepest part of boat, or vehicle, when floating.
Fairlead . . . . .	A ring serving as a guide for rope or cable.

TRUCK, AMPHIBIAN, 2½-TON, 6 x 6



- |   |  |   |   |
|---|--|---|---|
| A | Head Lamp  | N | Stern Compartment Hatch Cover                                       |
| B | Blackout Marker Lamp                                   | O | Rear R.H. Combination Blackout Stop and Tail Light                  |
| C | Horn   | P | Winch   |
| D | Lifting Eye  | Q | Rear L.H. Combination Blackout Tail and Service Stop and Tail Light |
| E | Engine Compartment Hatch Cover                         | R | Tool Compartment Hatch Cover  |
| F | Winch Cable Guide (in Windshield Lower Panel)          | S | Spare Wheel, Tire and Carrier                                       |
| G | Driver's Compartment                                   | T | Fuel Tank Filler Neck   |
| H | Air Exhaust Grille                                     | U | Driver's Seat   |
| I | Assistant Driver's Seat                                | V | Auxiliary Air Intake  |
| J | Fire Extinguisher                                      | W | Bow Compartment Hatch Cover   |
| K | Air Intake Grilles                                     | X | Blackout Driving Light  |
| L | Cargo Compartment                                      | Y | Surf Coaming  |
| M | Winch Cable Guide (in Cargo Compartment Rear Bulkhead) | Z | Winch Cable Guide (at Front of Bow)                                 |



CONTROLS AND OPERATION

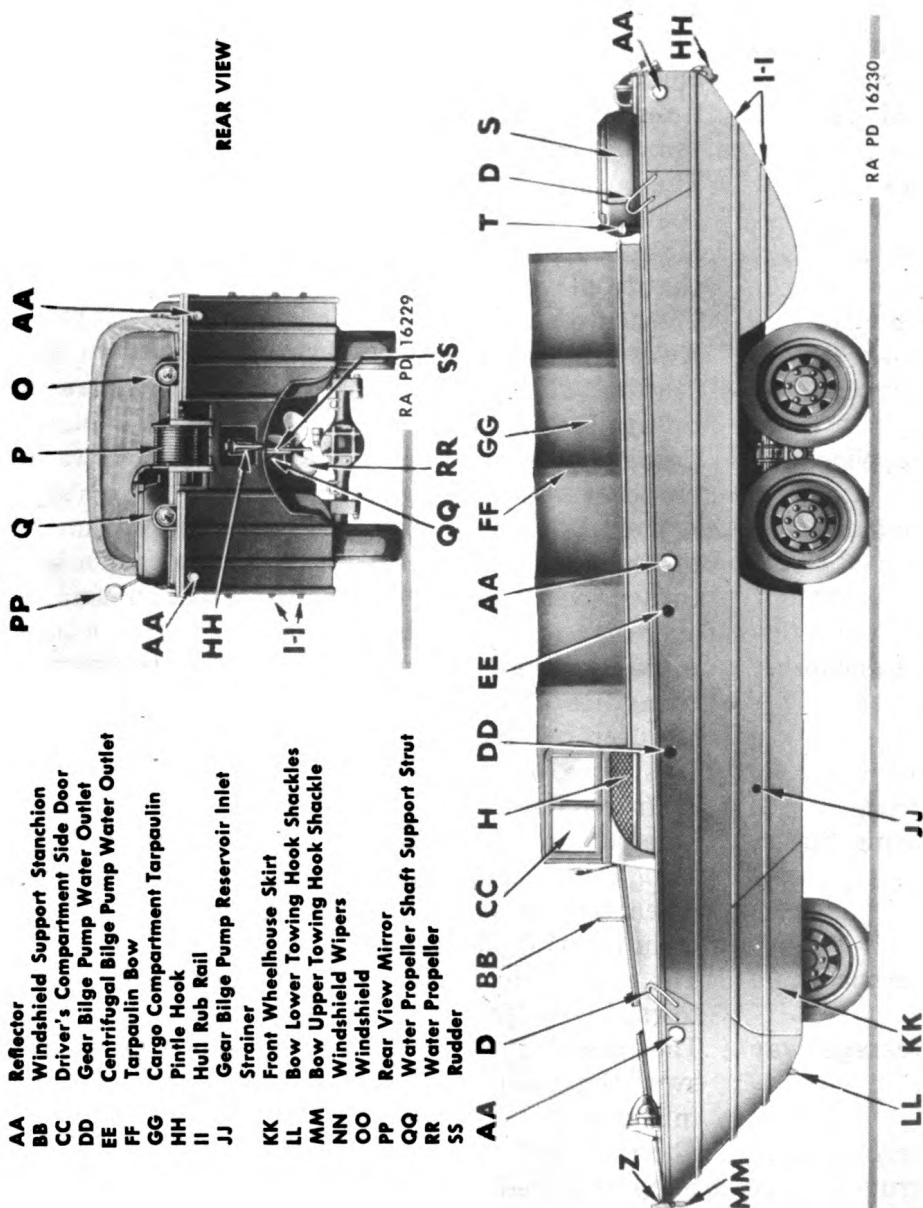


Figure 8—Location of Various Parts on Vehicle

**TRUCK, AMPHIBIAN, 2 1/2-TON, 6 x 6**

Name or Term	Definition
Fenders . . . . .	A cushion to protect side of vehicle when coming alongside of another vehicle, ship, or dock.
Hatch . . . . .	A cover of an opening in the deck, generally hinged and latched.
Helm . . . . .	The apparatus by which a ship is steered, the rudder and steering wheel.
Hold . . . . .	Interior of vehicle hull below floor or deck—space for cargo—below decks.
Hull . . . . .	The body of vehicle or that part which forms the boat.
Lee . . . . .	Means opposed to weather or the side opposite to that from which the wind blows, the sheltered side.
Moor . . . . .	To secure a vessel or vehicle.
Off-shore . . . . .	Away from the shore.
Port . . . . .	The left side of ship looking from stern (rear) toward bow (front).
Propeller tunnel .	Concave opening at rear of vehicle in which water propeller and rudder are mounted.
Rudder . . . . .	A piece hinged vertically near vehicle's stern. Interconnected with steering gear so that when it is turned, vehicle turns in same direction (water operation only).
Sea anchor . . . . .	A bulky object let down into water to form a "drag" to deter movement in water. Used when too deep to anchor in normal manner.
Sheer . . . . .	To swerve, or turn.
Secure . . . . .	To fasten down.
Spring line . . . . .	Line running diagonally from front or rear of one vehicle to opposite end of another, generally used when towing another vehicle alongside in water, or in mooring alongside vessel or dock.
Starboard . . . . .	The right side of ship looking from stern (rear) toward bow (front).
Steerage way . . .	The rate of motion sufficient to make a vessel answer the helm, or permit the steering of vehicle in water.
Stern . . . . .	The rear part of a boat or vehicle.
Strut . . . . .	Support—used as describing "V" type support which holds water propeller in alignment.
Stuffing box . . .	Device to prevent leakage at a shaft—such as water propeller shaft or rudder post.
Transfer case, water propeller	An auxiliary gear case or power take-off mounted between transmission and water propeller shafting

## CONTROLS AND OPERATION

Name or Term	Definition
	to permit engagement and disengagement of water propeller.
Wake . . . . .	The track left by a vessel in the water.
Water propeller .	Propeller (sometimes referred to as a "wheel" or "screw"), located at rear under hull, is driven through shafts by transmission to propel vehicle through water.
Wheel . . . . .	Used as describing a water propeller, or the steering wheel of a boat.

### 11. OIL, GAS, AND WATER SUPPLY

#### a. Crankcase Oil

(1) Crankcase oil filler neck (Fig. 9), mounted on right-hand side of engine, is accessible after engine compartment hatch is raised. Lubricant capacity of crankcase, type of lubricant recommended, and filling, draining, and flushing intervals are outlined in Section VI, "Lubrication."

(2) Oil filler dip stick (Fig. 9), mounted on right-hand side of engine, is also accessible after engine compartment hatch is raised. Lower portion of dip stick is graduated showing relative oil level of crankcase. Dip stick should be pulled out, lower portion wiped off with a clean cloth, reinserted to its limit, then pulled out again for correct reading. Oil level of crankcase will be indicated on graduated portion of gauge or dip stick. Crankcase oil should be kept up to the "full" mark.

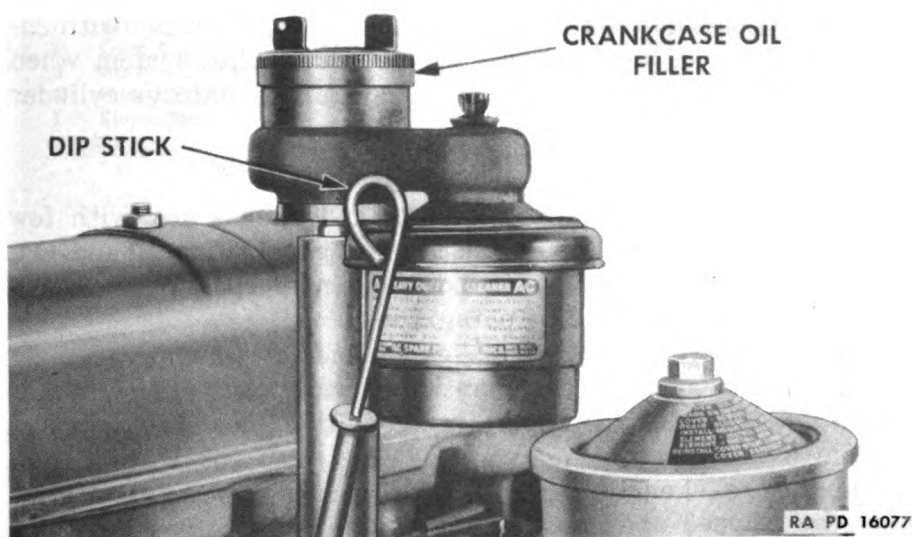


Figure 9—Crankcase Oil Filler and Dip Stick

**TRUCK, AMPHIBIAN, 2½-TON, 6 x 6****b. Fuel Supply**

(1) **Octane rating.** For best performance, gasoline with an octane rating of 70 or above should be used. Instruction plate is placed on engine valve cover. Fuel with an octane rating with less than that recommended necessitates the readjustment of ignition timing and, as a general rule, engine performance will be affected.

(2) Fuel tank filler neck is located at rear of vehicle on left-hand side. **CAUTION:** When replenishing fuel tank, same precaution should be taken as when filling fuel tank on a conventional truck. Supply filler hose should be properly grounded to prevent static sparks and care should be taken to prevent entrance of dirt or water into fuel tank.

(3) **Important:** If any fuel has been spilled into compartments of hull, these compartments must be thoroughly cleaned and all fumes evacuated before attempting to start engine. As a matter of precaution, engine compartment hatch should be raised and compartment ventilated before and after engine operation.

**c. Cooling System Supply**

(1) The basis of coolant for engine cooling system is fresh, clean water to which should be added inhibitors (rust preventives) and anti-freeze solutions (at temperature below 32°F.). **Do not use salt water in cooling system except in extreme emergency** — then drain and flush when fresh water is available.

(2) Radiator filler cap is accessible after engine compartment hatch has been raised. This cap is conventional notch type and care should be taken when removing it if engine is hot.

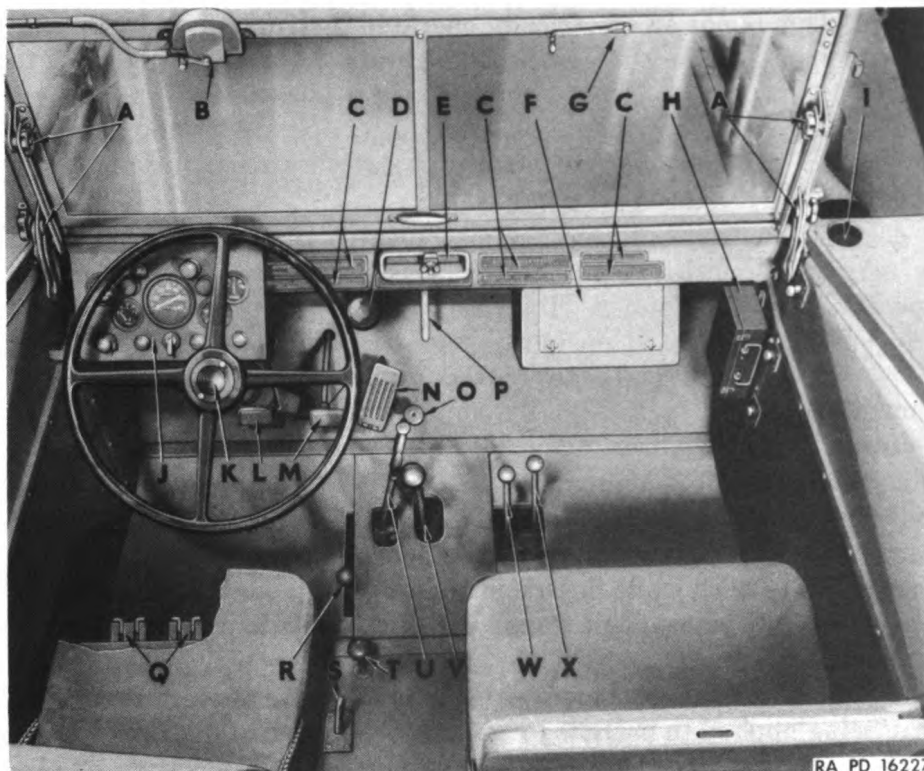
(3) If engine overheats from lack of water, do not add cold water immediately. Radiator should only be filled after boiling has ceased and engine cooled down, then add water slowly, preferably with engine running. Cold water should not be poured into system when engine is hot as such change in temperature may damage cylinder head and block.

**12. INSTRUMENTS, SWITCHES, AND GAUGES**

a. Operating instruments, switches, and gauges are, with few exceptions as noted, mounted on instrument panel (Figs. 10 and 11), located directly in front of driver. Location and purpose of these controls are outlined in succeeding paragraphs.

b. **Temperature Gauge.** This gauge indicates temperature of water in cooling system (not quantity of water in system). Water temperature depends upon operating conditions, load, etc. Normal operating temperature range should be between 160°F. to 185°F. If temperature should reach 212°F. (generally boiling), engine should be stopped and cause of overheating determined and cor-

### CONTROLS AND OPERATION



**Figure 10—Driver's Compartment**

- |   |  |
|---|--|
| <b>A</b> Windshield Regulators          | <b>M</b> Brake Pedal                     |
| <b>B</b> Left Hand Windshield Wiper     | <b>N</b> Accelerator Pedal               |
| <b>C</b> Caution and Instruction Plates | <b>O</b> Starter Button                  |
| <b>D</b> Flash Light                    | <b>P</b> Air Scoop Regulator             |
| <b>E</b> Winch Cable Guide              | <b>Q</b> Bilge Pump Valve Control Levers |
| <b>F</b> Map Compartment                | <b>R</b> Winch Control Lever             |
| <b>G</b> Right Hand Windshield Wiper    | <b>S</b> Tire Pump Control Lever         |
| <b>H</b> First Aid Kit                  | <b>T</b> Marine Propeller Control Lever  |
| <b>I</b> Front Clamp for Gun Mount      | <b>U</b> Hand Brake Lever                |
| <b>J</b> Instrument Panel               | <b>V</b> Gear Shift Lever                |
| <b>K</b> Horn Button                    | <b>W</b> Transfer Case Control Lever     |
| <b>L</b> Clutch Pedal                   | <b>X</b> Front Axle Shift Lever          |

**TRUCK, AMPHIBIAN, 2½-TON, 6 x 6**

rected. This is not an electrically operated instrument and will indicate temperature of the cooling system at all times from 100°F. to 220°F.

c. **Fuel Gauge.** Fuel gauge, electrically operated, indicates level of gasoline in fuel tank and is only operative when ignition switch is turned on.

d. **Speedometer.** Speedometer indicates road speed of vehicle in miles per hour. The instrument records total number of miles operated and "trip" miles. "Trip" indicator can be cleared by turning knurled button located on under side of speedometer head. Do not allow vehicle road speed to exceed maximum permissible speeds shown on plate, Fig. 7. This instrument will not indicate miles per hour operation in water, nor total miles operated in water.

e. **Oil Pressure Gauge.** Oil pressure gauge on instrument panel indicates pressure of engine lubrication oil. Pressure reading may vary according to operating conditions. However, if oil pressure should fall to zero while engine is running, stop engine immediately and determine cause. **This gauge does not indicate amount of oil in crankcase.**

f. **Ammeter** on instrument panel indicates rate of electric current flow being applied to battery by generator, or rate of discharge from battery. At low engine speeds, needle may show a negative or discharge reading.

g. **Ignition Switch.** Ignition switch is lever type and handle must be turned "on" before engine can be started. Do not allow switch to remain turned "on" with engine not running except when making necessary tests.

h. **Choke Button.** Choke button (marked "choke") should only be pulled out far enough to allow engine to run smoothly during warm-up period and should be allowed to return to "open" position as soon as possible after engine is started. Return spring on choke linkage returns choke valve to open position when control button is released.

i. **Throttle Button.** Throttle button (marked "throttle") on instrument panel may be used for starting engine or to set throttle at a sustained speed. Button can be pulled out in varying degrees, accelerating engine from idling speed to maximum governed speed.

j. **Main Light Switch.** Main light switch (Fig. 12), located on instrument panel, is a four-position push-pull type switch which controls both service and blackout head lamps, service and blackout stop and tail lamps. Switch is equipped with a circuit breaker type fuse which automatically opens light circuit when a short occurs and automatically closes circuit when thermostatic element in circuit breaker cools off. Switch operates in the following manner:

## CONTROLS AND OPERATION

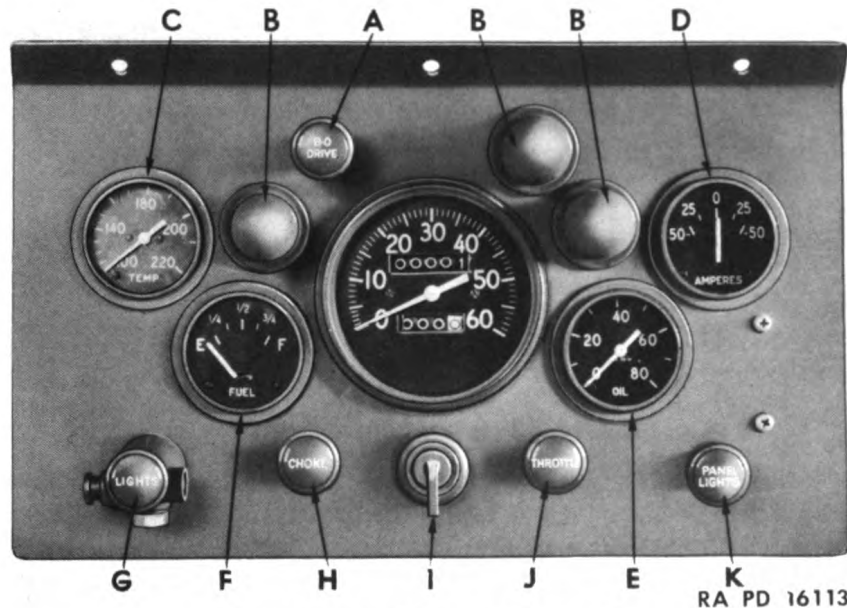


Figure 11—Instrument Panel

A	Blackout Driving Light Switch	G	Main Light Switch
B	Panel Lights	H	Choke Control Button
C	Temperature Gauge	I	Ignition Switch
D	Ammeter	J	Hand Throttle Control Button
E	Oil Gauge	K	Panel Light Switch
F	Fuel Gauge		

(1) **Off position.** When switch control button is pushed completely in, all lights, both service and blackout, are turned off. Blackout and service stop lights cannot be operated with switch in this position.

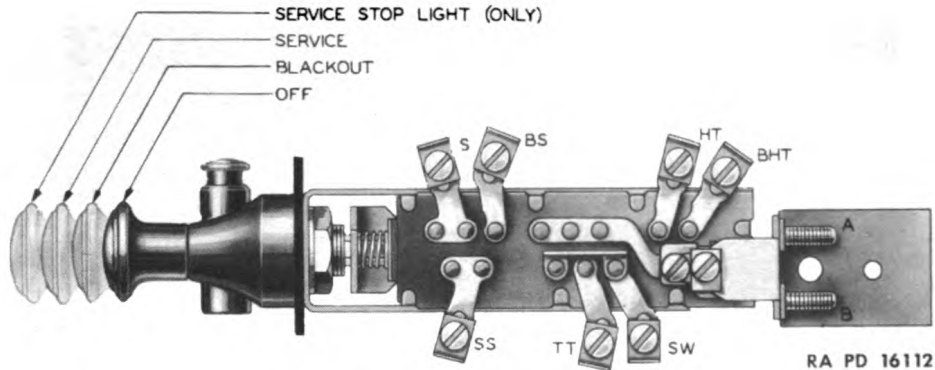
(2) **Blackout position.** When switch button is pulled to **first stage**, blackout head lamps and blackout stop and tail lamps are energized. Button is locked in place with automatic plunger type lock when pulled to this position.

(3) **Service position.** Switch locking button at left of switch body must be depressed before switch button can be pulled to **second stage** or service position. When switch is in service position, service head lamps, service stop and tail lamps, and instrument panel lights are energized.

(4) **Service stop light position.** When switch button is pulled **completely out**, service stop lights may be operated for daylight service.

**k. Blackout Driving Light Switch.** Blackout driving light switch, located on instrument panel (marked "B.O. Drive"), energizes blackout driving light which is installed adjacent to left-hand service head lamp. This driving light, which is a shielded type, is used in addition to the standard blackout head lamps when additional illu-

**TRUCK, AMPHIBIAN, 2 1/2-TON, 6 x 6**



**Figure 12—Main Light Switch**

mination is necessary during blackout conditions. Blackout driving light switch will not energize lamp until main light switch is in first stage or blackout position as previously explained.

**l. Panel Light Switch.** Panel light switch, located on instrument panel (marked "Panel") is a push-pull type and energizes instrument panel lights after main light switch is placed in second or service position as previously explained.

**m. -Starter Control Lever.** Engine starter is operated by stepping down on pedal (accessible to driver's right foot). Initial movement of pedal engages starter pinion with flywheel teeth. Further movement completes electrical circuit between battery and starter, causing starter to rotate, thus cranking engine. When engine starts, foot should be removed from pedal immediately. **CAUTION:** Do not step on pedal when engine is running.

**n. Windshield Wiper Control.** Vacuum windshield wiper is mounted on left side of windshield. Control button is provided for operation of this wiper as shown in Fig. 10. Button is pulled out to turn windshield wiper on, and pushed in to turn wiper off. A hand operated wiper is mounted on right-hand section of windshield.

**13. VEHICLE OPERATING CONTROLS**

**a.** Vehicle operating controls are located in driver's compartment (Fig. 10). Location and purpose of these controls are described in succeeding paragraphs. Actual operation of each control under various conditions is explained in respective operation paragraphs.

**b. Carburetor Control**

(1) Accelerator pedal (accessible to driver's right foot) is used to accelerate or decelerate engine, depending upon degree pedal is depressed or released. When pedal is completely released, engine will operate at idling speed. Acceleration from idling to governed speed is obtained by degree pedal is pressed down. Corresponding degree of deceleration is obtained by releasing pedal.



## CONTROLS AND OPERATION

(2) Hand primer, located on right-hand side of engine just above fuel pump, is used to prime carbureter when vehicle has been standing for long periods of time or has been drained of fuel.

**c. Clutch Control.** Clutch pedal, accessible to driver's left foot, engages and disengages clutch. Depressing clutch pedal disengages engine from transmission so that transmission gears may be shifted.

### **d. Transmission Control**

(1) Transmission shift lever, accessible to driver's right hand, is used to select various gear ratios or speeds provided in transmission. Transmission provides five speeds forward and one reverse. All transmission speeds are used in conjunction with transfer case when wheels are operated. In addition to transmitting speed and power to driving wheels and water propeller, transmission also transmits power to winch and air pump through interconnected power take-off.

**e. Transfer Case Control.** Transfer case shift lever is used to shift transfer case into high, neutral, or low speeds as required to operate wheels. Arrangement of this lever is such that low range cannot be used until front axle is in engaged position. Transfer case is not used to operate water propeller.

**f. Front Axle Engagement.** Front axle declutching lever is used to engage and disengage front axle drive. This lever has only two positions, namely "in" and "out." Front axle must be engaged (lever in "in" position) before transfer case can be shifted into "low" position. After front axle has been engaged, transfer case may be shifted into either high or low range.

### **g. Steering Control**

(1) **Front wheels.** Front wheels are turned or steered by means of conventional steering gear assembly which is interconnected to front axle steering knuckles and tie rod with drag link.

(2) **Rudder.** Vehicle is steered during water operation by means of a rudder mounted at stern just to the rear of water propeller. Movement of steering wheel is transmitted through steering column to cables interconnected with rudder.

**h. Service Brake Control.** Service brake pedal, accessible to and operated by driver's right foot, controls application and release of vacuum hydraulic operated brake shoes at each wheel. Driver applies pressure to pedal to actuate brakes as desired. Release of brakes is correspondingly as rapid as foot pressure on pedal is released.

### **i. Hand Brake Control**

(1) Manually operated hand brake lever, located to right of driver, is used to control application of brake band assembly mounted on transfer case. This brake system operates directly on transfer case output shaft, transmitting braking effort to wheels through

**TRUCK, AMPHIBIAN, 2½-TON, 6 x 6**

propeller shafts. Hand brake should not be used to brake vehicle during normal road operation. Primary purpose of this brake is to hold vehicle in parked position or to assist in bringing it to an emergency stop. When lever is pulled back, spring loaded latch will lock the lever in applied position.

**j. Winch Controls.** Power take-off shifting lever is used when necessary to operate winch. There are three operating positions, "low," "reverse," and "high," with neutral positions between. Refer to Para. 24 for operation of winch.

**k. Tire Pump Control.** Air compressor is driven by chain from power take-off auxiliary drive shaft. Pump is placed in engagement by means of a shift lever, which has two operating positions, "in" and "out." Clutch must be disengaged before tire pump shift lever is placed into "in" position.

**l. Water Propeller Control**

(1) Water propeller shift lever is used to engage or disengage gears in an auxiliary transfer case connected to rear of main transmission. Water propeller is engaged when lever is pulled up and disengaged when lever is pushed down. Clutch must be disengaged before water propeller lever is placed into engaged or disengaged position.

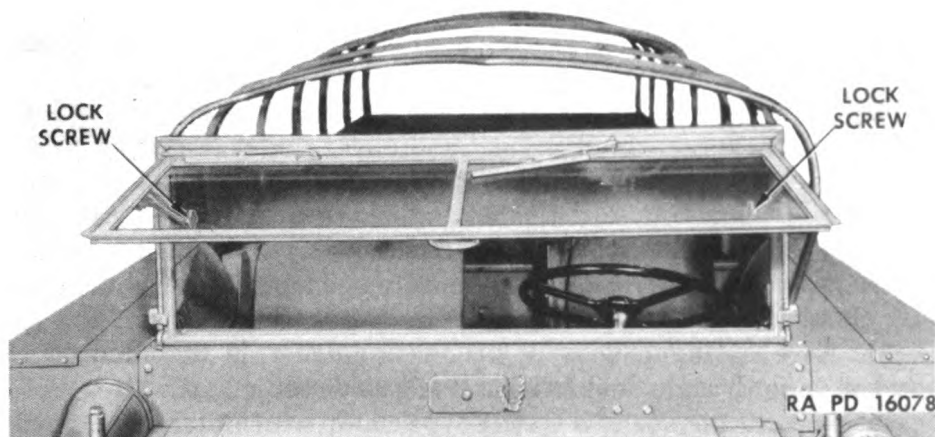
(2) Speed of water propeller is determined by selection of transmission gears. For normal operation, transmission should be placed directly into second speed for forward operation or into reverse for reversing operation. Water propeller should be engaged only when vehicle is operating in water. **Use of propeller on land, except for bilge pumping or brief testing, should always be avoided.**

**m. Bilge Pump Control**

(1) Bilge pumping system comprises two mechanically operated bilge pumps, a system of piping to various compartments, and manifold valve arrangement which permits independent pumping of various compartments by one pump.

(2) Gear type pump, located under driver's compartment, is driven with belt by water propeller drive shaft and operates when water propeller operates. This pump provides positive suction from the front, center, left rear, or right rear compartments as selected at the control valves.

(3) Four valve handles are provided to permit pumping of the compartments serviced by this bilge pump. The compartments can only be pumped out one at a time depending upon the selection at control valves. For normal operation when leaks are not apparent in other compartments, the middle control valve should be opened, as this compartment is most apt to require the use of bilge pump.

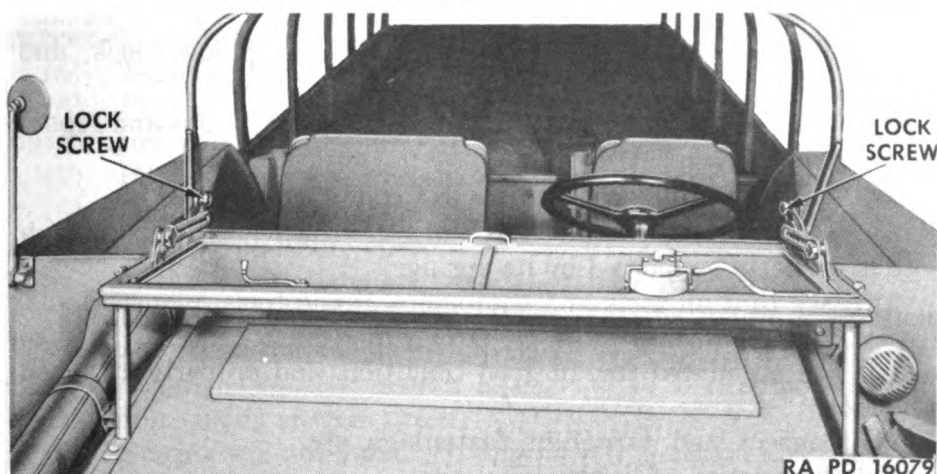
**CONTROLS AND OPERATION****Figure 13—Windshield in Tilted Position**

(4) A centrifugal emergency bilge pump is located below the cargo floor boards and is operated by chain drive from the water propeller drive shaft. This pump services the main (middle) section of the bilge only and as a general rule will not operate until the water is about 5 inches deep in this compartment.

(5) In addition to mechanically operated bilge pumps, a hand operated bilge pump is provided. This pump is stowed on right-hand front deck of vehicle.

**n. Miscellaneous Controls**

(1) **Windshield positioning.** Windshield can be placed in two positions, tilted or completely lowered. Fig. 13 shows windshield in tilted position. Two adjusting nuts, one on each side as shown in illustration, must be loosened before windshield can be placed in tilted position. Windshield can then be locked with nuts at desired

**Figure 14—Windshield in Lowered Position**

**TRUCK, AMPHIBIAN, 2 1/2-TON, 6 x 6**

point. Fig. 14 shows windshield in completely lowered position. Adjusting nuts on both sides, as shown, must be loosened to lower windshield to supports which are attached to forward deck.

(2) **Auxiliary air intake.** Auxiliary air intake is opened or shut by means of a lever which is located directly under center of windshield. When lever is pushed down and forward, intake is opened, permitting additional intake of air into engine compartment. This intake is used primarily when vehicle is completely covered with tarpaulin, also in extremely hot weather, generally reducing engine temperature about 10 degrees.

(3) **Fire extinguishers.** A fire extinguisher is mounted in a bracket on both right and left-hand sides to rear of each air outlet. Mounting lock consists of a spring type clamp which must be opened before extinguisher can be removed. Extinguisher is operated by turning a handle to left, then working up and down like a pump. Best results will be obtained by directing stream of liquid at base of flame.

(4) **Surf coaming.** Purpose of surf coaming at the bow of vehicle is to minimize water washing over bow, particularly in rough sea or when heavily loaded. Surf coaming can be raised and lowered by two bars which are held in open or closed position by screw locks on front deck.

(5) **Hatch controls.** All hatch covers are secured down to compartments with screw type latches. Hatches are equipped with seals and, when properly secured, will prevent water from entering into various compartments.

#### **14. PRESTARTING AND BEFORE OPERATION PREVENTIVE MAINTENANCE**

##### **a. Before Starting Engine—Vehicle Exterior**

(1) Look on ground under vehicle for evidence of oil leakage from axle housings, steering knuckle housings, pillow block, and steering gear.

(2) Inspect steering drag link and tie rod connections and report excessive looseness.

(3) Check tire inflation and inspect condition of tires.

(4) Inspect condition of brake lines at all wheels. See that each hose is properly supported by its spring.

(5) See that all tools and equipment (hand tools, pioneer tools, fire extinguishers, first aid kits, etc.) which have been assigned to vehicle are accounted for, in good condition, and properly attached to vehicle.

(6) Inspect load, tarpaulin, fastenings, etc.

(7) Test action of lights.

(8) Check windshield wiper blade and hose.

**CONTROLS AND OPERATION**

(9) Replenish fuel in tank. Do not fill tank entirely to top of filler neck.

**b. Before Starting Engine—Vehicle Interior**

(1) Inspection for possible oil leakage from transmission, power take-off, water propeller transfer case, and axle transfer case should be made if cargo condition permits access to these units.

**c. Before Starting Engine—In Engine Compartment**

(1) Remove filler cap at radiator and replenish water if low. Water level should not have changed since preceding inspection; if so, look for leaks around radiator core and connections.

(2) Inspect fan belt; see that it is in place and properly adjusted.

(3) Check engine oil level and condition of oil. If there has been any change in oil level, look for leaks in oil lines. If water or other foreign matter is found in oil, report condition.

(4) Inspect fuel lines and connections at carbureter, fuel filter, and fuel pump for leaks.

(5) Inspect condition of all exposed electrical wiring and connections. All connections should be clean and dry.

(6) Observe general condition of engine accessories, including carbureter air cleaner and cover, generator, starter, ignition shield, etc.

**15. STARTING VEHICLE ON LAND****a. Starting the Engine**

(1) Place transmission shift lever in "neutral." (All shift levers should be in neutral or "out" position.)

(2) Pull hand brake lever straight back and lock in applied position.

(3) Pull out hand throttle button about  $\frac{1}{2}$ ". This is not necessary if engine is warm.

(4) Hold choke button out about half-way if engine is cold. In extremely cold weather, choke button may be held completely out.

(5) Turn ignition switch to "on" position.

(6) Push clutch pedal down to disengage clutch and hold down until engine starts.

(7) Push starter lever down. Release lever when engine starts.

(8) Make necessary hand throttle and choke adjustments to obtain even engine idling speed.

**b. Starting Hints**

(1) **Operating starting motor.** The starting motor should not be engaged for periods longer than 10 to 15 seconds. After starter has been engaged without results, a period of 10 to 15 seconds should elapse before using starter again.

(2) **Engine will not start.** If engine will not start after reasonable cranking, do not continue to use starting motor until reason for failure is determined and corrected.

**TRUCK, AMPHIBIAN, 2½-TON, 6 x 6**

(3) **Starter fails to crank.** If starter fails to crank or cranks slowly, and battery is known to be in good condition, report starting motor failure to proper authority, then use hand cranking method.

**c. Hand Cranking.** A cranking gear is mounted on propeller shaft at rear of water propeller transfer case. Hand crank engine in following manner:

- (1) Place transmission in first speed.
- (2) Place transfer case lever in neutral position.
- (3) Engage water propeller.
- (4) Check rear of vehicle to make sure propeller is clear.
- (5) Insert flat end of cranking bar in cog of cranking gear. Standing with back to right side of vehicle, pull sharply on cranking bar and turn engine over one or two times before turning ignition switch on.
- (6) Pull hand throttle out about ½".
- (7) Hold (or block, if only driver is attending vehicle) choke button out about ½". If choke has been used during repeated efforts with starting motor, it will not be necessary to use choke when hand cranking.
- (8) Turn ignition switch on. Pull sharply on cranking bar. CAUTION: Do not push on cranking bar to start engine.
- (9) When engine starts, immediately step on clutch, disengage water propeller, then place transmission in neutral. Do not run water propeller for any length of time unless vehicle is in water.
- (10) If engine does not start in five or six crankings, reference should be made to "Trouble-Shooting" table in Section XXIV, "Engine," to determine cause of engine failure.

**d. Towing to Start.** Engine may be started by towing vehicle in following manner (engine can be started by towing with vehicle only on land, **not in water**).

- (1) Tow chain or line should be of sufficient length to permit maneuverability of both vehicles.
- (2) In **towed vehicle**, advance throttle about ½". Pull choke out part way, if not previously used.
- (3) Place transmission in fourth (fifth if traction is difficult).
- (4) Place transfer case in "high."
- (5) Front axle should not be engaged.
- (6) Turn on ignition switch.
- (7) While being towed for the first 100 feet, disengage clutch.
- (8) When towed vehicle speed reaches approximately 10 m.p.h., slowly engage clutch.
- (9) Disengage clutch immediately after engine starts.

**e. Cold Weather Starting.** Starting engine in cold weather should not prove difficult, providing various cold weather preparations have been made. Reference should be made to Section VI,

## CONTROLS AND OPERATION

"Lubrication," for proper lubricants recommended for use in cold temperatures. Precautions and routine maintenance operations itemized in Section XVII, "Cooling System," and Section XIX, "Starting Motor and Battery," should be followed.

### f. Warming Up Engine

(1) After engine has been started, engine should be permitted to go through a short "warm-up" period whenever conditions permit. This warm-up period provides the driver an opportunity to observe and check performance of engine before the vehicle is placed under way.

(2) After engine is running smoothly, listen for any unusual noises—sharp knocks, clattering, etc. Report any unusual noises immediately to proper authority.

(3) **Temperature gauge.** Cooling temperature should slowly rise until operating temperature of approximately 165°F. is reached. No prescribed time can be allotted during which temperature should reach normal as atmospheric temperature, length of time engine has been idle, etc., determine this period of "warm-up." However, if temperature rises sharply above normal up to boiling (212°F.), engine should immediately be stopped, overheating cause determined and corrected.

(4) **Oil Pressure gauge.** When engine first starts, consistency of oil may cause a sharp rise in the oil pressure reading on gauge. As engine warms up, oil pressure should recede slowly to normal. The pressure readings may fluctuate as engine speed increases or decreases. A sudden drop or erratic fluctuation of oil pressure indicates trouble. Engine should be immediately stopped, and condition investigated. **Oil pressure gauge does not indicate quantity of oil in crankcase.**

(5) **Ammeter.** Ammeter on instrument panel indicates charging activity of generating system. Ammeter may or may not show "charge" or plus (+) reading when engine is first started. As a general rule, ammeter will show charge as engine speed is increased, depending upon amount starting motor has drained battery. Ammeter should not show excessive discharge during warm-up period.

## 16. DRIVING VEHICLE ON LAND

a. General controls used in land operation are grouped in driver's compartment, and their locations and purposes have been explained previously. Succeeding paragraphs briefly outline fundamental requisites for efficient operation of vehicle on land.

b. During operation accomplish procedure outlined in Para 33.

### c. Transfer Case and Front Axle Shift Combinations

(1) Vehicle may be driven by rear axles **only**, or by front and rear axles. Front axle cannot be driven independently.

**TRUCK, AMPHIBIAN, 2 1/2 -TON, 6 x 6**

(2) **Rear axles driving only.** Transfer case may be operated in "high" ("H") only. Front axle declutching lever must be in "OUT" position. Transfer case cannot be operated in "low" ("L" on shift plate) when only rear axles are driving.

(3) **Front and rear axles driving.** Front axle declutching lever must be in "IN" position. Transfer case cannot be placed into "low" position until front axle lever is placed into "IN" position. After front axle has been engaged, transfer case can be operated in either "high" or "low" position.

(4) **Auxiliary drives.** When using transmission to operate winch or water propeller, front and rear axles may be driven at same time with transfer case levers in positions as previously explained.

**d. Shifting Transmission from Low to High Speeds**

(1) With transfer case in position for axle drive, transmission shift from first to fifth can be accomplished in successive stages as follows:

(a) Depress clutch pedal and release accelerator pedal.

(b) Place transmission shift lever from neutral into first speed position.

(c) Slowly release pressure on clutch pedal and at same time slowly depress accelerator pedal.

(d) After engagement is made, accelerate engine until road speed is increased to approximately that indicated on plate (Fig. 7). **Note:** Recommended maximum road speeds at various transmission ratios differ with transfer operated in "low" and "high".

(e) After necessary road speed has been obtained in first speed, release accelerator pedal, depress clutch pedal, and place transmission into second speed position.

(f) Release clutch pedal and accelerate to proper road speed, and repeat operations (a) through (e) for third, fourth and fifth speeds in successive stages.

(g) Fourth speed ratio is "direct" and is generally used for normal operations on average roads. Fifth speed is "over-drive" and is generally used to attain maximum "no-load" speed on good roads.

**e. Shifting Transmission from High to Low Speeds**

(1) Transmission should always be shifted into next lower speed before engine starts to labor, or vehicle speed is materially decreased. The need for "down-shifting" is generally apparent when ascending a steep grade or when more power is needed to pull on rough terrain, or in muck or sand. As a precautionary measure, the same ratio used to ascend a grade should be used when descending. "Double-clutch" procedures recommended for shift from high to lower transmission speeds are as follows:



## CONTROLS AND OPERATION

- (a) Depress clutch pedal and release accelerator pedal at same instant.
- (b) Move transmission shift lever into "neutral" ("N").
- (c) Release clutch pedal and accelerate engine momentarily to synchronize gears.
- (d) Depress clutch pedal again and move transmission shift lever into next lower speed. Do not use force on lever, "feel" it into position.
- (e) Release clutch pedal and accelerate engine to desired speed.
- (f) Transmission may be shifted successively into all next lower speeds in same manner.

### f. Transmission Reverse Shift

- (1) Vehicle must first be brought to a dead stop before transmission can be placed into reverse position in following manner:
  - (a) Push clutch pedal down to disengage clutch.
  - (b) Move shift lever as far as possible to the right, then toward front to reverse ("R") position.
  - (c) Release clutch pedal and accelerate engine to desired road speed.

### g. Front Axle Engagement

- (1) Engage front axle only in off-the-road operations, on steep grades, or during hard pulling. Front axle should not be engaged when operating on average roads under normal conditions.
- (2) Front axle can be engaged or disengaged at any vehicle speeds. It can be disengaged only when transfer case is in neutral or high range. Use of clutch is not necessary; however, this use tends to free up operation of lever. Considerable pressure may be necessary to disengage front axle declutching lever; however, this condition does not indicate any trouble.

### h. Transfer Case Shift—High to Low

- (1) This shift should be made while vehicle is still on hard ground and before difficult terrain is encountered. Front axle must be engaged before transfer case can be operated in "low" range.
- (2) Place front axle declutching lever into "IN" position.
- (3) Depress clutch pedal and move transfer case shift lever into "neutral" ("N") position.
- (4) Release clutch pedal and accelerate engine (approximately double that of vehicle speed).
- (5) Depress clutch pedal again and move transfer case shift lever forward into "low" position. Do not use excessive pressure.
- (6) Release clutch and accelerate engine to desired speed.

### i. Transfer Case Shift—Low to High

- (1) This shift may be accomplished regardless of vehicle speed.

**TRUCK, AMPHIBIAN, 2 1/2 -TON, 6 x 6**

(2) Depress clutch pedal and move shift lever into neutral ("N") position.

(3) Release clutch pedal and accelerate engine to synchronize with vehicle speed.

(4) Depress clutch pedal again, then move transfer case shift lever into high ("H") position. Accelerate engine to desired speed.

**j. Steering**

(1) Vehicle is steered in same manner as employed when driving conventional 6 x 6 truck. Rudder linkage is permanently linked to steering gear column; however, rudder action does not interfere with steering on land. Consideration must be taken of vehicle's width and turning diameters when making a turn. Refer to Para. 7 for turning diameter specifications.

**k. Operating on Grades**

(1) **Ascending grades.** Always shift into lower transmission speeds before engine begins to labor. This can be accomplished most successfully when vehicle still has sufficient momentum to permit changing gears without bringing vehicle to a stop. Front axle should be engaged when going up steep grades.

(2) **Descending grades.** Always shift into lower transmission speed. This will permit engine to act as a brake to assist in controlling vehicle speed. Do not permit the vehicle to exceed maximum road speeds in any gear when driving down grades. Excessive engine speeds developed under such conditions are harmful to engine.

(3) **CAUTION:** When shifting to a lower gear at any rate of vehicle speed, make sure that engine speed is synchronized with vehicle speed before clutch is engaged. If clutch is engaged at time engine is operating at lower than relative road speed, drive line parts may be damaged.

**1. Operating on Rough Terrain**

(1) Always engage front axle in off-the-road operation, on steep grades, and during hard pulling in sand, mud or clay.

(2) Do not attempt to "jump" vehicle out of deep sand, mud or clay. Never permit wheels to "dig." When vehicle progress stops, declutch immediately, then reverse slowly for several feet or until another start can be made. Go forward slowly again and declutch immediately before wheels start digging. It may be necessary to repeat this procedure several times to make a track, if possible, in the sand or mud. If progress cannot be made by using this procedure, winch should be used to assist vehicle out of the mud or sand before it becomes mired.

(3) Before attempting to operate in soft sand, reduce pressure of tires to approximately 15 lbs. Tires should be reinflated to recommended pressure before operation on solid ground.

**CONTROLS AND OPERATION****17. STOPPING VEHICLE ON LAND****a. Checking Vehicle Speed**

- (1) Release accelerator pedal.
- (2) Depress brake pedal slowly and evenly until vehicle is checked to desired speed.
- (3) Do not "fan" pedal, but apply even pressure. This will permit engine to assist in checking speed.

**b. Normal Vehicle Stop**

- (1) At the approach of a normal stop, release accelerator pedal, then check vehicle speed by even pressure on brake pedal.
- (2) Depress clutch pedal and move transmission shift lever into neutral ("N").
- (3) Increase pressure on brake pedal to bring vehicle to slow even stop.
- (4) Apply hand brake to park vehicle.
- (5) Place transfer case shift lever into neutral position. Place front axle declutching lever into "out" position.

**c. At the Halt**

- (1) Bring vehicle to normal stop (Para. 17b.).
- (2) Turn ignition switch off.
- (3) Turn all lights off.
- (4) Make inspections as outlined in Para. 34.

**18. STARTING—WATER OPERATION****a. Before Water Operation Preventive Maintenance**

- (1) This procedure is provided, and should be performed in addition to all items shown under "Pre-starting and Before Operation" (Para. 14).
- (2) **Exterior—vehicle on land**
  - (a) Inspect water propeller and see that it is securely mounted on shaft.
  - (b) Remove all foreign matter such as weeds, dirt, etc., from propeller and shaft.
  - (c) Check fit of water propeller rear shafting in rear "out-board" bearing. Report if excessively loose.
  - (d) Lubricate water propeller shaft rear "out-board" bearing, as specified in Section VI, "Lubrication."
  - (e) Inspect rudder and shaft. Rudder should be 3 degrees to the left with front wheels straight ahead. Report looseness of rudder on shaft.
  - (f) Look for loose or missing bolts at all points of attachment of chassis units to hull.
  - (g) Inspect all exterior hull panels for possible damage during land operation which may have resulted in penetration of panels.
  - (h) Make a careful and thorough examination of "bellows"

**TRUCK, AMPHIBIAN, 2 1/2 -TON, 6 x 6**

type seals at each end of propeller shaft housings under vehicle. See that clamp rings are securely tightened. Report the slightest evidence of damage or defective bellows. If these parts are damaged or in any way defective, do not allow vehicle to enter water until new parts are obtained and properly installed.

(1) Inspect all breather tubes on axles and pillow block. Report if damaged.

(j) Inspect all drain plugs on bottom and sides of hull. See that these plugs are securely tightened in place.

**(3) Interior—vehicle on land**

(a) Open all hatch covers and thoroughly ventilate interior of hull and bilge compartment.

(b) Inspect bilge compartments. Note and report presence of fuel or oil fumes which may be an indication of leakage from the various lines or units.

(c) Test action of bilge pumps and operation of control valves. Refer to Para. 18c. **Bilge compartment should be thoroughly pumped out and then cleaned of all leaves, paper, sand, dirt, twigs, or other foreign matter.**

(d) Check gear type bilge pump drive belt for proper tension.

(e) Inspect condition of and tension of driving chain at centrifugal type bilge pump.

(f) See that tools and equipment that have been assigned to vehicle are accounted for, in good condition, and securely attached.

(g) Check condition of leather flap valve and plunger in the hand bilge pump. Check condition of emergency buckets.

(h) Inspect hatch gaskets and seals and see that hatches are closed and securely locked.

(i) If rough operation is anticipated, cargo cover should be tightened securely on all sides and cargo secured in place.

(j) Check rudder control cable, pulleys and linkage. Report excessive play in cable.

**(4) Interior—after vehicle enters water**

(a) If conditions permit, inspect water propeller shaft, stuffing box and rudder shaft. If these show any indication of excessive leaking, gland nuts should be tightened. Do not set gland nuts extremely tight as this will cause overheating of stuffing box. A slight seepage of water through stuffing box may be considered normal.

(b) Inspect interior of hull for water leaks. Special attention should be given to hull seams, especially propeller tunnel.

**b. Starting Engine**

(1) Starting engine preparatory to entering water, embraces all instructions outlined in Paras. 15a. through f.

(2) If engine is to be started while vehicle is afloat, instructions as outlined in Para 15 should be used, with the exception of Para.

## CONTROLS AND OPERATION

15d., "Towing to Start." Engine cannot be started by towing vehicle in water.

**c. Testing Bilge Pumps.** It is a good practice to test operation of bilge pumps before entering water. This is not necessary, however, if water operation is intermittent. If time permits, make following test.

(1) Pour three or four pails full of water into each compartment. Water should be just high enough to cover suction end of bilge pipes. Middle compartment will require more. Vehicle should be placed so that the rear end is lower than front.

(2) Make certain that transfer case shift lever is in neutral position .

(3) Depress clutch pedal, place water propeller shift lever in engaged position (pull up), then place transmission directly into second forward speed.

(4) Release clutch pedal and accelerate engine to about  $\frac{1}{2}$  full throttle. Open one bilge control valve at a time until that particular compartment is dry. **Note: Only one valve should be opened at a time.** Watch bilge discharge from outlet on left side of hull near driver.

(5) After test is made, decelerate engine, depress clutch pedal, place transmission shift lever into neutral, then disengage water propeller.

(6) **CAUTION:** When operating water propeller on land, make certain that no one is near stern of vehicle as a safety precaution. Water propeller is not guarded and will inflict serious injury upon contact. Do not operate water propeller on land for any length of time.

## 19. LAUNCHING—WATER OPERATION

**a.** As a general rule, vehicle will enter water from land. This necessitates use of driving axles. Other conditions may necessitate entry of vehicle into water from ship's side which may not require use of driving axles.

### **b. Preparatory Operations**

(1) All hatches, cargo and equipment must be thoroughly secured before entering water. Auxiliary air intake should be closed.

(2) Inspect terrain at point of entry to determine transmission gear ratio required for entering water. If soft sand is present at either point of entry, or is expected at any future landing point, all tires should be deflated to approximately 15 lbs.

(3) Engine should be thoroughly warmed up, and oil, gas and water supply checked and replenished, if necessary.

(4) If steep water entry, rough sea, or heavy load is anticipated, raise surf coaming at bow of vehicle.

**TRUCK, AMPHIBIAN, 2 1/2-TON, 6 x 6****c. Entry From Land**

(1) Select, if possible, a gradual slope into water. If necessary to make entry over rough, mucky, or rocky terrain, take into consideration the vehicle's approach and departure angles and ground clearance. (Refer to Para. 7.)

(2) For normal water entry, vehicle enters with only wheels driving as follows:

(a) Place front axle declutching lever into engaged position, transmission shift lever into second speed, and transfer case shift lever into high range.

(3) Accelerate as required when going into water and continue at required speed until vehicle is afloat.

(4) Immediately after vehicle is afloat, accomplish following operations.

(a) Decelerate engine.

(b) Depress clutch pedal.

(c) Step on foot brake pedal **hard** to stop wheels from rotating.

(d) Place transmission shift lever directly into second forward speed position.

(e) Place water propeller shift lever into engaged position (pull up).

(f) Release clutch pedal and accelerate engine rapidly at the same time to desired speed.

(g) If vehicle is well out into water and there seems to be no necessity for use of driving wheels, step on clutch momentarily and place transfer case shift lever into neutral position. It is not necessary to disengage front axle, as front axle drive will be needed when landing vehicle.

(h) **Note:** Operation from (a) through (g) should be accomplished in order stated and as quickly as possible. Do not force any of the shift levers into mesh with extreme pressure but rather "feel" them into engagement.

(i) After water propeller is engaged, best operation is full throttle with transmission in second forward speed.

(5) If entering into a heavy surf, strong current, or when maximum speed is desired, water propeller may be operated, as well as the driving wheels, when vehicle enters water, as follows:

(a) Stop vehicle with brakes before attempting to make water propeller shift.

(b) Depress clutch pedal and place water propeller into engaged position, transmission into second speed, front axle declutching lever engaged position, and transfer case into high.

**d. Starting From Ship Side Or Pier**

(1) If vehicle is to be swung from a ship for entry to water, make

## CONTROLS AND OPERATION

certain that engine is warmed up and operating as vehicle is placed into water. After vehicle has been launched and mooring lines cast off, water propeller should be immediately engaged with transmission in second speed.

(2) In pulling away from ship's side or pier, push front of vehicle outward and avoid turning front away sharply. If sharp turn away from pier or ship is made, back of vehicle will tend to swerve toward pier or ship and cause possible damage. If possible when leaving the side of a vessel or pier, push vehicle well out into water before starting water propeller.

(3) Always use fenders (bumpers) at the side of vehicle when alongside of a vessel or a pier.

### 20. OPERATION IN WATER

a. **General.** No set rules can be established for operating or driving vehicle in water. Various conditions require different operation procedures. A thorough knowledge of steering in water, water propeller drive system, and bilge pump system, together with knowledge of various emergency expedients, is essential. Recommendations and instructions given in succeeding sub-paragraphs have been compiled from actual experience. These instructions should be thoroughly studied and understood. The instructions include only operation under average conditions. Reference should be made to Para. 23, "Emergency Expedients" for any out-of-the-ordinary conditions which may be encountered.

#### b. Forward Steering

(1) Rudder of vehicle by which it is steered in water is mounted near stern. This rudder is operated or turned by cables attached to conventional steering gear column. As rudder is attached near stern, normal forward steering is obtained by forcing stern the opposite way from desired forward turn. **Driver, however, turns steering wheel in a conventional automotive manner.**

(2) Water steering requires more turning of steering wheel than is generally used when operating on land. While rudder responds quickly to motion of steering wheel, the vehicle's response is not as rapid as experienced on land. It is therefore necessary to anticipate any turns when operating in water. This is particularly necessary when steering in rough water.

(3) When holding a straight course in rough water, driver must try to anticipate the action of waves by turning steering wheel ahead of time. In this way, sheering or swerving from the desired course can be minimized. If vehicle is allowed to start swerving, it will take considerable effort to bring it back to its course.

(4) Bear in mind that under extremely adverse sea conditions, reduction of speed will reduce trouble from waves. When landing be-

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fore heavy surf, steer absolutely square in front of waves and reduce speed as wave crest approaches stern.

(5) When operating at less than top speed, bear in mind that enough vehicle speed should be maintained to provide steerage way. If necessary to reduce speed of vehicle to point where rudder will not steer vehicle, occasional short spurts of engine should be made to drive enough water against rudder to provide desired steering. When approaching shore in rough water, make all speed possible between waves and also as soon as driving wheels touch bottom.

(6) When steering close to an object in water, remember that stern has a tendency to swerve toward an object when vehicle is steered away from it.

**c. Steering in Reverse**

(1) Reverse steering in water under average conditions, requires approximately same technique as used when reversing "land" vehicle. When operating in strong winds and rough water, however, reverse steering will be uncertain. The most satisfactory reverse steering can be secured by forcing stern in desired direction while still driving ahead. This starts stern of vehicle turning and as propeller is placed into reverse, this turn will generally be maintained.

(2) Always place all wheels in driving position (high range) as they will materially assist in power and steering of vehicle in reverse.

**d. Forward Driving.** Water propeller can be engaged in second speed—full throttle, third speed—full throttle, or third speed— $\frac{1}{4}$  throttle. Maximum speed on water is attained in second speed—full throttle (See Marine Propeller instruction plate—Fig. 6). When third speed is used either at full throttle or  $\frac{1}{4}$  throttle, speed on water is reduced, however, fuel mileage is increased as itemized on instruction plate, Fig. 6. Third speed— $\frac{1}{4}$  throttle is obtained in following manner:

(1) Disengage water propeller and engage rear wheels high range. Set hand throttle until speedometer registers 12 m.p.h. (rear wheels operating and turning freely in water).

(2) With hand throttle remaining in position for 12 m.p.h., rear wheel operation in water, disengage rear wheels (transfer case into neutral), then engage water propeller and operate at same throttle setting.

**e. Disengaging Or Engaging Water Propeller.** If necessary to disengage or engage water propeller while operating in water, following operations should be accomplished:

(1) Depress clutch pedal and decelerate engine.

(2) Push down on water propeller shift lever to disengage or pull up to engage and release clutch.

**f. Reversing.** It is impossible to make a quick stop with vehicle in water. Bear in mind that vehicle brakes have no effect when afloat. Reversing propeller is the only method of stopping in water. When necessary to reverse in water, water propeller and driving wheels (high range) should be reversed. Driver must foresee a stop



## CONTROLS AND OPERATION

or a condition where reversing is necessary. When such conditions are apparent, reverse vehicle in following manner:

- (1) Depress clutch pedal and decelerate engine.
- (2) Make sure that front axle declutching lever is into "IN" position, then place transfer case into "high" range.
- (3) While holding clutch pedal in depressed position, place transmission lever into reverse.
- (4) Release clutch pedal and accelerate engine to full throttle (governed speed).
- (5) After vehicle speed is checked to point of control, reduce speed as necessary to maneuver properly.

### g. Pumping Bilges

(1) As explained in Para. 13m., "Bilge Pump Control," the mechanical bilge pumping system consists of two bilge pumps operated by water propeller shafting. These pumps operate only when water propeller is in engaged position.

(2) As the pumping of various compartments in hull depends upon the position of shut-off valves, it is important that attention be given to alternate pumping of all compartments while operating in water. **Remember:** All valves must be closed except the one which controls compartment to be pumped. It is a practical plan to alternate control valves every few minutes during operation in calm water to permit clearing of bilge compartments of any water which may seep in from normal operation. Under average operating conditions, the valve controlling pumping of center compartment should be left open for longer periods of time.

(3) When operating in rough water, note where vehicle is "shipping" water and operate bilge pump control valves accordingly. Reference should be made to Para. 23, "Emergency Expedients" for pumping of bilges under emergency conditions.

## 21. LANDING FROM WATER

a. A general rule to remember when landing, is that **all driving wheels** should be operating **before** land is approached. A gradual slope from water should be selected, if possible. Also avoid, if possible, landing through mud, clay, or thick weed patches. Weeds may tend to entangle water propeller.

### b. Approaching Land

(1) Various water and wind conditions must be taken into consideration when approaching land. Under normal conditions where swift current, wind and rough water are not present, approach should be made in following manner:

(a) When approaching land, the driving wheels should be engaged a considerable distance before reaching shallow water. (This is particularly important when approaching land in rough water.) Place driving wheels into engagement by depressing clutch, placing front axle declutching lever into "in" position, and placing transfer case into desired (generally "low") range.

(b) Continue to operate full throttle with propeller and wheels until wheels are grounded. After wheels are grounded and vehicle is

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well out of water, **water propeller must** be disengaged, and transmission and transfer case shift lever placed into suitable driving positions.

**c. Approach In Swift Current.** If landing must be made in a swift current, start making approach well above point of departure. Come in toward shore at approximately a 45 degree angle. After front wheels ground, stern of vehicle will tend to swing down with the current. In extreme cases, it may be necessary to come in at a closer angle than 45 degrees.

**d. After Landing**

(1) If conditions permit after landing, bilges should be completely pumped out as explained in Para. 18c., "Testing Bilge Pumps." A large quantity of water inside vehicle adds considerably to weight and should be pumped out before operating on rough terrain. Also, when conditions permit, accomplish the operations itemized in Section V, "Preventive Maintenance and Inspection" pertaining to "after-water operation."

**22. ANCHORING, MOORING AND TOWING****a. Anchoring**

(1) Anchor, stowed in bow compartment, is used with interconnecting winch cable or other lines to hold vehicle to bottom. When anchor bottoms, flukes or points of anchor, fasten to bottom, thus holding vehicle stationary.

(2) Do not fasten anchor shackle to winch cable hook. Remove anchor shackle bolt, and fasten shackle into chain ring. Install bolt and tighten. Remember the anchor **must** be fastened securely to line or cable **before** dropping it overboard.

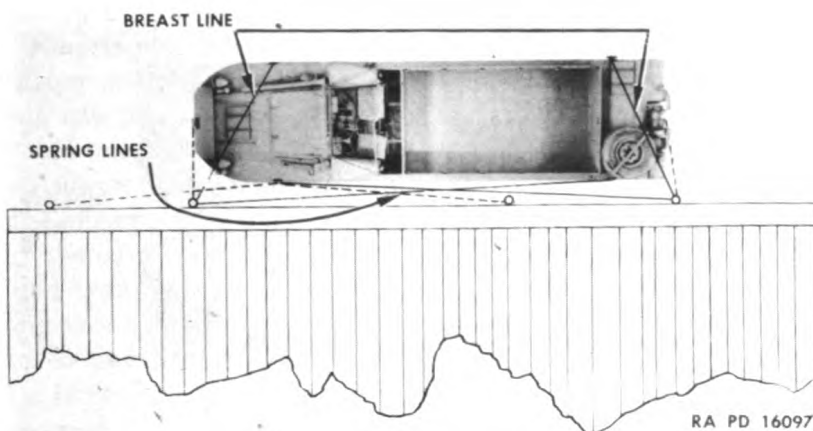
(3) As anchoring is generally necessary under emergency conditions, all available line and cable should be connected to anchor, as the longest line will provide safest anchoring.

(4) Under emergency conditions, any bulky, heavy object can be used as an anchor, such as spare tire and wheel, etc.

(5) If unable to bottom anchor in extremely deep water, additional bulky object can be let down into the water. The tarpaulin, with enough ballast in it to keep it under water, can be used. This type of "sea anchor" will reduce drifting.

**b. Mooring.** In extremely rough weather, avoid mooring alongside a dock or vessel; however, if necessary to moor, long mooring lines should be used to reduce strain. Bow or front of vehicle should head into current unless wind is stronger than current, in which case head bow into wind. Fig. 15 illustrates method of mooring vehicle to dock with the use of breast lines at front and rear, and spring lines from front and rear of vehicle to dock as shown. These lines should hold vehicle without pulling against dock. It is necessary, however, to

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**Figure 15—Method of Mooring Vehicle**

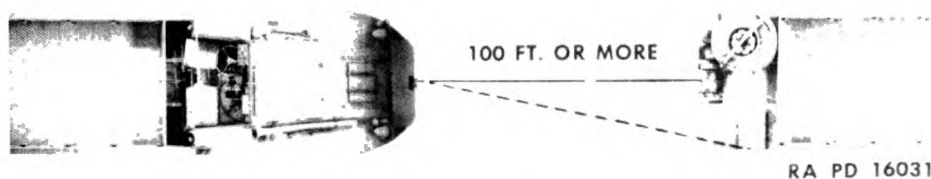
take into consideration rise and fall of tide when mooring. Line should be lengthened or shortened as necessary to meet conditions.

**c. Towing**

(1) There are two methods which are commonly used when towing in water; towed vehicle at stern and towed vehicle alongside of towing unit. **Important: Always drop tow before attempting to land. Winch towed vehicle out of water [see (4) (c)].**

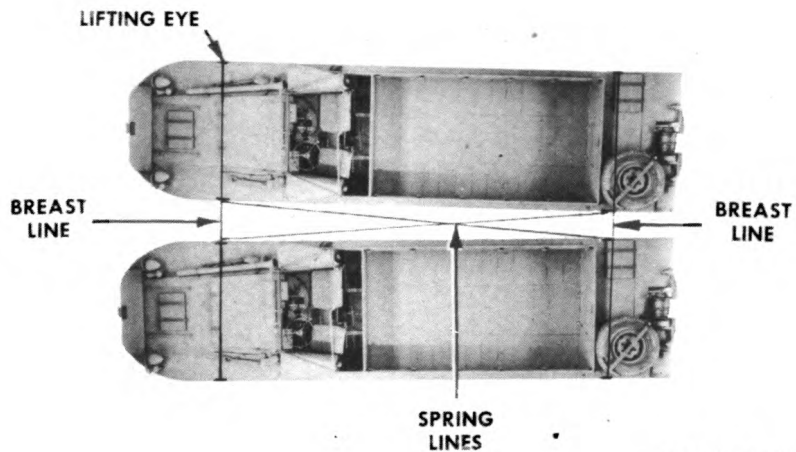
(2) **Towing Attachments.** For towing purposes in the water, each vehicle is equipped with a tow hook anchor shackle at the front (just under bow winch cable guide), pintle hook at rear (just below winch), and two lifting eyes on right and left side.

(3) **Towing vehicle at stern (Fig. 16).** Tow cable should be attached securely to rear pintle hook on towing vehicle or direct from winch, and to bow tow hook anchor shackle on towed vehicle. Tow cable should be approximately 100 feet long to permit maneuverability of both vehicles. When operating in rough water, the longest possible tow line should be used. When approaching bank, towed vehicle should not be too close to towing unit. Slack tow cable so that towing vehicle can make landing without added load, then land other vehicle with winch. Steer towed vehicle directly behind front vehicle.



**Figure 16—Method of Towing at Stern**

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**Figure 17—Method of Towing Alongside**

(4) **Towing vehicle alongside (Fig. 17).** In smooth water, when considerable maneuvering is necessary, it is advisable to tow another unit from alongside. Ample fenders (bumpers) should be used between the two units. The two units should be moored together as follows:

(a) Illustration in Fig. 17 shows use of "breast" and "spring" lines when towing or maneuvering alongside. Breast lines at front and rear should extend from outside lifting eye of one unit to the outside lifting eye of other unit. Spring lines should extend from inside, front lifting eye of one unit to the inside rear lifting eye of another.

(b) The two units should not be too close together. Distance between the two units should vary between 1½ feet to 4 feet. The greater distance to be used if any waves might be encountered. The bow ends should be approximately one foot farther apart than the sterns, so that action of water will tend to keep units safely apart.

(c) All towing lines and cables should be thoroughly wrapped with canvas or rags where they pass through cable guide, anchor shackles, and pintle hooks or where rubbing occurs. **Extreme care should be taken to prevent lines from becoming entangled in water propeller or rudder.**

### 23. EMERGENCY EXPEDIENTS

a. **General.** Conditions which require emergency measures may be encountered in water operations. These conditions, together with probable expedients, are itemized in succeeding paragraphs and should be thoroughly studied by operating crew. The crew should bear in mind, that emergency expedients should be applied as simultaneously as possible, rather than attempting to accomplish them

## CONTROLS AND OPERATION

one at a time. In emergencies, every known expedient should be accomplished quickly.

**b. Emergency Steering.** If steering cable breaks or rudder jams, preventing operation of rudder, one of three methods of emergency steering can be used.

(1) If only driver is in vehicle, stop water propeller, open stern compartment hatch, and secure rudder tiller so that rudder is in straight ahead position. After rudder is secured, place all wheels into "high" transfer case range, water propeller shaft lever in "in" position, and transmission in second speed. Operate at full throttle and steering can be obtained with front wheels. Steering with wheels will not be as responsive as with rudder.

(2) If two are in crew, center wheels in straight-ahead position and have second member of crew steer vehicle with tiller in stern compartment.

(3) If rudder is damaged and wedged at an angle, making it impossible to hold course, rudder shaft must be disconnected in stern compartment and rudder dropped through bottom of vehicle. Removal of rudder is explained in Section XXXIII, "Steering System," Para. 259. After rudder has been removed and hole plugged, vehicle can be steered with front wheels. All wheels high range and water propeller second speed.

**c. Water Propeller Fails.** If water propeller is rendered inoperative, some progress can be made by using all wheels in "high" transfer case range, and third transmission speed full throttle. Water propeller should be disengaged. Under extremely favorable conditions, speed will be approximately 2 m.p.h.

**d. Power Fails.** If engine fails and vehicle is near shore, shovels and tarpaulin bows, floor boards, etc. will make useful paddles. If impossible to paddle against off-shore wind or current, anchor vehicle until assistance arrives.

**e. Pumping Bilge**

(1) The two mechanical bilge pumps will service bilges under all normal conditions. If for any reason water propeller cannot be operated or flooding condition cannot be reduced with mechanical bilge pumps alone, use hand bilge pump and, if necessary, buckets, helmets, and any other articles suitable for bailing. To prime hand pump, hold overboard so that water will be forced up through bottom.

(2) If necessary to use mechanical bilge pumps without water propeller operating (due to damaged propeller or if serving as a stationary pontoon), disconnect water propeller shafting to rear of pump drives.

**f. Hull Penetrations**

(1) Penetrations above water line should be plugged with wooden

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plugs or rags, etc. Start plug from outside and pull in through hole.

(2) Penetrations below water line may also be plugged with wooden plugs, or rags, etc. Where possible, start plugs or rags through holes from outside of hull. Pressure of water will assist in keeping plug in place. If penetration is just below water line, shifting cargo to opposite side or end may bring hole above water line.

**g. Rough Weather**

(1) When operating in rough weather in water, action of vehicle is sometimes unpredictable. Various hints in the succeeding subparagraphs should be studied and applied when necessary as conditions arise.

(2) In strong winds and rough water, steering in reverse will be uncertain. When reversing, stern can be best controlled by giving vehicle occasional forward spurts to force the stern in the desired direction.

(3) When vehicle is completely covered with cargo tarpaulin and entrance flaps are closed, engine must receive its air through auxiliary air intake. However, in rough water, this can be opened only between waves. Cargo entrance flap should be kept open on the side away from wind. If it is necessary to go through heavy surf, all openings can be kept tight a few minutes, but should be opened as soon as possible to cool engine.

(4) When running through a heavy surf, it is particularly important that back and sides of cargo cover be absolutely tight.

(5) All cargo should be thoroughly secured before operation in rough water.

(6) In extremely rough sea from ahead, shift movable weights toward stern to help keep bow above waves, and to reduce tendency for propeller to jump out.

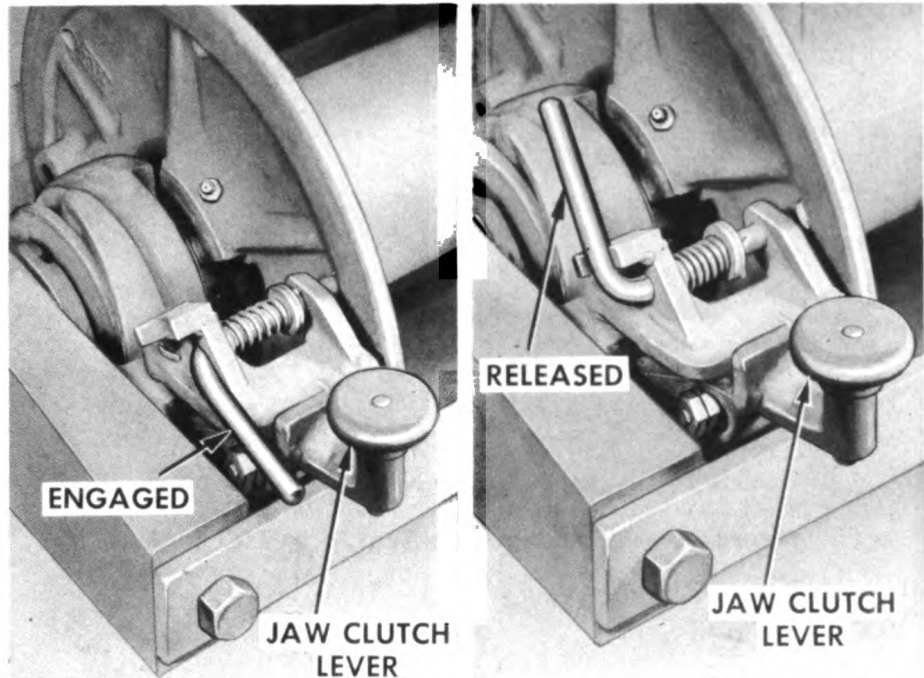
**24. WINCH OPERATION—LAND AND WATER**

a. Knowledge of winch operation, conditions under which winch may be used, and rigging methods are important when operating this vehicle in amphibious service. Winch, rear mounted, is used to assist vehicle and other units under many varied conditions. Reference should also be made to Section XXXVIII, "Winch" for mechanical maintenance instructions on winch mechanism.

**b. Operation Controls**

(1) **Power take-off lever.** Winch is driven by power take-off at left side of transmission. Engagement for pulling or hoisting is through power take-off shift lever located in cab (Fig. 10). This lever has three operating positions; low, reverse, and high with neutral positions in between. Hinge locking plate, attached to floor board beside lever, provides positive means of locking lever into neutral position (between reverse and low). This arrangement will prevent

CONTROLS AND OPERATION



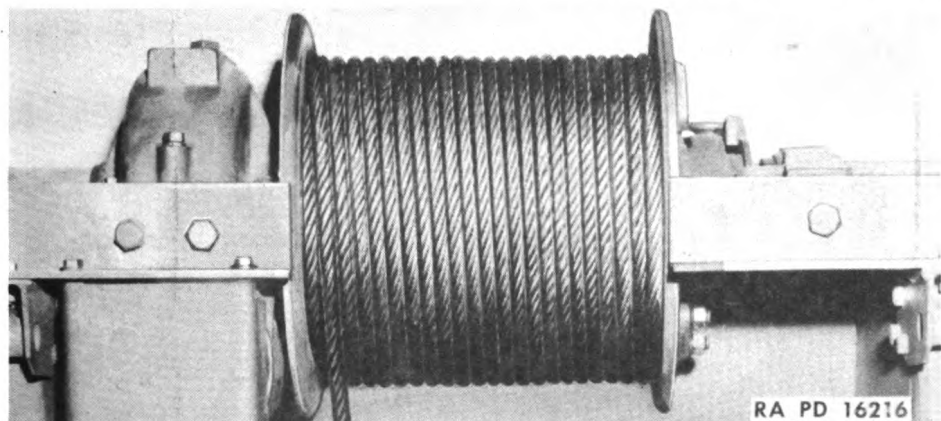
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**Figure 18—Winch Sliding Jaw Clutch Lever and Drum Flange Lock**

accidental engagement of power take-off. An automatic safety brake on worm shaft will sustain load while lever is being shifted into various operating positions.

(2) **Sliding jaw clutch.** Sliding jaw clutch at winch mechanism. Fig. 18, is used to engage and disengage winch drum. When sliding jaw clutch handle is placed into disengaged position, winch cable can be pulled out by hand. Sliding jaw clutch must be engaged to permit operation of winch under power.

(3) **Drum flange lock.** The drum flange lock (Fig. 18) is mount-



**Figure 19—Cable Should Be Wound Evenly on Drum**

**TRUCK, AMPHIBIAN, 2½-TON, 6 x 6**



6 TO 100 FEET

SEE FIGURE 30

SEE FIGURE 38

RA PD 16032

**Figure 20—Winching from Rear, 6 to 100 Feet**



100-150 FEET

SEE FIGURE 31

SEE FIGURE 37

RA PD 16033

**Figure 21—Winching from Rear, 100 to 150 Feet**



200-300 FEET

SEE FIGURES 28, 29, 40

SEE FIGURE 36

RA PD 16034

**Figure 22—Winching from Rear, 200 to 300 Feet**



**CONTROLS AND OPERATION**



6 TO 70 FEET

SEE FIGURE 30

SEE FIGURE 34

RA PD 16035

**Figure 23—Winching from Front, 6 to 70 Feet**



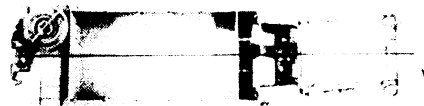
100 TO 120 FEET

SEE FIGURE 31

SEE FIGURE 33

RA PD 16036

**Figure 24—Winching from Front, 100 to 120 Feet**



200 TO 250 FEET

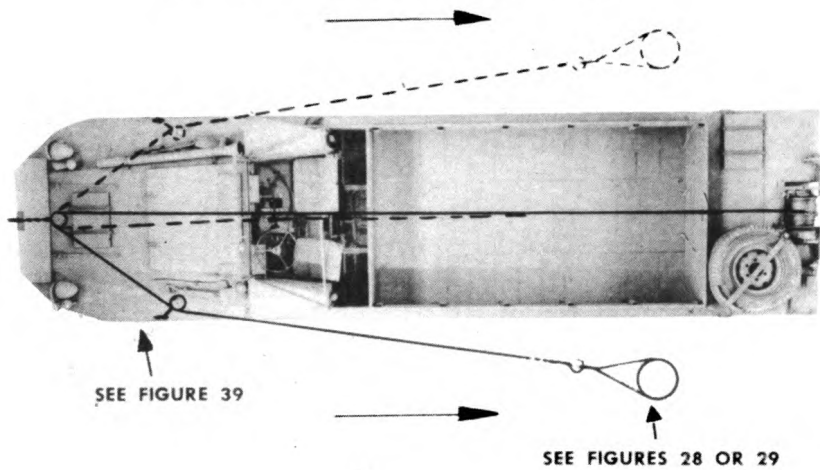
SEE FIGURE 28, 29 OR 40

SEE FIGURE 32

RA PD 16037

**Figure 25—Winching from Front, 200 to 250 Feet**

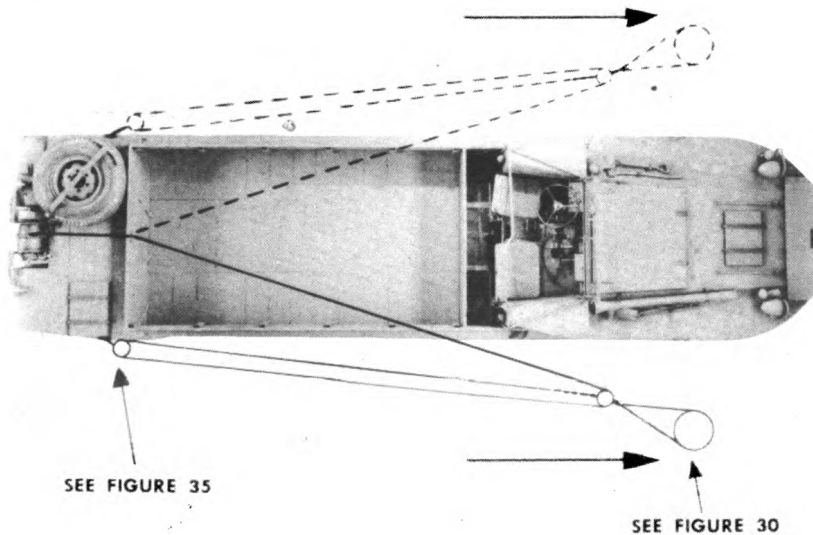
**TRUCK, AMPHIBIAN, 2 1/2-TON, 6 x 6**



RA PD 16038

**Figure 26—Short Hitch, Winching from Front**

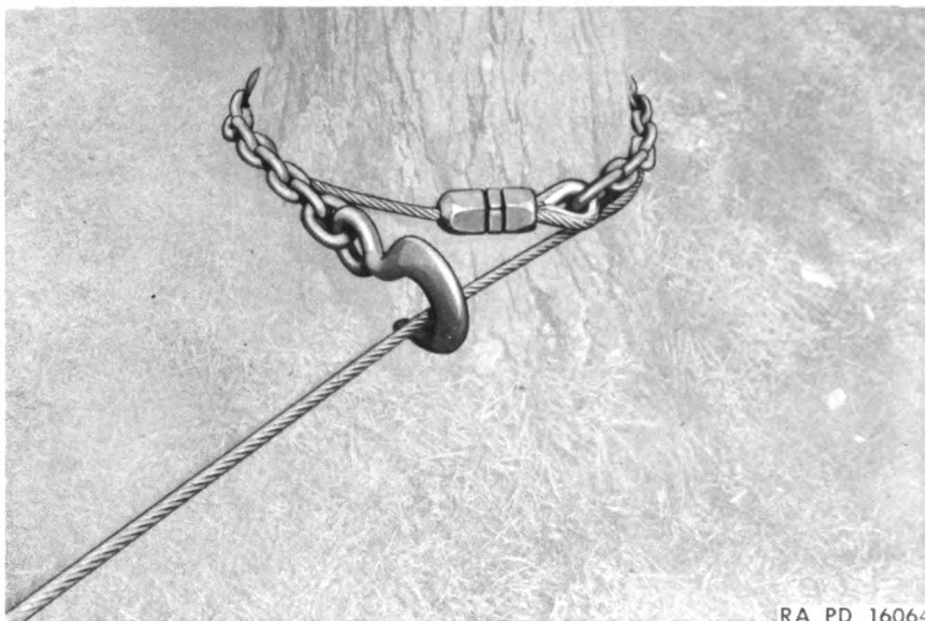
ed to sliding jaw clutch handle mechanism. This lock, which is spring loaded, engages one of several holes in the winch drum when sliding jaw clutch is in released position. This mechanism prevents cable from unwinding from drum while vehicle is under way. Flange lock handle must be raised up and disengaged from the drum before sliding jaw clutch can be engaged with drum. Disengaged position of flange lock handle is shown in Fig. 18.



RA PD 16039

**Figure 27—Short Hitch, Winching from Rear**

**CONTROLS AND OPERATION**



**Figure 28—Emergency Hitch Around Tree with Cable as used in Figures 22 and 25**

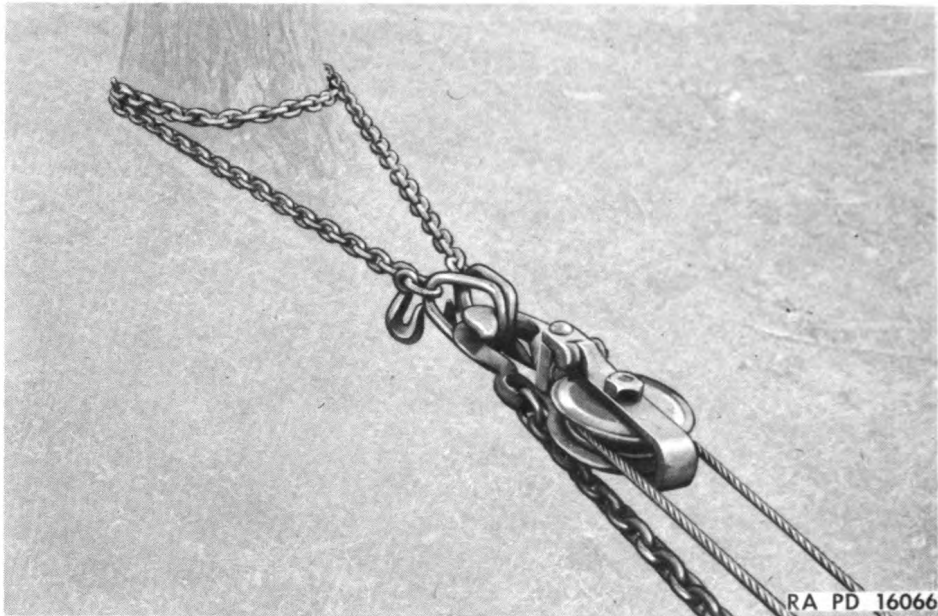
**c. Operating Cycle**

(1) **To hook on.** Place sliding jaw clutch lever into released position. Pull up and release drum flange lock handle. Pull off enough cable to make hook-up.



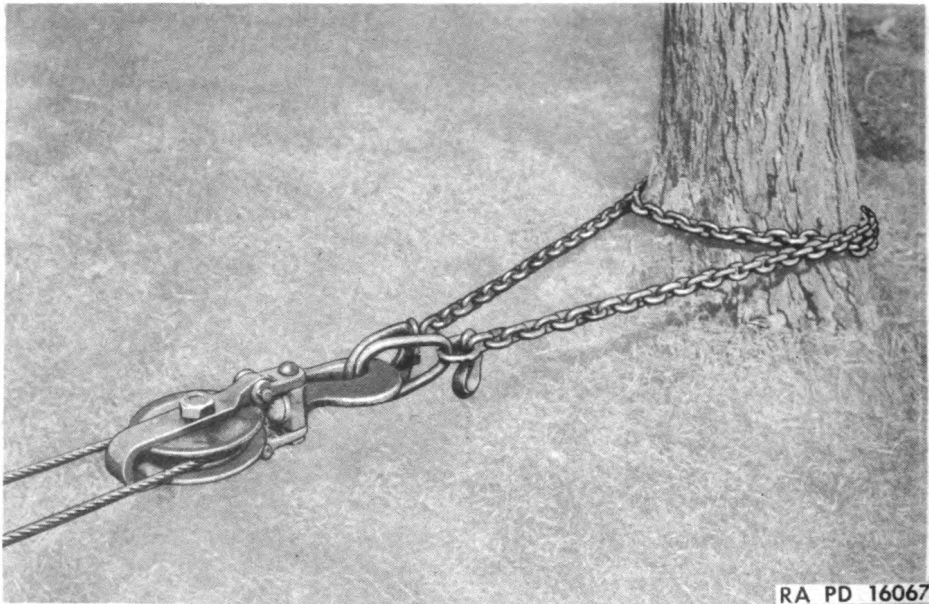
**Figure 29—Correct Hitch Around Tree with Chain as used in Figures 22, 25 and 26**

**TRUCK, AMPHIBIAN, 2 1/2-TON, 6 x 6**



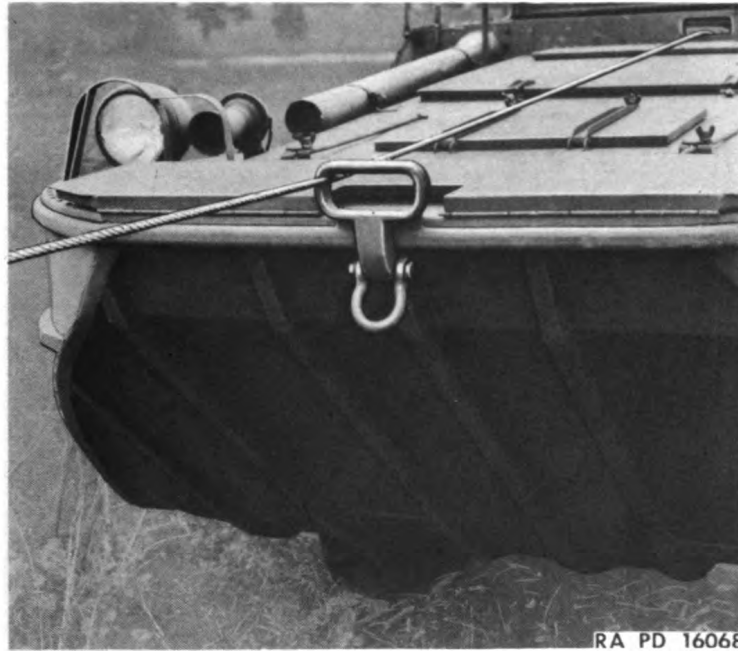
**Figure 30—Rigging at Tree with Snatch Block and Chain as used in Figures 20, 23 and 27**

(2) **To pull (wind in).** Place sliding jaw clutch lever into engaged position, depress engine clutch pedal, shift power take-off lever into low position if load is heavy, or high position to take slack or if load is extremely light, then release engine clutch pedal.



**Figure 31—Rigging at Tree with Snatch Block as used in Figures 21 and 24**

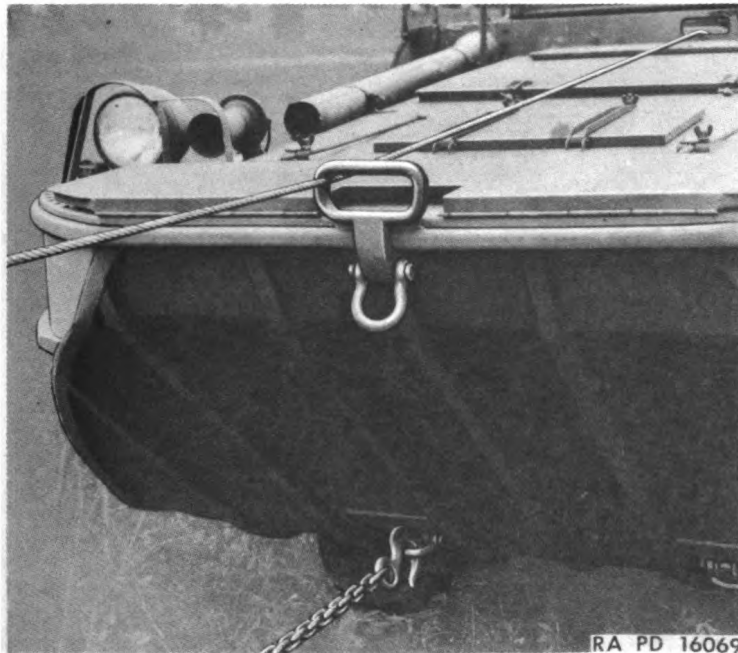
**CONTROLS AND OPERATION**



**Figure 32—Winch Rigging as used in Figure 25**

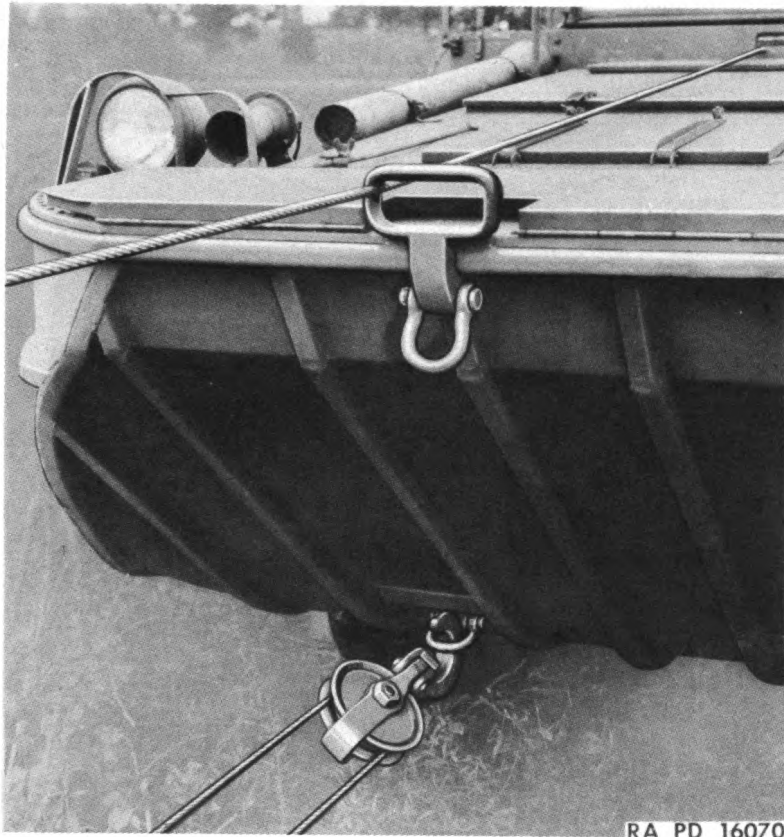
(3) **To stop.** Depress engine clutch pedal and shift take-off lever into neutral position.

(4) **To lower (pay out).** Depress engine clutch pedal and shift power take-off lever into reverse.



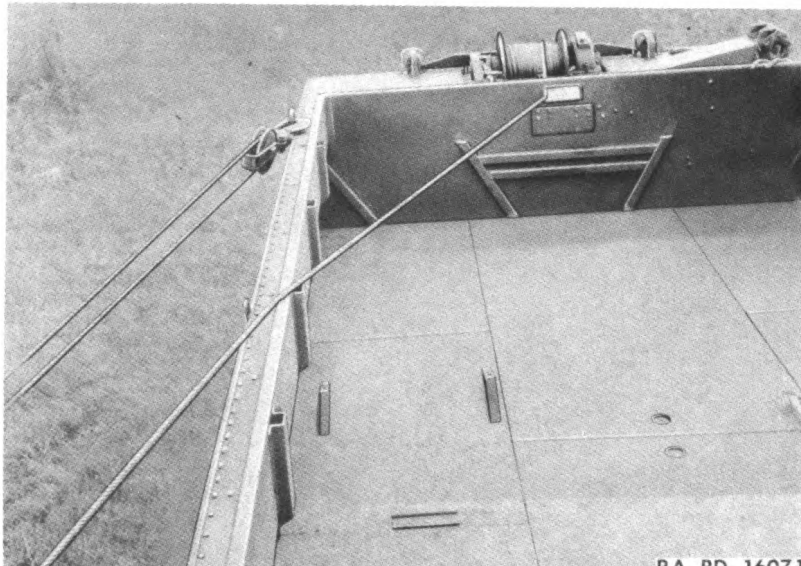
**Figure 33—Winch Rigging as used in Figure 24**

**TRUCK, AMPHIBIAN, 2½-TON, 6 x 6**



RA PD 16070

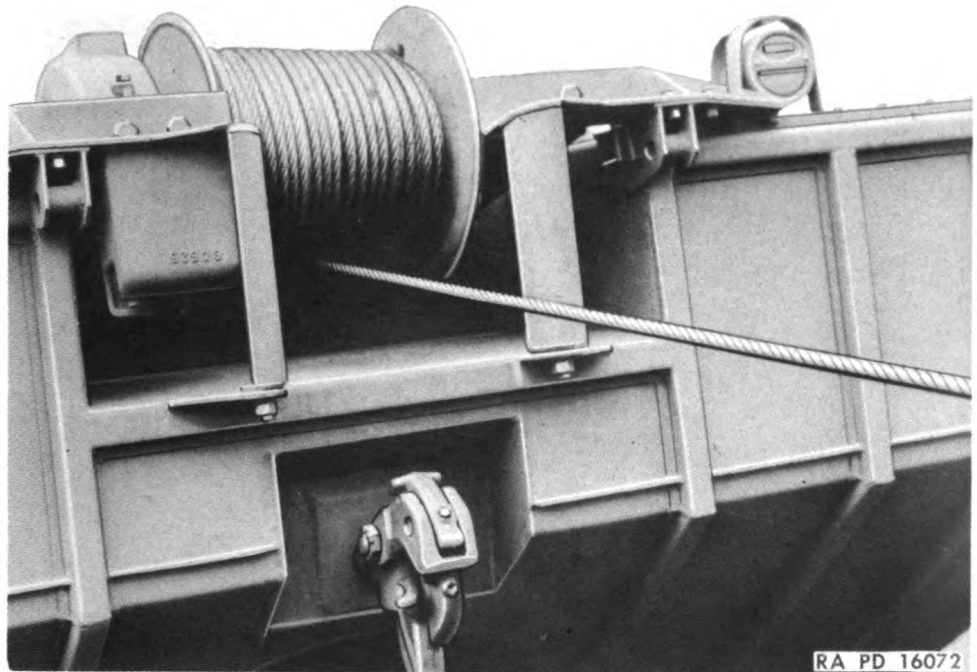
**Figure 34—Winch Rigging as used in Figure 23**



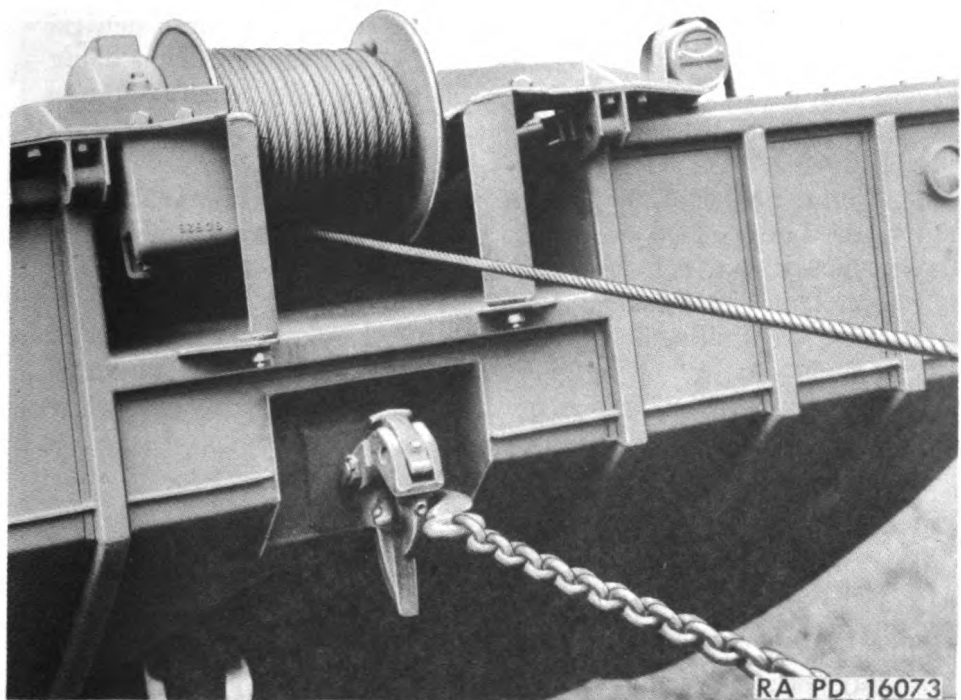
RA PD 16071

**Figure 35—Winch Rigging as used in Figure 27**

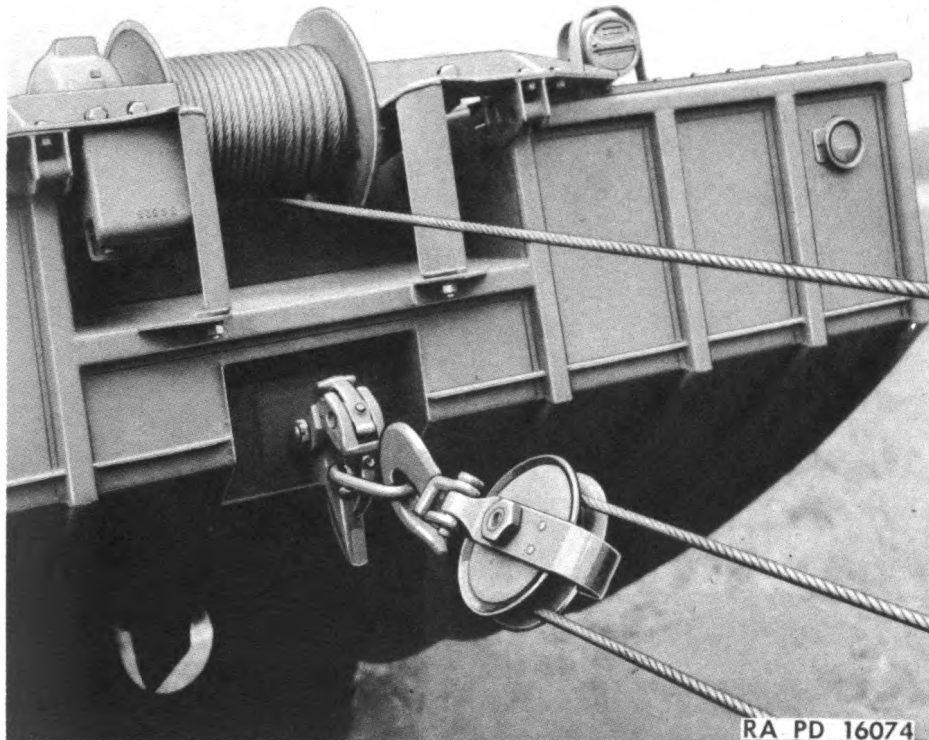
**CONTROLS AND OPERATION**



**Figure 36—Winch Rigging as used in Figure 22**



**Figure 37—Winch Rigging as used in Figure 21**

**TRUCK, AMPHIBIAN, 2½-TON, 6 x 6**

**Figure 38—Winch Rigging as used in Figure 20**

(5) **Winch not in use.** Power take-off lever must be in neutral position. Hinge locking plate must be in place to prevent lever being thrown into gear accidentally. Winch sliding jaw clutch should be in disengaged position with drum flange lock in engaged position (handle down).

**d. Pulling Speeds.** Winch pulling speeds are based on maximum engine speed of 1000 r.p.m. which should not be exceeded when using winch. Operating winch faster than this engine speed will result in excessive strains and probable failure of parts.

**e. Wind In (Pulling) Speed Shift.**

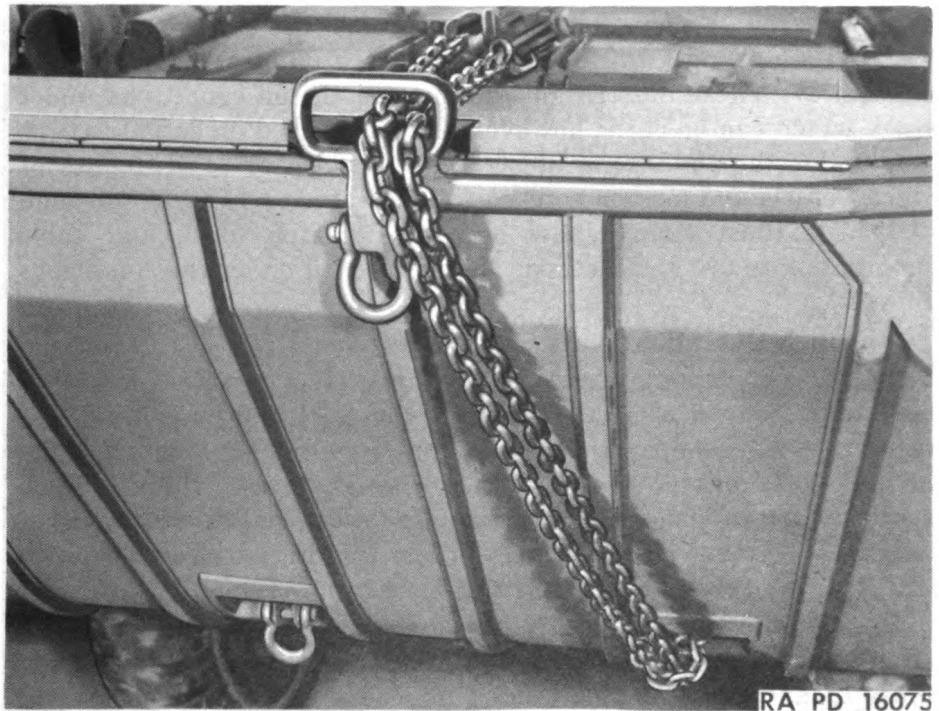
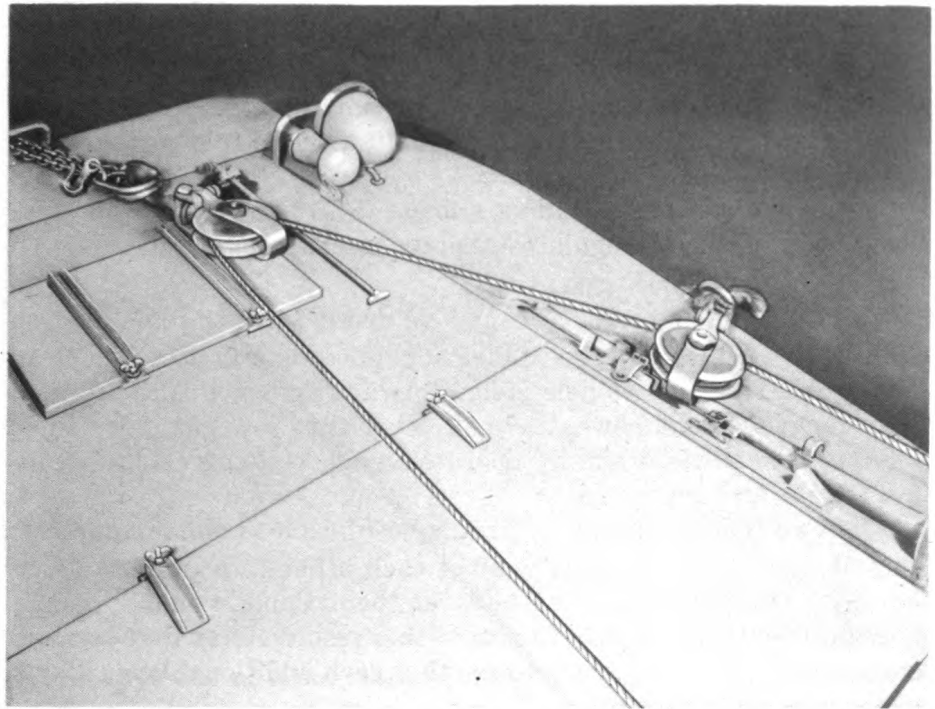
(1) The “wind in” or pulling speeds (low and high) are obtained by moving power take-off shift lever to engage proper gearing. Use high speed position for handling light loads or lower speed position for heavy loads. Do not race engine when winching, especially when winch is pulling a light load or when winding in cable with no load.

(2) **Important.** When winching this vehicle, always assist winch with wheels as cable becomes tight, using transmission in first (or reverse for backpulls) and transfer case auxiliary range in “low.”

**f. Pay Out (Lowering) Speed Shift.** Two methods may be used for “paying out” winch cable.



**CONTROLS AND OPERATION**



RA PD 16075

**Figure 39—Winch Rigging as used in Figure 26**

**TRUCK, AMPHIBIAN, 2 1/2-TON, 6 x 6**

(1) **Not under load.** Place sliding jaw clutch into disengaged position with drum flange lock lever raised up in locked disengaged position. Pay out speed depends upon the amount of pull applied to rope. Drag brake on drum flange will automatically keep drum from spinning and cable unwinding too rapidly. Care should be taken not to kink cable.

(2) **When winch is handling a load.** Shift power take-off lever into reverse gear and regulate speed by accelerating engine.

**g. Winding Cable**

(1) Cable should not be wound on drum without some load on cable. If no load is available, cable should be properly attached to an anchor or a tree, and vehicle pulled forward by winch. (Sliding jaw clutch engaged and power take-off lever into low.) A very light pressure on vehicle brake by operator while winding cable will insure a tight and neat wind.

(2) **Caution.** Winding on first layer of cable is most important. Coils of cable must be tight against each other to prevent coils on next layer from pressing down between them. Cable should be wound on drum evenly and slowly to obtain this result. After first layer is wound evenly, it is necessary to see that each additional layer starts back across drum properly.

**h. Rigging Under Various Conditions.** Several examples of winch rigging under various conditions are illustrated in Figs. 20 through 27. These illustrations do not present all conditions under which winch can be used; however, they are based on actual experience under the conditions illustrated. Methods of attachments of winch vehicle and anchor points are illustrated in Figs. 28 through 40. These illustrations show necessary snatch block and cable combination to use and methods should be used under the conditions shown.

**i. Winch Operation Hints and Precautions**

(1) **Use of driving wheels with winch.** If a vehicle is assisting itself with its own winch, all driving wheels should be utilized. Always start wheels operating the instant winch cable starts to take the load. In other words, do not start driving wheels if there is slack in winch cable. When driving wheels are used to assist winch operation, make certain that winch is in low (pulling), transmission in 1st speed (or reverse) and transfer case in low range.

(2) **Sand anchor.** Use of sand anchor is illustrated in Fig. 40. After winch cable attachment has been made to anchor shackle, points of anchor should be guided into sand or ground as shown, holding it steady as winch takes up slack and drives flukes or points of anchor into sand. If driver is operating alone, anchor points can be started into the ground before driver starts to operate winch. If sand

**CONTROLS AND OPERATION**



**Figure 40—Use of Sand Anchor, May be used in Manner Shown in Figures 22 and 25**

or ground is soft, anchor can be thrown out and will dig into ground, in many instances, when load is put on winch cable.

(3) Bear in mind that winch will be more powerful with all the cable off of the drum before it starts to operate. Under many conditions, this is not possible. However, the best procedure to use is to pay out as much cable from the winch drum as possible before starting the pull.

(4) Cable guides in the hull permit winch cable to be pulled straight into winch drum when winching from the front. However, when winching from the rear, this straight pull cannot be obtained under some conditions. If it is necessary to pull at an angle from the rear, all free cable should be guided evenly onto the drum as the winch winds in.

Section IV  
**ARMAMENT**

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General .....	25
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Gun mount supports .....	27

**25. GENERAL**

a. Provision has been made on the hull for the mounting of standard ring type gun mount and machine gun.

**26. GUN MOUNT**

a. When gun mount is installed on vehicle, machine gun is operated by gunner located to right of driver.

**27. GUN MOUNT SUPPORTS**

a. Three supports or sockets are provided at right front corner, right rear corner, and center rear of driver's compartment. These gun mount supports are clamp type and hold the legs of mount securely when clamp and "U" bolts are tightened.

**Section V**

**PREVENTIVE MAINTENANCE AND INSPECTION**

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Weekly inspection and preventive maintenance . . . . .	37
Monthly inspection and preventive maintenance . . . . .	38
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**28. PURPOSE AND SCOPE**

a. Inspection and preventive maintenance procedures and operations outlined in this section provide an opportunity for crew and Using Arms maintenance personnel to replenish essential operating materials, to detect by audible, visual or manual inspection improper functioning of operating units and systems, and to make minor adjustments on parts subject to wear during normal operation. Its outstanding purpose is to eliminate the element of neglect which is too often responsible for sudden, unexpected failure of vehicle operation.

**29. PREVENTIVE MAINTENANCE AND INSPECTION TERMS**

a. Various terms are used when describing inspection and preventive maintenance operations. Using Arms maintenance personnel should familiarize themselves with these terms.

**30. PLACING NEW OR USED VEHICLE INTO SERVICE**

a. If a used or new vehicle is being placed into service, accomplish general inspection operations included in Paras. 31 and 32.

**31. PRE-STARTING AND BEFORE OPERATION INSPECTION AND PREVENTIVE MAINTENANCE**

a. Purpose of this pre-starting and before operation inspection and preventive maintenance procedure is to be sure that condition of the vehicle has not changed since the after-operation inspections were performed. While these procedures are of a routine nature, the driver and crew should bear in mind that such inspections are important from standpoint of vehicle performance and crew safety dur-

**TRUCK, AMPHIBIAN, 2 1/2-TON, 6 x 6**

ing operation. By being thoroughly familiar with recommended procedures, crew can go through these inspections almost automatically and in a few minutes' time size up general condition of vehicle.

b. As pre-starting and before operation preventive maintenance procedures are of vital interest to driver, these procedures are listed in Para. 14, Section III, "Controls and Operation."

**32. BEFORE WATER OPERATION INSPECTION**

a. As before water operation preventive maintenance procedures are of vital interest to driver, these procedures are listed in Para. 18, Section III, "Controls and Operation."

**33. INSPECTION DURING OPERATION**

a. In preventive maintenance, it is the attention to little things that count—such as unusual noises or odors and slight irregularities in vehicle performance. Taking necessary steps to correct any defects that develop completes the preventive procedure. While vehicle is in motion, a good driver listens for any sounds which may be a sign of trouble. He knows and watches for the odor of an overheated generator, overheated brakes, boiling anti-freeze, fuel vapor from a leaky fuel system or other such signs of trouble. Every time he uses brakes, shifts gears, changes speeds, or turns, he considers it a test and notes any unsatisfactory or unusual performance. Only under emergency condition should the vehicle be operated after indications of trouble have been observed.

b. During Land and Water Operation listen for such noises as the following which usually indicate the trouble specified.

- (1) Squeaks in engine—Generator or water pump trouble.
- (2) Engine Knocks—An alert driver can do much to avoid serious damage to engine by investigating and reporting the first signs of engine knocks.
- (3) Spark ping—Not serious during acceleration.
- (4) Hissing sound—Escape of steam due to overheating.
- (5) Excessive grinding noises under floor boards—Transmission, power take-off, or transfer case trouble.
- (6) Excessive heavy vibration in and beneath vehicle—Loose propeller shaft mounting, bent propeller shaft or worn universal joint.
- (7) Instruments—Glance frequently at instrument panel gauges and observe engine temperature, oil pressure, ammeter action and fuel supply.
- (8) Transmission and transfer case gears should shift without excessive effort or noise.
- (9) Note and report excessive play or looseness in steering mechanism or in rudder action.

## PREVENTIVE MAINTENANCE AND INSPECTION

(10) Note and report inefficient action of clutch. Clutch pedal should have approximately 2½" free travel.

(11) Performance—Be on the alert for lack of power or any other condition which may indicate engine trouble. In this way the alert driver can avoid a complete breakdown. Always stop vehicle before trouble stops engine and the condition will be easier to correct.

c. During Operation—On Land Only.—In **addition** to the foregoing items under **b**, the following inspection procedure is provided for land operation only.

(1) If a continuous hum develops in wheels it may be due to improper wheel bearing adjustment and should be investigated and reported.

(2) If squealing of tires occurs on turns and sharp curves it is an indication of improper tire inflation and excessive speed and should be corrected.

(3) If any sound comes from axles, it may be an indication of improperly adjusted or worn axle gears and should be investigated and reported.

(4) Steering—First sign of pulling to one side or the other may indicate the need for tire inflation or repair. Note and report inefficient action of brakes.

d. During Operation—On Water Only.—In addition to the foregoing items for land and water operation under **b**, the following procedure applies during water operation only. If there is a possibility of vehicle remaining in water for periods of 24 hours or more, it is essential that procedures in "Before Operation," "At Halt," and "After Operation" be accomplished.

(1) Make periodic inspection of each bilge compartment, if possible, to determine possibility of excessive leaks or inability of bilge pumps to keep compartments empty. Be alert to operation of bilge pumps and note exhaust of large quantities of water which may be an indication of damage to any section of hull and the need for immediate landing for repair.

(2) Note excessive vibration which may be an indication of looseness of water propeller, shaft and bearings.

(3) Keep air intake grilles and auxiliary intake open when possible to permit maximum cooling.

### 34. INSPECTION AT HALT

a. Some troubles are difficult to identify during operation due to location of units in the various hull sections. The driver should take advantage of every halt to locate and identify anything that might cause failure during operation. Driver should immediately report any conditions that he cannot handle. All inspection operations in this section apply during land operation only except those given under e.

**TRUCK, AMPHIBIAN, 2½-TON, 6 x 6**

**b. Driver's Compartment**

- (1) Hand brake should hold vehicle while at halt.
- (2) Instruments and gauges should show a normal reading.

**c. Exterior**

- (1) Note and report excessive temperature of brake drums or wheel hubs.
- (2) Inspect steering mechanism carefully. Report tie rod or drag link connections that are excessively loose.
- (3) Check tire inflation and condition of tires.
- (4) Examine driving axles for lubricant leaks and note temperature.
- (5) Check load, tarpaulin, fastenings, etc.

**d. In Vehicle**

- (1) Look for lubricant leaks and note excessive temperatures of all accessible driving units.

**e. In Engine Compartment—Engine Stopped**

- (1) Remove radiator cap and replenish water if low.
- (2) Inspect radiator core and connections for leaks.
- (3) Inspect fan belt and check its adjustment.
- (4) Check engine oil level and condition of the oil.

**35. INSPECTION AFTER WATER OPERATION**

**a.** Inspections after water operation are necessary to make sure that the vehicle is in a satisfactory condition for immediate operation either on land or in water. Unless immediate return to water operation is anticipated, the "daily after operation" inspection operation in Para. 36 should be accomplished.

**b. After Operation—Vehicle in Water.** Before vehicle is landed, if conditions permit, a thorough inspection should be made to determine existence of leaks throughout hull, inefficiency of bilge pumps or defects in driving mechanism.

**c. After Water Operation—Vehicle on Land—Note:** Items (1) to (9) may be omitted if immediate return to water operation is anticipated.

- (1) Open all hatches and note existence of fuel or oil fumes which may indicate leakage from the various units.
- (2) Before stopping engine, operate bilge pump controls to remove all water from bilge compartment.
- (3) Wash vehicle inside and out with fresh water if possible. All compartments should be partially filled with clean water and then pumped out through pumping system.
- (4) Inspect flexible brake hose all wheels. See that they are properly supported by their springs and report if hose has been damaged during water operation.



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(5) Inspect all breather tubes from axles and pillow blocks and report if damaged during water operation.

(6) Check tire inflation. See that tires are in good condition and properly inflated for land operation.

(7) Remove seaweed or any other foreign matter which may have become wound around water propeller, shafting, rudder, exposed axle propeller shaft, or under structure.

(8) Inspect bellows type seals at each end of propeller shaft housings. These seals should be replaced if damaged in any way.

(9) Inspect water propeller and mounting. Lubricate water propeller shaft rear bearing.

(10) After a period of water operation, and unless immediate return to water operation is anticipated, it is recommended that a small quantity of lubricant be drained from axle housings and carefully examined to determine possibility of water having entered axles. If water is apparent, all lubricant should be drained from axles and units should be flushed and refilled with proper lubricant.

(11) Lubricate all points which are accessible from exterior of vehicle. (Refer to Section VI, "Lubrication".)

### 36. INSPECTION AFTER LAND OPERATION

a. This procedure is particularly important after either land or water operation because at this time the driver inspects and tests various units and systems to find any defects that may have developed during the previous operation. The driver should correct any conditions found and report those that he cannot handle. These inspections, while comparable to those itemized under "Pre-Starting and Before Operation" should be more thorough. Inspection operations should be followed up with necessary maintenance or service operations. This procedure should never be entirely omitted even in extreme tactical situations but may be reduced to the bare fundamental services. When performing these operations, driver should remember and consider any irregularities noticed during the day's operation.

#### b. In Driver's Compartment—Before Stopping Engine

(1) Hand brake lever ratchet should keep lever in applied position and brakes should hold.

(2) See if engine idles smoothly and investigate any unusual noises or conditions noticed during operation.

(3) See if engine temperature is normal.

(4) See if oil pressure is normal.

(5) Ammeter should show no excessive discharge or charge. Reading should be close to 0 at idling speed.

(6) Note approximate amount of fuel required to refill tank and replenish if necessary.

**TRUCK, AMPHIBIAN, 2 1/2-TON, 6 x 6****c. In Engine Compartment**

- (1) Raise engine hatch and note the presence of excessive fumes which might indicate leaks in the exhaust system, fuel and oil lines or in the hull.
- (2) Note and report excessive engine vibration.
- (3) Note and report excessive looseness or rubbing of fan belt on pulley.
- (4) Inspect carbureter control linkage.
- (5) Inspect electrical wiring and connections. All connections should be clean, tight and dry.
- (6) Inspect fuel and oil lines and report leaks.
- (7) Inspect mounting of engine accessories such as starter, generator, fuel pump, carbureter, etc.
- (8) Remove radiator cap and replenish water if needed. Remove cap carefully to avoid danger of escaping steam pressure. If considerable water is required to replenish system, look for leaks in radiator core, water lines and connections.
- (9) Check engine oil level and condition of the oil.
- (10) Check oil level in carbureter air cleaner and crankcase breather. Rub fingers through oil to detect dirt. If cleaners are dirty, service according to instructions.

**d. In Vehicle**

- (1) Open hatch covers and remove floor boards. Notice unusual odors which might indicate leakage of fuel or oils from the various units.
- (2) Examine rudder control, cable and linkage.
- (3) Inspect transmission and power take-off for lubricant leaks and note temperature.
- (4) Inspect water propeller transfer case for lubricant leaks.
- (5) Inspect axle drive transfer case for lubricant leaks.
- (6) Inspect stuffing boxes at propeller shafts and rudder control shafts. See that stuffing box hose is in good condition.
- (7) Examine axle propeller shaft housing seals at hull.
- (8) Inspect mounting of water propeller transfer case, propeller shaft center bearings and pillow block.

**e. Under Vehicle**

- (1) Inspect steering gear drag link and tie rod and steering arms. Actually handle these parts in order to determine excessive looseness.
- (2) Examine hull at points of mounting of steering gear, frame, spring brackets, axle brackets, etc., to see that attaching bolts and nuts are present and tight. Observe necessity for adding sealing compound at these points.
- (3) Look for lubricant leaks from axle housings, steering knuckle housings, steering gear and pillow block.

**PREVENTIVE MAINTENANCE AND INSPECTION**

(4) Remove all foreign matter such as nails, glass, stones, or weeds from tires. Replace any missing valve caps and check for improperly locked valve stems which may indicate pulling of valve stem on tube as a result of operating tires when soft.

(5) Examine springs and suspensions for broken springs, loose or missing rebound clips.

(6) Check brake lines for leaks. See that springs and clips which support flexible brake hose are tight and in proper position. Report torn or defective hose.

(7) Remove foreign matter from around exposed propeller shafting. Tighten loose universal joint bolts.

(8) Check wheel and axle shaft flange nuts. Report damaged or missing rims, bolts, nuts, or other attaching parts.

(9) Place hand cautiously on each brake drum and wheel hub and note temperature. All drums should be approximately same temperature. Report wheel hubs that are too hot to touch with hand as this may indicate lack of lubricant, damaged or improperly adjusted bearings or brakes.

(10) Report all damaged, loose or missing sheet metal parts such as hull sections which have been penetrated, loose or missing hatches, etc.

(11) See that winch cable is tight and evenly wound; if not, rewind cable. Report defective cable. Check shear pin and spares under rear deck.

(12) Test action of lights and switches if assignment permits use of lights. If lamps are loose, tighten them. Report broken brackets and cracked lenses.

(13) Inspect load, tarpaulin and fastenings. Make sure that load is in good condition and properly secured.

(14) Check all tools and equipment which have been assigned to vehicle and see that they are in good condition and properly located.

**37. WEEKLY INSPECTION AND PREVENTIVE MAINTENANCE**

a. Weekly preventive maintenance procedure is general adjustment and inspection routine which requires the performance of adjustments to offset the effect of normal wear throughout the vehicle as well as other maintenance operations necessary, to restore vehicle to proper operating condition. Following procedure should be performed with vehicle on land.

**b. In Vehicle**

(1) Check clutch pedal free travel. The amount of free travel of clutch pedal before clutch starts to disengage should be approximately 2½ inches. Inspect and report defective clutch action.

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(2) Inspect vehicle controls and report excessive looseness in rods and levers.

(3) Inspect hydraulic brake lines and check connections.

(4) Inspect general condition of inside of hull and bilge compartments. Clean thoroughly and report damaged, loose or missing parts.

(5) Clean top of battery and terminals with clean water or with solution of water and baking soda. Tighten terminals at each end of ground cable and at each end of battery to starting motor cable. Remove battery filler plugs. Use a hydrometer and check specific gravity of each battery cell. If electrolyte is not well over top of plates, add distilled water or report condition so that distilled water may be added. Never use salt water in battery.

(6) Check and service engine oil and oil filter as required.

(7) Remove ignition system shield cover and inspect and service spark plugs, distributor breaker points, and ignition high and low tension cables as required. Check all wiring and connections.

(8) Inspect and service engine air cleaner and crankcase ventilator breather as required.

(9) Check mounting bolts of all units within the hull. This should include starting motor, generator carbureter, engine, power take-off, water propeller transfer case, axle transfer case, propeller shaft universal joints, bilge pumps, tire pump, etc.

(10) Check gear type bilge pump drive belt and centrifugal type bilge pump drive chain. Service as required.

(11) Inspect all units within hull for oil and fuel leaks. If leakage occurs at oil seals, report condition.

(12) Remove level plugs from transmission, transfer cases and steering gear. Be sure lubricant is at the correct level. Service as required. Be sure to replace plugs.

(13) Flush interior of vehicle with plenty of clean, fresh water. Use bilge pumps to drain various compartments and observe action of bilge pump during this operation.

(14) Check winch operation and inspect condition of winch, cable and drive shaft. Check winch lubrication.

(15) See that all tools and equipment which have been assigned to vehicle are accounted for, in good condition, and properly installed in their correct location. This should include hand tools, pioneer tools, fire extinguishers, first aid kits, sand anchor, tow chain, etc.

**c. Exterior**

(1) Inspect hatch covers and attaching parts. Examine hatch cover seals and repair or report those found defective.

(2) Remove level plugs from all drive axles and from steering knuckles and see that lubricant is at correct level. Service as required. If water operation has been experienced during preceding week, it is

## PREVENTIVE MAINTENANCE AND INSPECTION

recommended that a small quantity of lubricant be drained from each of these units and oil be carefully examined to determine possible water content. If water is found, unit should be drained, flushed, and refilled with proper lubricant. Be sure to replace plugs.

(3) Check all mounting bolts used for attachment of chassis units to hull. If loose or missing bolts are found, these points should be well caulked with sealing compound before tightening or replacing. Tighten axle flange and wheel nuts.

(4) Completely wash outside of vehicle.

(5) Inflate tires to correct pressure.

(6) Examine all structural sections of hull and report loose or missing parts, or conditions which require welding.

(7) Inspect shock absorber linkage and mounting. Check for leakage of fluid from shock absorbers.

(8) Inspect bellows type seals at each end of propeller shaft housings and replace these parts if damaged or defective. Tighten seal clamp ring screws.

(9) Inspect all points of spring suspension such as shackles, brackets, "U" bolts, clips, etc.

(10) Carefully check steering gear drag link and tie rod connections and report excessive looseness.

(11) Check wheel bearing adjustment.

(12) Check wheel and axle shaft flange nuts.

### 38. MONTHLY INSPECTION PREVENTIVE MAINTENANCE

a. Purpose of this inspection interval is to perform lubrication inspection and maintenance services that will offset normal wear and eliminate any conditions which may interfere with dependable operation during forthcoming months. Driver should accompany vehicle and assist in procedure when possible or provide a suitable report of vehicle operating conditions.

b. No set routine or mileage can be established for this interval until experience has pointed out necessity of establishing specific mileage service. All the operations itemized in other inspection intervals should be accomplished in a more detailed and thorough manner, and followed up with maintenance or service operations.

### 39. SEMI-ANNUAL INSPECTION AND PREVENTIVE MAINTENANCE

a. Purpose of this inspection interval is to provide an opportunity for replacement, repair, or rebuild of major units which may prove by past service experience to be necessary. Operations at this interval should include, in a more detailed and thorough manner, the operations which are generally accomplished at the weekly and monthly inspection intervals. An established mileage interval may be set up in

**TRUCK, AMPHIBIAN, 2 1/2-TON, 6 x 6**

lieu of semi-annual period, after service performance has proven necessity of such action.

b. Semi-annual inspection and preventive maintenance interval provides an opportunity to make various seasonable adjustments if necessary, as well as analyzing the service performance of vehicle during foregoing six months.

**40. SEASONAL AND TEMPERATURE CHANGES**

**a. From Above Freezing To Below Freezing**

- (1) Add anti-freeze to cooling system.
- (2) Test and add anti-freeze as required during operation.
- (3) Use lubricants specified for climatic and operating conditions.
- (4) Keep battery fully charged. Remember that at a gravity lower than 1160 batteries will freeze at 2° F.
- (5) Keep moisture out of fuel system.
- (6) Take necessary precautions to see that engine is operated at normal operating temperature.
- (7) Use a more volatile gasoline.
- (8) Adjust exhaust manifold heat control valve and adjust carbureter.

**b. From Below Freezing To Above Freezing**

- (1) Remove anti-freeze from cooling system and flush the system.
- (2) Use lubricant specified for climate.
- (3) Adjust exhaust manifold heat control valve and carbureter.

**c. Icing Conditions**

- (1) Drive at slower speeds. Stop vehicle frequently and inspect all controls, as slush freezing on bottom of vehicle will interfere with vehicle control.
- (2) Remove sleet from windshield.
- (3) Remove slush and mud from controls when parking vehicle.
- (4) Do not set hand brake when parking. Do not park in water which may freeze.

**41. PREPARING VEHICLE FOR LONG-TERM STORAGE**

a. If for any reason vehicles must be placed in storage for a long period of time, it is important that precautions be taken to make sure that the vehicle will be in good condition for operation when required.

Section VI

**LUBRICATION**

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General .....	42
Lubrication guide .....	43
Points to be serviced and/or lubricated by ordnance maintenance personnel .....	44
Reports and records .....	45

**42. GENERAL**

The following lubrication instructions for Truck, Amphibian, 2½-ton, 6 x 6, DUKW, are published for the information and guidance of all concerned, and supersede all previous instructions. Materiel must be lubricated in accordance with the latest instructions contained in Technical Manuals and/or Ordnance Field Service Bulletins.

**43. LUBRICATION GUIDE**

Lubrication instructions for all points to be serviced by the using arm are shown in the Lubrication Guide which specifies the types of lubricants required and the intervals at which they are to be applied. The following lubrication instructions contain the same information as the guide. Guides from which data is reproduced are 10 x 15 in. laminated charts which are part of the accessory equipment of each piece of materiel. Data contained in the lubrication guides is taken from TM's and is binding on using troops.

**44. POINTS TO BE SERVICED AND OR LUBRICATED BY  
ORDNANCE MAINTENANCE PERSONNEL**

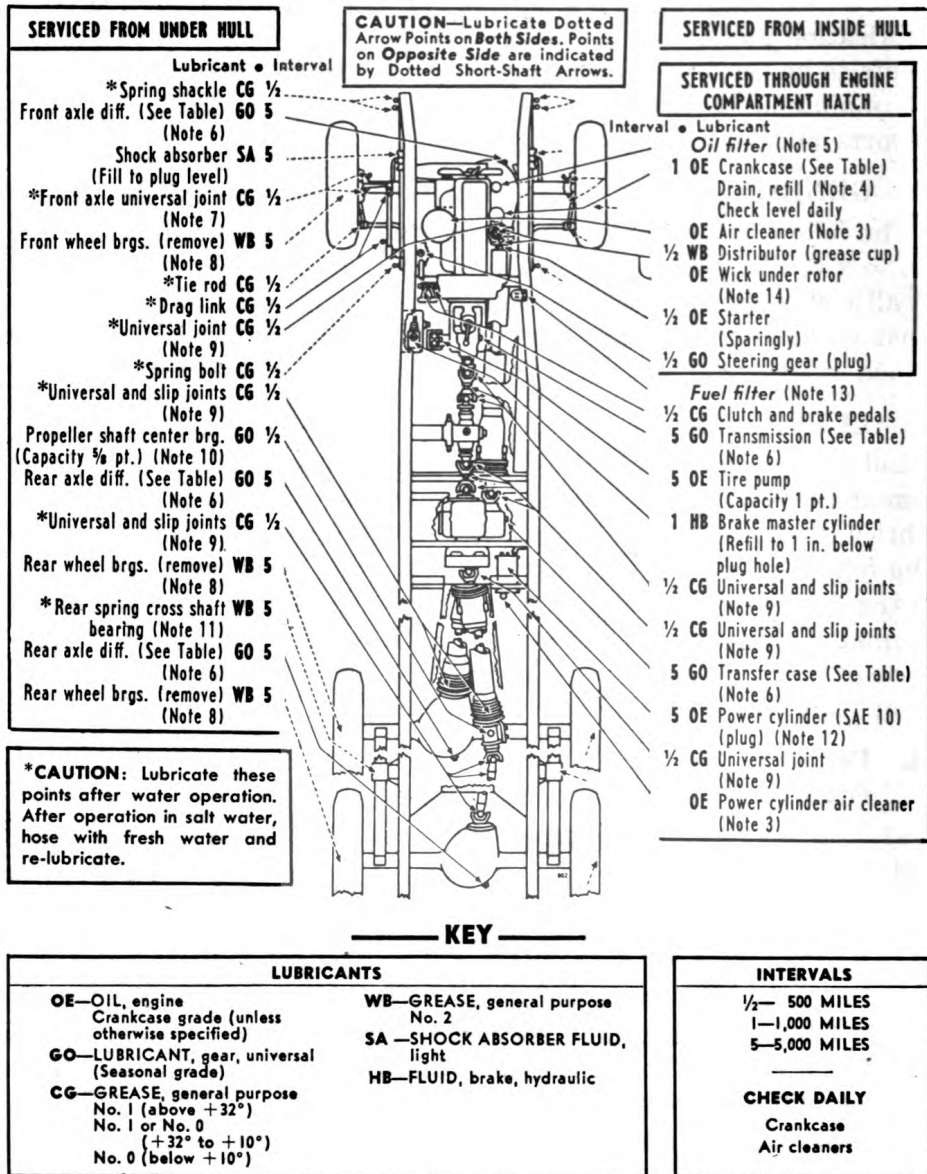
a. **Starter outboard bearing.** Every 5,000 miles, remove starter and lubricate outboard bearing through oiler with OIL, engine, crankcase grade.

**45. REPORTS AND RECORDS**

a. **Reports.** If lubrication instructions are closely followed, proper lubricants used, and satisfactory results are not obtained, a report will be made to the ordnance officer responsible for the maintenance of the materiel.

b. **Records.** A complete record of lubrication servicing will be kept for the materiel.

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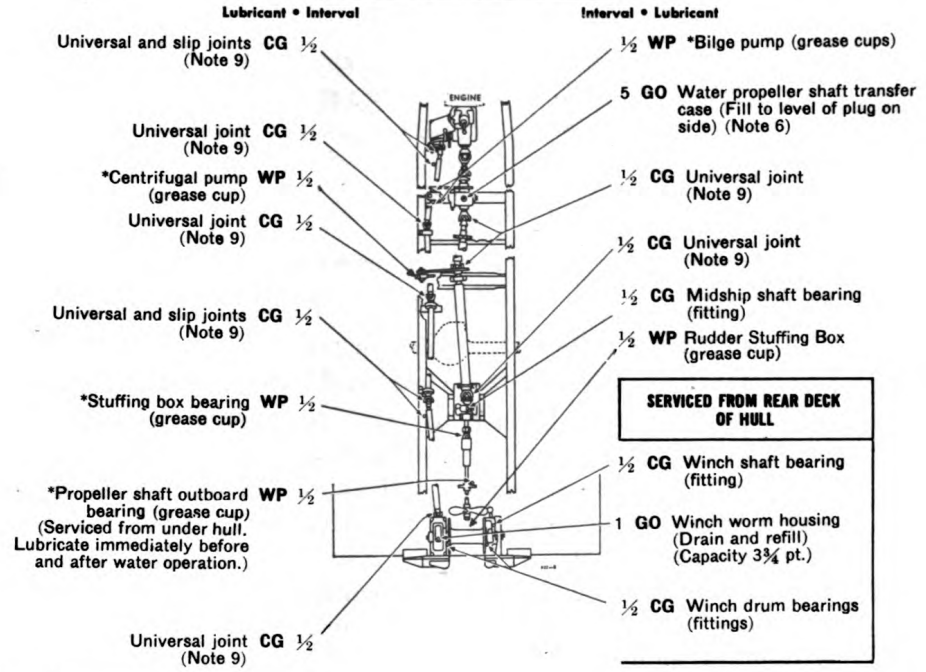


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**LUBRICATION**

**NOTE—All points are serviced from INSIDE HULL, unless otherwise specified.**



**\*CAUTION:** Lubricate these points after every water operation.

**KEY**

LUBRICANTS	
WP—No. 4 GREASE, water pump	CG—GREASE, general purpose No. 1 (above +32°) No. 1 or No. 0 (+32° to +10°) No. 0 (below +10°)

INTERVALS
1/2— 500 MILES
1—1,000 MILES
5—5,000 MILES

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**TABLE OF CAPACITIES AND LUBRICANTS TO BE USED**

	Capacity (Approx.)	Above +32°	+32° to +10°	+10° to -10°	Below -10°
Crankcase (refill) . . . . .	10 qt.	OE SAE 30	OE SAE 30	OE SAE 10	
Transmission	11 pt.				
Transfer Case	4 pt.				
Water Propeller Transfer Case	1 pt.		GO		
Front and For- ward Rear Axle	13 pt.	GO SAE 90	SAE 90 or 80	GO SAE 80	Refer to OFSB 6-11
Rearward Rear Axle Diff.	10 pt.				

**NOTES**

**Additional Lubrication and Service Instructions  
on Individual Units and Parts**

- FITTINGS.** Clean before applying lubricant. Lubricate until new lubricant is forced from the bearing, unless otherwise specified. Lubricate chassis points and universal joints as soon after water operation as possible. Also, always lubricate chassis points after washing truck.
- INTERVALS** indicated are for normal service. For extreme conditions of speed, heat, sand, mud, snow, rough roads, dust, etc., reduce interval by ⅓ or ½, or more if conditions warrant.
- AIR CLEANERS.** **Engine air cleaner.** Daily, check level and refill oil reservoir to bead level with OIL, engine, crankcase grade. Every 100 to 1,000 miles, depending on operating conditions, drain, clean and refill. Every 2,000 miles, also remove air cleaner and wash all parts. **Crankcase breather.** Every 1,000 miles, or oftener if necessary, remove crankcase breather, clean and reoil with OIL, engine, crankcase grade. **Power cylinder air cleaner.** Every 5,000 miles, or oftener if necessary, remove cylinder air intake cylinder, wash filter element in SOLVENT, dry-cleaning, dip in OIL, engine, seasonal grade, and reassemble. Proper maintenance of air cleaners is essential to prolonged engine life.
- CRANKCASE.** Drain only when engine is hot. Refill to FULL mark on gauge. Run engine a few minutes and recheck oil level. If oil filter element is changed, one additional quart will be required. Drain plug is reached through plug hole in bottom of

**LUBRICATION**

hull. **CAUTION:** Be sure pressure gauge indicates oil is circulating. See Table.

5. **OIL FILTER.** Every 1,000 miles, drain filter through drain plug. Every 3,000 miles, remove, inspect and install new element if necessary. Every 8,000 miles, or less if oil becomes dirty, install new element. After renewing element, refill crankcase to FULL mark on gauge. Run engine a few minutes and recheck oil level.
6. **GEAR CASES.** Weekly, check level with truck on level ground and, if necessary, add lubricant to correct level; also make visual inspection for leakage and report leakage to ordnance maintenance personnel. Keep lubricant in differentials to level of lower filler plug. Vents located on front and both rear axles are extended by means of a flexible hose, to inside of hull. Make sure vents are not clogged. Drain, flush and refill at end of first 1,000 miles; thereafter as indicated at points on chart. When draining, drain immediately after operation. Plug holes are provided in bottom of hull through which drain plugs for transmission and transfer case may be reached.
7. **FRONT AXLE UNIVERSAL JOINTS.** Remove plug at top, lubricate through lower fitting until lubricant is visible at top plug hole. Replace plug.
8. **WHEEL BEARINGS (Front and rear).** Remove wheel, clean and repack bearings only. To clean and pack wheel bearings properly, they must be removed from the hub. Follow the procedure below:
  - a. **Front wheel bearings.**
    - (1) Remove the bearings from the hub and wash them in SOLVENT, dry-cleaning, until all the old lubricant is removed from both inside and outside of cage.
    - (2) Lay them aside to dry and wash the inside of the hub with SOLVENT, dry-cleaning.
    - (3) When bearings are thoroughly dry, pack the races with GREASE, general purpose No. 2, and reassemble in hub. To satisfactorily pack a bearing it is necessary to knead lubricant into space between the cage and inner race. Do not apply any lubricant to the inside of the hub. The lubricant packed in the bearing races is sufficient to provide lubrication until the next service period. An excess may result in leakage of the lubricant into the brake drum.
    - (4) Replace wheel and tighten adjusting nut until wheel binds. Back off the nut until wheel turns freely without side play. Lock adjusting nut into position.

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**b. Rear wheel bearings.** Rear axle is full-floating type and axle shaft must be removed to adjust wheel bearings.

(1) Unscrew axle shaft flange stud nuts which hold axle, remove axle shaft, oil seal and retainer.

(2) Release two lock nuts which hold bearings.

(3) Clean and pack bearings, using same procedure as for front wheel bearings above.

(4) Replace bearings and tighten inner lock nut until wheel binds. Back off nut  $\frac{1}{8}$  turn, or sufficiently to permit wheel to turn freely without side play.

(5) Replace second lock nut, tighten and test adjustment.

(6) Insert axle shaft in housing and make final test for adjustment. New oil seals must be used after axle has been disassembled for lubrication or repair. **CAUTION:** Stud nuts used to hold the wheel to the hub must not be lubricated.

9. **UNIVERSAL JOINTS AND SLIP JOINTS.** Apply GREASE, general purpose, seasonal grade, to joint until it overflows at relief valve, and to slip joint until lubricant is forced from end of slip joint. Universal and slip joints used on winch drive shaft are not provided with vents. Use hand gun to prevent damage to joint seals. On the front axle and forward rear axle, the universal joints are encased in large water-tight tubes and are covered by large rubber bellows where joints are connected to axle housing. These must be removed to lubricate these joints and splines. When lubricating, allow surplus lubricant to remain on joints before installing bellows.
10. **PROPELLER SHAFT CENTER BEARING.** Mounted on top of forward rear axle and reached from under hull. Lubricate through plug hole on top of unit with LUBRICANT, gear, universal, seasonal grade, to level of plug on side of unit.
11. **REAR SPRING CROSS SHAFT BEARINGS.** Every 5,000 miles, remove rear spring cross shaft seats and bearings, clean and repack with  $\frac{1}{2}$  pt. GREASE, general purpose No. 2.
12. **POWER CYLINDER.** Every 5,000 miles, remove plugs on top and at front of cylinder and lubricate with about one teaspoonful of OIL, engine, SAE 10.
13. **FUEL FILTER.** Every few days, remove drain plug to drain accumulated dirt. Remove element as necessary and wash in SOLVENT, dry-cleaning. **Caution: Do not drain into hull.**
14. **DISTRIBUTOR.** Every 500 miles refill grease cup with GREASE, general purpose No. 2, turn cup one full turn. Apply

**LUBRICATION**

few drops OIL, engine, crankcase grade to wick under rotor. Wipe breaker cam lightly with GREASE, general purpose, seasonal grade, and lubricate breaker arm pivot with OIL, engine, crankcase grade, sparingly.

15. **FRONT AND REAR SPRINGS.** Every 500 miles, paint sides with GREASE, graphite, light.
16. **OIL CAN POINTS.** Every 500 miles, lubricate spark and throttle control rod ends, sliding surface of winch jaw clutch, rudder steering cable pulleys, rudder control rod ends, pintle hook, all yokes and clevises, hinges, latches, etc., with OIL, engine, crankcase grade.
17. **POINTS REQUIRING NO PERIODIC LUBRICATION SERVICE.** Fan, water pump, generator, clutch pilot bearing, clutch release bearing, clutch shaft splines, steering column upper bearing, clutch shift fork ball stud, winch drive shaft support bearings, water propeller shaft drive center bearing, shock absorber links, power take-off.
18. **MANIFOLD HEAT CONTROL.** Every 500 miles, apply GREASE, graphite, light, to intake manifold gate valve, to prevent rusting.
19. **PINTLE HOOK SPRING.** Every 5,000 miles pack with water pump grease.

Section VII

**CARE AND PRESERVATION**

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Remove paint .....	52
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**46. RECORDS**

a. **Use.** An accurate record must be kept of each motor vehicle issued by the Ordnance Department. For this purpose the Ordnance Motor Book (0.0. Form No. 7255), generally called "Log Book," is issued with each vehicle and must accompany it at all times. This book furnishes a complete record of the vehicle from which valuable information concerning operation and maintenance costs, etc., is obtained and organization commanders must insist that correct entries be made. This book will habitually be kept in a canvas cover to prevent its being injured or soiled.

b. **Assignment Record.** The page bearing a record of assignment must be destroyed prior to entering the combat zone. All other references which may be posted regarding the identity of the organization must also be deleted.

**47. CLEANING**

a. Grit, dirt, and mud are the sources of greater wear to a vehicle. If deposits of dirt and grit are allowed to accumulate, particles will soon find their way into bearing surfaces, causing unnecessary wear, and if the condition is not remedied, will soon cause serious difficulty. When removing engine parts or any other unit, in making repairs and replacements, or if, in the course of inspection, working joints or bearing surfaces are to be exposed, all dirt and grit that might find its way to the exposed surfaces must first be carefully removed. The tools must be clean, and care must always be taken to eliminate the possibilities of brushing dirt or grit into the opening with the sleeve or other part of the clothing. To cut oil-soaked dirt and grit, hardened grit, or road oil, use dry cleaning solvent applied with cloths (not waste) or a brush. Care should be taken to keep water from the power unit, as it might interfere with proper ignition and carburetion. Detailed information on cleaning is included in TM 9-850.

b. Oil holes which have become clogged should be opened with a piece of wire. Wood should never be used for this purpose, as splinters

## CARE AND PRESERVATION

are likely to break off and permanently clog the passages. Particular care should be taken to clean and decontaminate vehicles that have been caught in a gas attack. See Section X, DECONTAMINATION, for details of this operation.

### 48. PAINT

a. Ordnance material is painted before issue to the using arms and one or more maintenance coats per year will ordinarily be ample for protection. With but few exceptions this material will be painted with ENAMEL, synthetic, olive drab, lusterless. The enamel may be applied over old coats of tung oil enamel and oil paint previously issued by the Ordnance Department if the old coat is in satisfactory condition for repainting.

b. Paints and enamels are usually issued ready for use and are applied by brush or spray. They may be brushed on satisfactorily when used unthinned in the original package consistency or when thinned no more than 5% by volume with THINNER. The enamel will spray satisfactorily when thinned with 15% by volume of THINNER, (linseed oil must not be used as a thinner since it will impart a luster not desired in this enamel). If syrayed, it dries hard enough for repainting within ½ hour and dries hard in 16 hours.

c. Complete information on painting is contained in TM 9-850.

### 49. PREPARATION FOR PAINTING

a. If the base coat on the material is in poor condition, it is more desirable to strip the old paint from the surface than to use sanding and touch-up methods. After stripping, it will then be necessary to apply a primer coat.

b. PRIMER ground, synthetic, should be used on wood as a base coat for synthetic enamel. It may be applied either by brushing or spraying. It will brush satisfactorily as received or after the addition of not more than 5% by volume of THINNER. It will be dry enough to touch in 30 minutes, and hard in 5 to 7 hours. For spraying, it may be thinned with not more than 15% by volume of THINNER. Lacquers must not be applied to the PRIMER, ground, synthetic, within less than 48 hours.

c. PRIMER, synthetic, rust inhibiting, for bare metal, should be used on metal as a base coat. Its use and application are similar to that outlined in paragraph (b) above.

d. The success of a job of painting depends partly on the selection of a suitable paint, but also largely upon the care used in preparing the surface prior to painting. All parts to be painted should be free from rust, dirt, grease, kerosene, oil, and alkali and must be dry.

### 50. PAINTING METAL SURFACES

a. If metal parts are in need of cleaning, they should be washed in

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a liquid solution consisting of 1/2 pound of SODA ASH in 8 quarts of warm water, or an equivalent solution, then rinsed in clear water and wiped thoroughly dry. Wood parts in need of cleaning should be treated in the same manner, but the alkaline solution must not be left on for more than a few minutes and the surfaces should be wiped dry as soon as they are washed clean. When artillery or automotive equipment is in fair condition and only marred in spots, the bad places should be touched with ENAMEL, synthetic, olive drab, lusterless and permitted to dry. The whole surface will then be sandpapered with PAPER, flint No. 1 and a finish coat of ENAMEL, synthetic, olive drab, lusterless applied and allowed to dry thoroughly before the material is used. If the equipment is in bad condition, all parts should be thoroughly sanded with PAPER, flint No. 2, or equivalent, given a coat of PRIMER, ground, synthetic, and permitted to dry for at least 16 hours. They will then be sandpapered with PAPER, flint No. 00, wiped free from dust and dirt, and final coat of ENAMEL, synthetic, olive drab, lusterless applied and allowed to dry thoroughly before the material is used.

**51. PAINT AS A CAMOUFLAGE**

a. Camouflage is now a major consideration in painting Ordnance vehicles, with rust prevention secondary. The camouflage plan at present employed utilizes three factors: color, gloss, and stenciling.

**(1) Color**

Vehicles are painted with ENAMEL, synthetic, olive drab, lusterless, which was chosen to blend in reasonably well with the average landscape.

**(2) Gloss**

The new lusterless enamel makes a vehicle difficult to see from the air or from relatively great distances over land. A vehicle painted with ordinary glossy paint can be detected more easily and at greater distance.

**(3) Stenciling**

White stencil numbers on vehicles have been eliminated because they can be photographed from the air. A blue drab stencil enamel is now used which cannot be so photographed. It is illegible to the eye at distances exceeding 75 feet.

**(4) Preserving camouflage**

(a) Continued friction or rubbing must be avoided, as it will smooth the surface and produce a gloss. Care should be taken to see that washing is done entirely with a sponge or a soft rag. The surface should never be rubbed or wiped, except while wet, or a gloss will develop.



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(b) It is not desirable that vehicles, painted with lusterless enamel, be kept as clean as vehicles were kept when glossy paint was used. A small amount of dust increases the camouflage value. Grease spots should be removed with SOLVENT, dry cleaning. Whatever portion of the spot cannot be so removed should be allowed to remain.

(c) Continued friction of wax-treated tarpaulins on the sides of a vehicle will also produce a gloss, which should be removed with SOLVENT, dry cleaning.

(d) Tests indicate that repainting with olive drab paint will be necessary once yearly, with blue drab paint twice yearly.

### 52. REMOVING PAINT

a. After repeated paintings, the paint may become so thick as to crack and scale off in places, presenting an unsightly appearance. If such is the case, remove the old paint by use of a lime-and-lye solution (see TM 9-850 for details) or REMOVER, paint and varnish. It is important that every trace of lye or other paint remover be completely rinsed off and that the equipment be perfectly dry before repainting is attempted. It is preferable that the use of lye solutions be limited to iron or steel parts. If used on wood, the lye solution must not be allowed to remain on the surface for more than a minute before being thoroughly rinsed off and the surface wiped with rags. Crevices or cracks in wood should be filled with putty and the wood sandpapered before refinishing. The surfaces thus prepared should be painted according to directions.

b. Be sure all rust is removed before painting procedures are followed.

### 53. PAINTING LUBRICATING DEVICES

a. Oil cups, grease fittings, oil holes, and similar lubricating devices, as well as a circle about three-fourths of an inch in diameter at each point of lubrication will be painted with ENAMEL, red, water resisting, in order that they may be readily located.

Section VIII

**VEHICLE EQUIPMENT**

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Care of tools and equipment.....	57

**54. VEHICLE TOOLS**

a. Following vehicle tools are stored in stern compartment:

Bag, Tool (1)	Screwdriver 6" (1)
Bar, Side Ring Removal (1) (Tire Rim)	Tool, Rim Side Ring (Tire Rim)
Gun, Lubrication (1)	Wrench, Adjustable (3 auto)
Hammer, 1 lb. Ball Pein (1)	Wrench, Adjustable End (12 crescent)
Handle, Wheel Nut Wrench (1)	Wrench, Double End (723) (1)
Jack and Handle (1)	Wrench, Double End (27S) (1)
Lever, Hand Crank (1)	Wrench, Double End (28S) (1)
Pliers, 6" Combination (1)	Wrench, Double End (731A) (1)
Screwdriver, #1 X-recess (1)	Wrench, Double End
Screwdriver, #2 X-recess (1)	(#25 heavy type) (1)
Screwdriver, #3 X-recess (1)	Wrench, Spark Plug (1)
Screwdriver, #4 X-recess (1)	Wrench, Wheel Bearing Nut (1)

**55. PIONEER TOOLS**

a. Following pioneer tools are stowed on the deck of hull:

Single Bit Axe (1) "D" Handle Shovels (2) Pick Mattock (1)

**56. EQUIPMENT**

a. Items listed below are carried inside vehicle and fastened in the most convenient available spaces:

Assembly, Anchor (1)	Extinguisher, Fire (2)
Assembly, Heavy Duty Snatch Block (2)	Gauges, Tire (attached to hose) (2)
Assembly, Rope (2)	Hose, Tire Inflation (2)
Assembly, Utility Tow Chain (1)	Kit, First Aid (1)
Book, Instruction (1)	Light, Flash (1)
Buckets, Canvas (2)	Pump, Hand Bilge (1)
Can, Oil (1)	Shear Pins, Winch (10)
Cord, Sash (100 ft.)	Sponges (2)
	Boat Hook (1)

**57. CARE OF TOOLS AND EQUIPMENT**

a. Before and after extensive water operation of tools and equipment which have been or will be subjected to water, should be thor-

**VEHICLE EQUIPMENT**

oughly lubricated and/or cleaned, as salt water has a deteriorating effect on material.

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**Important:** Tools and equipment mounted in and on this vehicle must be kept in good condition, as they are vital to the successful and safe operation of vehicle.

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Section IX

**DECONTAMINATION**

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**58. PROTECTIVE MEASURES**

a. When material is in constant danger of gas attack, unpainted metal parts will be lightly coated with engine oil. Instruments are included among the items to be protected by oil from chemical clouds or chemical shells, but ammunition is excluded. Care will be taken that the oil does not touch the optical parts of instruments or leather or canvas fittings. Material not in use will be protected with covers as far as possible. Ammunition will be kept in sealed container.

b. Ordinary fabrics offer practically no protection against mustard gas or lewisite. Rubber and oilcloth, for example, will be penetrated within a short time. The longer the period during which they are exposed, the greater the danger of wearing these articles. Rubber boots worn in an area contaminated with mustard gas may offer a grave danger to men who wear them several days after the bombardment. Impermeable clothing will resist penetration more than an hour, but should not be worn longer than this.

**59. CLEANING**

a. All unpainted metal parts of material that have been exposed to any gas except mustard and lewisite must be cleaned as soon as possible with SOLVENT, dry cleaning, or ALCOHOL, and wiped dry. All parts should then be coated with engine oil.

b. Ammunition which has been exposed to gas must be thoroughly cleaned before it can be fired. To clean ammunition use AGENT, decontaminating, noncorrosive, or if this is not available, strong soap and cool water. After cleaning, wipe all ammunition dry with clean rags. **Do not use dry powdered AGENT, decontaminating (chloride of lime) (used for decontaminating certain types of material on or near ammunition supplies), as flaming occurs through the use of chloride of lime on liquid mustard.**

**60. DECONTAMINATION**

a. For the removal of liquid chemicals (mustard, lewisite, etc.) from material, the following steps should be taken:

**b. Protective Measures**

(1) For all of these operations a complete suit of impermeable clothing and a service gas mask will be worn. Immediately after removal of the suit, a thorough bath with soap and water (preferably

## DECONTAMINATION

hot) must be taken. If any skin areas have come in contact with mustard, if even a very small drop of mustard gets into the eye, or if the vapor of mustard has been inhaled, it is imperative that complete first aid measures be given within 20 to 30 minutes after exposure. First aid instructions are given in TM 9-850 and FM 21-40.

(2) Garments exposed to mustard will be decontaminated. If the impermeable clothing has been exposed to vapor only, it may be decontaminated by hanging in the open air; preferably in sunlight, for several days. It may also be cleaned by steaming for two hours. If the impermeable clothing has been contaminated with liquid mustard, steaming for six to eight hours will be required. Various kinds of steaming devices can be improvised from materials available in the field.

### (c) Procedure

(1) Commence by freeing material of dirt through the use of sticks, rags, etc., which must be burned or buried immediately after this operation.

(2) If the surface of the material is coated with grease or heavy oil, this grease or oil should be removed before decontamination is begun. SOLVENT dry cleaning, or other available solvents for oil should be used with rags attached to ends of sticks.

(3) Decontaminate the painted surfaces of the material with bleaching solution made by mixing one part AGENT, decontaminating (chloride of lime), with one part water. This solution should be swabbed over all surfaces. Wash off thoroughly with water, then dry and oil all surfaces.

(4) All unpainted metal parts and instruments exposed to mustard or lewisite must be decontaminated with AGENT, decontaminating, noncorrosive, mixed one part solid to fifteen parts solvent (ACETYLENE TETRACHLORIDE). If this is not available, use warm water and soap. Bleaching solution must not be used, because of its corrosive action. Instrument lenses may be cleaned only with PAPER lens tissue, using a small amount of alcohol, ethyl. Coat all metal surfaces lightly with engine oil.

(5) In the event AGENT, decontaminating (chloride of lime) is not available, material may be temporarily cleaned with large volumes of hot water. However, mustard lying in joints or in leather or canvas webbing is not removed by this procedure and will remain a constant source of danger until the material can be properly decontaminated. All mustard washed from material in this manner lies unchanged on the ground necessitating that the contaminated area be plainly marked with warning signs before abandonment.

(6) The cleaning or decontaminating of material contaminated with lewisite will wash arsenic compounds into the soil, poisoning

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many water supplies in the locality for either men or animals.

(7) Leather or canvas webbing that has been contaminated should be scrubbed thoroughly with bleaching solution. In the event this treatment is insufficient, it may be necessary to burn or bury such material.

(8) Detailed information on decontamination is contained in FM 21-40, TM 9-850, and TC 38, 1941, Decontamination.

**61. SPECIAL PRECAUTIONS FOR AUTOMOTIVE MATERIAL**

a. When vehicles have been subjected to gas attack with the engine running, the air cleaner should be serviced by removing the oil, flushing with SOLVENT dry cleaning, and refilling with the proper grade of oil.

b. Instrument panels should be cleaned in the same manner as outlined for instruments.

c. Contaminated seat cushions will be discarded.

d. Washing the compartments thoroughly with bleaching solution is the most that can be done in the field. Operators should constantly be on the alert, when running under conditions of high temperature, for slow vaporization of the mustard or lewisite.

e. Exterior surfaces of vehicles will be decontaminated with bleaching solution. Repainting may be necessary after this operation.