

FIRST ECHELON

PREVENTIVE MAINTENANCE SERVICES

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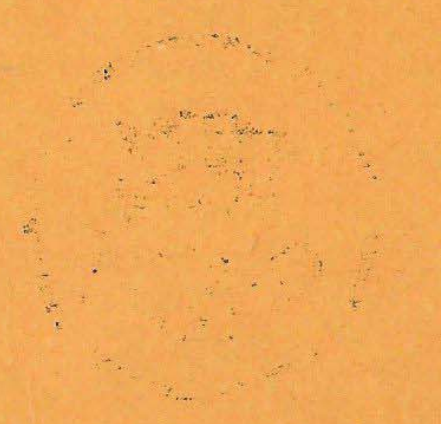
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**MOTOR VEHICLE INSPECTIONS AND PREVENTIVE
MAINTENANCE SERVICES**

CHAPTER 2

FIRST ECHELON PREVENTIVE MAINTENANCE

Section I

GENERAL

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5. ROLE OF THE DRIVER IN PREVENTIVE MAINTENANCE.

a. The vehicle driver (or crew) is the most important single factor in preventive maintenance. Only through him can the mechanic know what difficulties a piece of equipment is giving. If the driver (or crew) fails to take an interest in the vehicle, the vehicle and the efficiency of the company or unit will suffer.

b. Each driver is required to perform certain daily maintenance services on his vehicle as a matter of regular routine. The faithful performance of these services will do much to prolong the life of the vehicle, to avoid major repairs and overhaul by higher echelons, and will assure the driver that his vehicle will perform its missions consistently and dependably.

c. Preventive maintenance by the driver includes the following:

(1) Inspecting and servicing the vehicle in accordance with those operations listed on W.D., Form No. 48 (see par. 6 below).

(2) Repairing defects which the driver is capable of repairing, equipped to repair, and authorized to repair.

(3) Reporting defects whose repair is not a function of the driver.

(4) Prevention of vehicle abuse.

6. DRIVER'S DAILY PREVENTIVE MAINTENANCE SERVICES.

a. The items to be inspected and serviced, daily and weekly, by the driver are listed on the reverse side of W.D., Form No. 48, "Driver's Trip Ticket and P. M. Service Record" (figs. 2 and 3). These items cover both wheeled and half-track vehicles, and full-track and tank-like wheeled vehicles, as well as motorcycles, and are to be inspected and serviced according to those procedures in section II which apply to the particular vehicle, and according to the manual supplied with each vehicle.

GENERAL

b. Drivers must be trained to be thoroughly familiar with the items listed, and with the manner in which they are to be inspected and serviced. During the training period, Form No. 48 may be used as a check-list, but the items must be memorized so that the services will be performed automatically at the prescribed occasions, either before operation, during operation, at-halt operation, or after operation, as listed.

c. The general inspection and service of each item applies, also, to any supporting member, or connection, and usually includes a check to see whether or not the item is in good condition, correctly assembled, secure, or excessively worn.

(1) The inspection for "good condition" is usually an external visual inspection to determine whether or not the unit is damaged beyond safe or serviceable limits, or if it is in such a condition that damage will result upon operation. The term "good condition" is explained further by the following terms: not bent or twisted, not chafed or burned, not broken or cracked, not bare or frayed, not dented or collapsed, not torn or cut, and adequately lubricated.

(2) The inspection of a unit to see that it is "correctly assembled" is usually an external visual inspection to determine whether or not it is in its normal assembled position in the vehicle.

(3) The check of a unit to determine if it is "secure" is usually an external inspection, a hand-feel, a pry-bar, or wrench check for looseness in the unit. Such an inspection should include any brackets, lock washers, lock nuts, locking wires, or cotter pins used in the assembly.

(4) "Excessively worn" will be understood to mean worn close to or beyond serviceable limits, and likely to result in a failure if not replaced before the next scheduled inspection.

7. NECESSITY FOR SCHEDULED PREVENTIVE MAINTENANCE.

a. **Before-operation Services.** These services are performed on the vehicle to ascertain whether or not conditions have changed since the last After-operation Service. Many things can happen to a vehicle between the last check and the time it rolls again. Sabotage may be attempted; booby traps may be installed; another vehicle may back into it; a limb or some other object may fall on it; tires may go flat; moisture may ground the spark plugs; freezing may occur; engine oil, fuel, or water may leak out. Therefore, at least a quick check is necessary before the vehicle is again put into operation. The Before-operation Service should never be omitted, even in extreme tactical situations.

b. **During-operation Service.** The During-operation Service consists of detecting improper performance. On the march, it is important to notice unusual noises or odors, or unsatisfactory performance in vehicle operation, and to take corrective steps before the deficiencies develop to the point of actual breakdown.

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c. **At-halt Service.** During halts, the driver has an opportunity to correct or report any condition noticed during operation which was not serious enough to require action at the time. The object of the At-halt Service is to detect and correct deficiencies developed during operation. Some troubles are difficult to discover while rolling, therefore, advantage should be taken of every halt to locate and correct anything that may cause a fall-out after the march is resumed. The At-halt Service represents the irreducible minimum of preventive maintenance that must be performed to continue operation of vehicle. It may be regarded as minimum "battle maintenance" and should be performed under all tactical conditions, even though the more extensive services must be slighted or omitted altogether. Results of the At-halt Service should be reported promptly to the section leader or other designated authority.

d. **After-operation Service.** The purpose of the After-operation Service is to prepare the vehicle to operate again at a moment's notice. This preventive maintenance service is particularly important, because at this time, the driver inspects his vehicle thoroughly to detect any deficiencies that may have developed, and corrects those he is permitted to correct. He should report promptly to his section leader, or other designated authority, the results of his service. If this service is performed thoroughly, the vehicle should be ready to roll again on a moment's notice. The After-operation Service should never be entirely omitted even in extreme tactical situations, but may be reduced to the bare fundamental services outlined for the At-halt Service.

e. **Weekly Service.** The Weekly Service is designated to reinforce daily maintenance. It consists of the After-operation Services plus additional attention to certain designated items, including a general tightening, cleaning, and lubrication if required. This Weekly Service should include a detailed check by the section leader, and the company officer on the quality of maintenance performed by the drivers or crews.

CHAPTER 2

FIRST ECHELON PREVENTIVE MAINTENANCE (Cont'd)

Section II

PROCEDURES FOR SCHEDULED PREVENTIVE
MAINTENANCE SERVICES

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8. BEFORE-OPERATION SERVICE.

a. **General.** This service should never be entirely omitted, even in extreme tactical situations. If thoroughly trained, the driver or crew will go through it almost automatically so that a few moments will enable him to size up the condition of the vehicle.

b. **Procedures.** The Before-operation Service consists of inspecting the following items according to the procedures described below and correcting any deficiencies, or reporting them to the proper authority. Upon completion of the service, results should be reported promptly to the section leader, or other designated individual.

(1) **ITEM 1, TAMPERING AND DAMAGE.** Check for any injury to vehicle, items of special equipment, or armament. Check for any damage that may have occurred from falling debris, shell fire, sabotage, collision since parking the vehicle, or presence of booby traps. Raise hood, or open engine compartment doors, and look for signs of tampering or sabotage such as loosened or damaged accessories, or drive belts. Dry the spark plugs, distributor, or magnetos and wiring, if they are wet, to facilitate starting.

(2) **ITEM 2, FIRE EXTINGUISHER.** Check for tight mountings, full charge, corroded nozzles, and closed valves. Pay particular attention to extinguisher lines and nozzles in the engine compartment of tanks and tank-like wheeled vehicles, checking for damage and correct aiming.

(3) **ITEM 3, FUEL, OIL, AND WATER.** Check the amount of fuel in the tanks, noting any indications of leaks or tampering. Add fuel if necessary and check spare fuel cans. Check oil level. Add oil if necessary. Check level and condition of coolant. During period when anti-freeze is used, have hydrometer test made of coolant. Add antifreeze with water if required. *NOTE: Any appreciable change in levels since the last After-operation Service should be investigated and reported to designated authority.*

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(4) **ITEM 4, ACCESSORIES AND DRIVES.** Check all accessories such as carburetors, generators, regulators, starters, fans, shrouds, and water pumps for loose connections or mountings.

(5) **ITEM 5, AIR-BRAKE TANKS.** Check the air-brake reservoir tanks to see that they are secure and undamaged; and that all air-line connections are tight. Also be sure that water (condensation) has been drained from the tanks and that pet cocks are closed.

(6) **ITEM 6, LEAKS, GENERAL.** Check under the vehicle and in the engine compartment for any indications of fuel, oil, water, gear oil, or brake fluid leaks. Check the cooling system for indications of leaks, paying particular attention to radiator core and connecting hose. Check the engine crankcase, oil filters, oil tanks, oil coolers, and lines for indications of oil leaks. Check the fuel system for indications of leaks. Trace all leaks to their source and correct or report them to designated authority.

(7) **ITEM 7, ENGINE WARM-UP.** To test for hydrostatic lock on radial engines, before closing master battery switch, crank engines at least two complete revolutions by hand to determine whether any fluid is present in the lower cylinders. If the engine will not turn over readily, report condition to responsible person, and drain fluid from the lower cylinders through spark plug holes or pet cocks. **CAUTION:** *As a precaution against fire or explosion, before starting the engine, open the ventilators or hatches to be sure that the hull compartments, particularly engine compartment, are clear of fuel drippings and gas fumes.* Start the engine and note the action of the starter mechanism, particularly whether the starter has adequate cranking speed and engages and disengages properly without unusual noise when the starting control is operated. If oil pressure gage or signal light does not indicate properly within 30 seconds, the engine should be stopped and the trouble corrected or reported to proper authority. On motorcycles, which do not have an oil pressure indicating device, remove oil tank filler caps and check for proper oil circulation. Set the throttle so that the engine will run at normal (fast idle) warm-up speed and during the warm-up period, proceed with the following Before-operation Services. **CAUTION:** *Great damage will result if engine is placed under load before reaching normal operating temperature.*

(8) **ITEM 8, CHOKE OR PRIMER.** While starting the engine, check the operation of the choke or primer. As the engines warm up, reset the choke as required to prevent overchoking and dilution of engine oil.

(9) **ITEM 9, INSTRUMENTS.**

(a) **Oil Pressure Gage or Light Indicator.** Check the gage to see whether it indicates properly, and check the light indicator, to see whether it fails to go out. If these instruments fail to indicate properly, stop the engine immediately, investigate the cause, and report it to the proper authority.

(b) **Ammeter or Light Indicator.** The ammeter should show a high charging rate for the first few minutes after starting until the gen-

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erator restores to the battery the current used in starting. After this period, the ammeter should register a zero or slight positive charge with lights and accessories turned off and the engine operating at a fast idle. Any unusual drop or rise in reading should be investigated. A high charge reading for an extended period may indicate a dangerously low battery or faulty generator regulator. A light indicator should go out when the engine is running at fast idle with lights turned off.

(c) *Tachometer.* Observe whether tachometer is operating properly and indicating the approximate engine revolutions per minute. If there is a revolution counter, it should register the accumulating revolutions.

(d) *Fuel Gage.* Observe whether gage is operating properly. Normally, fuel tanks would have been filled after operation, and the gage should register FULL.

(e) *Air-brake Pressure Gage.* During the warm-up period, operate the engine at fast idle speed and observe whether the brake air pressure builds up at a normal rate to the specified maximum limits, and whether the governor then cuts off to stop compressing action. With the engine at normal idling speed, bleed the air pressure down by repeated brake application, and observe whether the governor cuts in the compressor within the specified limits. Again bleed down the air pressure and observe whether the low pressure indicator signals properly at the specified air pressure. Build up the air pressure again and observe whether the indicator signal stops as pressure is built up above the danger point.

(f) *Voltmeter.* Note whether voltmeter is operating properly. It should register at least the nominal battery voltage usually indicated by a red line on the face of the instrument.

(g) *Temperature Gage.* Engine temperature should increase gradually during the warm-up period. Extremely low temperature after a reasonable warm-up period may indicate existing troubles that should be investigated and corrected.

(10) **ITEM 10, HORN AND WINDSHIELD WIPER.** Press the horn or siren button (unless tactical situation prohibits), to see that the signal is normal. Check the windshield wipers for missing or damaged blades or arms, and note whether the blades contact the glass properly. Start the windshield wipers, checking to see that they operate normally through their full stroke.

(11) **ITEM 11, GLASS AND REAR VIEW MIRRORS.** Check for damaged glass, frames, or brackets. Clean mirror, and aim it properly; also clean the windshield and door glass.

(12) **ITEM 12, LAMPS (LIGHTS) AND REFLECTORS.** Within the limits permitted by the tactical situation, check operation of all switches and see that all lamps operate properly. Check to see that the lamps

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(lights) and warning reflectors are secure, and that lenses are clean and not broken.

(13) **ITEM 13, WHEEL AND FLANGE NUTS.** Check all wheel mountings and rim and axle flange nuts to see that they are secure.

(14) **ITEM 14, TIRES OR TRACKS.** All tires should be gaged and properly inflated before operation and spares properly secured in their carriers. On half- or full-track vehicles, inspect the tracks and bogie suspensions, rollers, sprockets, and idlers for any damage that may have developed since the last After-operation Service, through shell fire, accident, sabotage, or the elements. Also check for loose spring-loaded idler lock nuts, improper track tension, and loose wedge nuts.

(15) **ITEM 15, SPRINGS AND SUSPENSIONS.** Check the springs to see whether they have abnormal sag, broken or shifted leaves, loose or missing rebound clips, eyebolts, U-bolts, or shackles. Shock absorbers should be secure and not leaking; linkage should not be worn or bent.

(16) **ITEM 16, STEERING LINKAGE.** Inspect the steering gear and linkage to see that they are in condition for safe operation. Pay particular attention to the steering arms and steering linkage, looking for loose or bent parts. Apply both steering levers on full-track vehicles, and observe whether they both meet resistance slightly before or on reaching a vertical position. Check to see that the lever locking devices hold properly.

(17) **ITEM 17, FENDERS AND BUMPERS.** See that they are secure and in good condition.

(18) **ITEM 18, TOWING CONNECTIONS.** See that the truck tractor fifth wheel or pintle and lunette are in good condition. Be sure mountings and locking devices are secure; report any damage or deficiency that may have occurred. Check all towing shackles to see that they are in proper condition for safe operation.

(19) **ITEM 19, BODY, LOAD, AND TARPAULINS.** Inspect body for looseness and damage. See that ropes are lashed securely to hooks or rings and that load is evenly distributed. Inspect cargo carefully for damage, pilfering, or shifting.

(20) **ITEM 20, DECONTAMINATOR.** Check for tight mountings, full charge, and closed valves.

(21) **ITEM 21, TOOLS AND EQUIPMENT.** See that tools and equipment belonging to the vehicle are present, serviceable, and properly mounted or stowed. Check against vehicle stowage.

(22) **ITEM 22, ENGINE OPERATION.** If engine has not yet reached normal operating temperature, as indicated by the temperature gage, normal operating temperature may be assumed when the engine will operate under load with the choke fully released, and when the oil pressure gage indicates approximate normal operating pressure, during en-

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gine acceleration. Gradually accelerate engine several times after it has reached normal operating temperature, and note any unusual noise or unsatisfactory operating characteristics which would indicate trouble. Check dual engine installations as above.

(23) **ITEM 23, DRIVER'S PERMIT AND FORM No. 26.** Operator must make sure that driver's permit is in his possession and that Standard Form No. 26, "Driver's Report—Accident, Motor Transportation," Lubrication Guide, and vehicle manuals are present in the vehicle, and that they are legible and safely stowed.

(24) **ITEM 24, AMPHIBIAN SERVICES.** (Land Operation.) Perform any additional amphibian services peculiar to the vehicle involved. Refer to vehicle manual for procedures. **CAUTION:** *As a precaution against fire or explosion, before starting the engine, open the ventilators or hatches to be sure that the hull compartments, particularly the engine compartment, are clear of fuel drippings and gas fumes.*

(25) **ITEM 25, DURING-OPERATION CHECK.** The During-operation Services should start immediately, as soon as the vehicle is put in motion.

9. DURING-OPERATION SERVICE.

a. **General.** While the vehicle is in motion, a good driver (or crew) should listen for any sounds that may be a sign of trouble, such as rattles, knocks, squeals, or hums. He should look for steam from the radiator, and smoke from any part of the vehicle, and should know and be on the alert for the odor of an overheated generator, overheated brakes, overheated clutch, boiling coolant, fuel vapor from a leak in the fuel system, exhaust gas, or other such signs of trouble. Every time the brakes are used, gears shifted, or the vehicle turned, the driver should consider it a test, and note any unsatisfactory or unusual performance. A good driver should check the instruments constantly, and notice promptly if any instrument indicates that some unit may be operating improperly.

b. **Procedures.** The During-operation Service consists of observing the following items according to procedures described below, stopping the vehicle if serious trouble develops, and noting minor deficiencies to be corrected or reported at the earliest opportunity, usually the next scheduled halt.

(1) **ITEM 26, STEERING BRAKES.** When a full-track vehicle is first driven, after completion of the Before-operation Service, apply the steering brakes before attempting any appreciable speed to see whether they will stop the vehicle effectively, with the levers in approximately the vertical position, and whether they steer the vehicle satisfactorily with normal pull on the steering levers. Continue to make similar observations at all times during operation of the vehicle.

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(2) **ITEM 27, FOOT AND HAND BRAKES.** The foot brakes on wheeled and half-track vehicles should operate smoothly and effectively without pulling the vehicle to one side, leaving a satisfactory reserve of pedal travel available. Failure of brakes to hold vehicle may result from burned-out, wet, or greasy linings, or leaks in hydraulic brake system. When hydraulic brakes are applied in making a quick stop with full load at normal speed, the brake pedal should go no closer to the floorboard than approximately 1 to 2 inches. Make sure the hand brake is fully released when the vehicle is in motion. When the vehicle is stopped, the hand brake should hold the vehicle on a reasonable incline, leaving a reserve of one-third lever travel available.

(3) **ITEM 28, CLUTCH.** See that clutch does not grab, chatter, or squeal during engagement, or slip when fully engaged. Clutch pedal must have satisfactory free travel as specified by manual before it begins to disengage clutch. Otherwise, clutch may slip when under load. Too much free travel, however, may keep clutch from disengaging fully, thus causing transmission gear teeth to clash and be damaged when shifting.

(4) **ITEM 29, TRANSMISSION.** Gears must shift smoothly, operate quietly, and not creep out of mesh during operation. Jumping out of gear may indicate wear in shifting mechanism or gear teeth, or misalignment of transmission and clutch housing. On multiple transmission installations, all transmissions should be synchronized to shift simultaneously.

(5) **ITEM 30, TRANSFER.** Check this unit in the same manner as in item 29.

(6) **ITEM 31, ENGINE AND CONTROLS.** The driver must be on the alert for deficiencies in engine performance such as lack of usual power, misfiring, unusual noise or stalling, indications of engine overheating, or unusual exhaust smoke. Notice whether the engine responds to the controls satisfactorily, and see that the controls are in proper adjustment.

(7) **ITEM 32, INSTRUMENTS.** Observe the readings of all instruments frequently during operation to see whether they are indicating properly.

(a) *Temperature Gage.* See that the gage reads in normal range (except when operating under unusual conditions). Excessive engine heat may indicate trouble and should be investigated immediately.

(b) *Oil Pressure Gage.* In case of any unusual drop or no oil pressure, stop the vehicle immediately. Report trouble to proper authority for correction. Lack of oil pressure may indicate insufficient oil, leaks, loose bearings, or a defective oil pump; and may result in premature wear, or may damage the engine to the extent of failure. Where oil

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pressure signal light is used, as on a motorcycle, the light should remain off while engine is operating.

(c) *Viscometer*. See that indicator remains in the normal range section of the dial with engine at normal operating temperature. Report any abnormal reading.

(d) *Ammeter*. During operation, the ammeter must indicate a zero or a positive reading with all lights and accessories turned off. A discharge reading may indicate a faulty generator or regulator. When a signal light is used instead of an ammeter, the light should be off when the engine is operated at or above a fast idle.

(e) *Tachometer*. See that tachometer indicates the engine speed and accumulating revolutions (if there is a revolution counter) correctly at all times when the engine is running. The engine speed should not be allowed to exceed that specified on the caution plate. On dual-engine installations, both tachometers must register approximately the same revolutions per minute, which will indicate that the engine controls are synchronized properly.

(f) *Air-brake Pressure Gage*. See that gage indicates no more nor less than the specified governed air pressure (see vehicle manual).

(g) *Fuel Gage*. See that gage continues to indicate the approximate amount of fuel in the tank.

(h) *Speedometer and Odometer*. Speedometer must indicate the vehicle speed correctly at all times. See that vehicle is not allowed to exceed the speed for each gear range as specified on the caution plate. The odometer must register the total accumulated mileage.

(8) **ITEM 33, STEERING GEAR**. See that there is no excessive pulling to either side (except that due to crown of road) nor excessive wandering or shimmy of the vehicle. This may be caused by low tire pressure, excessive play in steering mechanism, excessive wear, loose parts, maladjustment, loose wheel bearings, or improper wheel alinement.

(9) **ITEM 34, RUNNING GEAR**. Listen for any unusual noise from wheels, axles, or from tracks and their wheels and supporting rollers.

(10) **ITEM 35, BODY AND TRAILER**. The driver must be on the alert for looseness of body or attachments, shifting load, abnormal sagging or tilting of the vehicle, loose top, tarpaulin or curtains, or unusual weaving of towed loads.

(11) **ITEM 36, GUNS: MOUNTINGS AND ELEVATING, TRAVERSING, GYRO, AND FIRING CONTROLS**. While the vehicle is in operation, but before it is used in combat, the designated members of the crew should check both manual and hydraulic turret-traversing and gun-elevating controls, stabilizer controls, and firing controls, to be sure that all mechanisms respond properly.

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(12) **ITEM 37, AMPHIBIAN SERVICES.** (Land operation.) Perform any additional amphibian services peculiar to the vehicle involved. Refer to vehicle manual for procedures.

10. AT-HALT SERVICE.

a. **General.** The At-halt Service may be regarded as minimum battle maintenance and must be performed under all tactical conditions even though the more extensive maintenance services may be slighted or omitted altogether.

b. **Procedures.** This service consists of investigating any deficiencies noted during operation, inspecting the following items according to the procedures described below, and correcting any deficiencies found. Upon completion of the preventive maintenance service, deficiencies not corrected must be reported promptly to the section leader or other designated individual.

(1) **ITEM 38, FUEL, OIL, AND WATER.** Check the fuel supply to see that it is adequate to operate vehicle to the next refueling point. When refueling, use safety precautions for grounding static electricity, and allow space for expansion in filler neck. Filler cap vents must be open, pressure cap valves must be free, and cap must be replaced securely. Check the crankcase oil level and, if necessary, add oil to proper level. Remove radiator filler cap, being careful of steam, especially if a pressure cap is used. Check coolant to see that it is at proper level, and replenish as necessary. Do not fill to overflowing, but leave sufficient space for expansion. If engine is hot, fill slowly while engine is running at a fast idle.

(2) **ITEM 39, TEMPERATURE: HUBS, BRAKE DRUMS, TRANSFER, TRANSMISSION, AND AXLES.** Place hand cautiously on each drum and wheel hub to see whether it is abnormally hot or cold. On track vehicles, check similarly the hubs, sprockets, idlers, and upper and lower rollers. An excessively hot drum may indicate dragging shoes or improper adjustment. An abnormally cool drum (by comparison with the others) may indicate brake is not functioning. If wheel hubs are too hot to grasp with the hand, bearings may be inadequately lubricated, damaged, or improperly adjusted. If wheel hubs are abnormally cold, test for possible looseness. A regular check of these items will go far to avoid premature failures or possible accidents. Check the transmission, transfer, differential, final drives, and axle housings for overheating or excessive oil leaks.

(3) **ITEM 40, AXLE AND TRANSFER VENTS.** Check the vents of these units to see that they are present and not damaged or clogged.

(4) **ITEM 41, PROPELLER SHAFTS.** Check for looseness, damage, oil leaks, and foreign material such as wire or brush.

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(5) ITEM 42, SPRINGS AND SUSPENSIONS. Check for broken or shifted spring coils or leaves, damaged or loose clips, U-bolts, eyebolts, shackles, shock-absorber linkage, and torque rods. On bogie suspensions, check arms, links, pins, wheels, and rollers for looseness or damage.

(6) ITEM 43, STEERING LINKAGE. Examine steering-control mechanism, arms, and linkage for damage or looseness, and investigate any irregularities noted during operation.

(7) ITEM 44, WHEEL AND FLANGE NUTS. Check to see that all wheel mounting and rim nuts and axle flange nuts are present and secure.

(8) ITEM 45, TIRES AND/OR TRACKS. Check for flats or damage. Remove nails, glass, or stones from treads and objects between duals. (Air pressures that have increased during operation should not be reduced.) On track vehicles, check tracks, bogie wheel tires, and bogies to see that they are secure and not damaged and that track tension is satisfactory. Remove stones and trash from tracks and bogies.

(9) ITEM 46, LEAKS, GENERAL. Check under the hood or in the engine compartment and beneath the vehicle for indications of leaks. Check to see whether oil is leaking from crankcase, oil tanks, oil coolers, filters, or lines. Check the cooling system for leaks, paying particular attention to the radiator core and connecting hose.

(10) ITEM 47, ACCESSORIES AND BELTS. Check to see that fan, water pump, and generator are secure and that all their drive belts are in correct adjustment and not damaged. Driver should adjust belts only in emergencies. Ordinarily he should report them for handling by the second echelon.

(11) ITEM 48, AIR CLEANERS. If operating under extremely dusty or sandy conditions, inspect the air cleaners and breather caps to see that they are in condition to deliver clean air properly. Service if necessary.

(12) ITEM 49, FENDERS AND BUMPERS. Check these items for looseness or damage.

(13) ITEM 50, TOWING CONNECTIONS. Check all towing connections to see that they are properly fastened and securely locked. Check for frayed or broken cables and damaged or missing attachment plugs. Make sure that support springs hold lines in a way to prevent chafing.

(14) ITEM 51, BODY, LOAD, AND TARPAULIN. Inspect vehicle body and trailed loads for shifting; also check the tarpaulins to see that they are properly secured and not damaged.

(15) ITEM 52, APPEARANCE AND GLASS. Clean windshield, door, and window glass, rear view mirror, light lenses, and inspect for damage.

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(16) ITEM 53, AMPHIBIAN SERVICES. (Land Operation.) Perform any additional amphibian services peculiar to the vehicle involved. Refer to vehicle manual for procedures.

11. AFTER-OPERATION AND WEEKLY SERVICE.

a. When performing the After-operation Service, the driver or crew must remember and consider any irregularities noticed during the day in the Before-operation Service, During-operation Service, and At-halt Services. Any units that require inspection or service while they are still at operating temperature should be inspected as soon as possible after parking the vehicle and before any interruption, such as mess or rest, allows the units to cool. The After-operation Service should never be entirely omitted even in extreme tactical situations but may be reduced to the bare fundamentals outlined for the At-halt Service. Weekly preventive maintenance which is performed in addition to the After-operation Service is a general tightening and check of certain factors that may affect vehicle performance. It also covers items that affect appearance but which are not likely to prevent vehicles from operating.

b. **Procedures.** The After-operation Service consists of inspecting the following items according to the procedures described below and correcting or reporting any deficiencies. Those items marked with an asterisk (*) will receive certain additional attention at the time of the weekly service, as described below. Upon completion of these services, results must be reported promptly to the section leader or other designated individual.

(1) ITEM 54, FUEL, OIL, AND WATER. Check coolant level and replenish as necessary, taking care to leave sufficient space for expansion. If an appreciable amount of coolant is required, have value of antifreeze checked. Fill fuel tanks, observing safety precautions for grounding static electricity, and bring engine oil to proper level. Refill spare fuel, oil, and water cans. If an unusual amount of oil or coolant is required for engine, check for leaks and report the condition. *NOTE: During period when antifreeze is in use, have hydrometer test made of coolant.*

(2) ITEM 55, ENGINE OPERATION. Check to see that the engine idles satisfactorily. Accelerate and decelerate the engine, and note any tendency to miss or backfire, or any unusual engine noise or vibration that might indicate worn parts, loose mountings, incorrect fuel mixture or faulty ignition. Correct or report any unsatisfactory engine-operating characteristics noted during operation.

(3) ITEM 56, INSTRUMENTS. Check all instruments to see that they are securely mounted, properly connected, and undamaged.

(4) ITEM 57, HORN AND WINDSHIELD WIPERS. Check the horn or siren to see that it is securely mounted and properly connected. Check

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to see that the arms and blades of windshield wipers are in good condition and that the wipers operate properly.

(5) **ITEM 58, GLASS AND REAR VIEW MIRRORS.** Clean the rear view mirrors, windshield, and other glass, checking to see that they are securely mounted and undamaged.

(6) **ITEM 59, LAMPS (LIGHTS) AND REFLECTORS.** Observe whether the lights operate properly with the switches at all ON positions and go out when switched off. Operate brake pedal and observe whether the stop lamp (light) functions properly. During blackouts, inspect lamps (lights) with the switch in the blackout position only. Be sure that all lamps (lights) are off after they have been inspected. Inspect all lenses and warning reflectors for dirt or damage; clean if necessary.

(7) **ITEM 60, FIRE EXTINGUISHERS.** Check to see that the entire system is in good condition and securely mounted. If the red blow-off seal on the valve head of the fire extinguisher is blown, or if the extinguisher has been used, report it for refill or replacement. Be sure the nozzles are cleaned of any obstructions such as dirt or corrosion.

(8) **ITEM 61, DECONTAMINATOR.** Check to see that it is in good condition and securely mounted.

(9) **ITEM 62, *BATTERY AND VOLTMETER.**

(a) Check the battery to see that it is clean, secure, and not leaking. Cables and vent caps should be clean and secure. Check the voltmeter to see whether it registers at least the nominal battery rating. This is usually indicated by a red line on the face of the instrument.

(b) *Weekly.* Clean dirt from top of battery. If terminal connections or posts are corroded, clean them thoroughly and apply fresh, thin coating of grease. Tighten terminal bolts if loose. Remove vent caps and check level of electrolyte. Add water if required, taking precautions so that battery will not be damaged during freezing temperatures. Battery should be secure, not bulging, cracked, or leaking electrolyte; battery carrier should be secure, clean, free of rust, and well painted. If mountings are loose, tighten them cautiously so as not to damage the battery case. Report any defects to designated authority.

(10) **ITEM 63, *ACCESSORIES AND BELTS.**

(a) Check all accessories such as carburetors, generators, regulators, starters, fans, shrouds, and water pumps for loose connections or mountings. Check adjustment of fan and accessory drive belts. Belts should deflect the amount specified in vehicle manual; loose or unserviceable belts should be reported to proper authority.

(b) *Weekly.* Tighten or adjust any loose connections, linkage, or mountings on accessories. Examine all belts for fraying, wear, cracking, or presence of oil. Check all belts half-way between their respective pulleys to determine whether the belts are properly adjusted. Loose

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belts may cause improper operation of accessories and may become damaged. Tight adjustment may cause damage to both accessories and belts. Ordinarily the driver should not adjust belts except in an emergency. Improper adjustment or unserviceable belts should be reported. On tanks and tank-like wheeled vehicles, also check any accessory drive shafts, couplings, or universal joints to see that they are secure and not leaking or damaged.

(11) ITEM 64, *ELECTRICAL WIRING.

(a) Check all ignition wiring to see that it is securely connected, clean, and not damaged.

(b) *Weekly.* Check all accessible wiring to see that it is securely connected and supported, that the insulation is not cracked or chafed, and that its conduits and shielding are in good condition and secure. Report any unserviceable wiring.

(12) ITEM 65, *AIR CLEANERS AND BREATHER CAPS.

(a) Check to see that the oil in the air cleaner is at the correct level and not excessively dirty. Excessive dirt in the oil may be felt with the fingers. It is not usually necessary to remove the air cleaner from the carburetor air horn to make this inspection. If the oil in the cleaner is excessively dirty, clean and refill with fresh oil. If operating in sandy or dusty territory, remove air cleaners and breather caps, and clean. In order to keep abrasive dirt out of the engine, air cleaners and breather caps must be kept clean and properly serviced at all times.

(b) *Weekly.* Remove and disassemble the air cleaners. Clean the bodies and elements in solvent. Fill the reservoirs to the correct level with clean engine oil. Apply engine oil to the elements and allow excess to drain. When reassembling the cleaners, make sure that all gaskets are in good condition and in place. Reinstall the air cleaners giving special attention to mountings to see that cleaners are pressed firmly in place against the air-horn seals, correctly aligned, and secure. Also check to see that all ducts connecting air cleaners to carburetors are secure and not damaged. Remove all breather caps and crankcase-filter cleaning elements. Wash them thoroughly in solvent, dip in engine oil, drain off the excess, and reinstall. If breathers are of the oil-bath type, clean and service them in the same manner as for the oil-bath air cleaners above.

(13) ITEM 66, *FUEL FILTERS.

(a) On Cuno-type filters, turn the handle one complete turn. Check all fuel filters for leaks.

(b) *Weekly.* On vehicles where the fuel tank is above the filter, close the shut-off valve in the fuel line. Remove the drain plug to allow water and sediment to drain out of the filter bowl. Then replace drain plug, tighten it securely, reopen shut-off valve in fuel line, and

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note whether fuel is leaking from the drain plug. On a filter with two plugs in bottom of bowl, the plug to one side is the drain plug.

(14) **ITEM 67, ENGINE CONTROLS.** Check for worn or disconnected linkage. Also correct or report any unsatisfactory engine control linkage operation noted during operation.

(15) **ITEM 68, *TIRES AND/OR TRACKS.**

(a) Remove all foreign matter such as nails, glass, or stones from tires or from between duals. Inspect tires for signs of low pressure, abnormal tread wear, cuts, position of valve stems, and presence of valve caps. Correct deficiencies noted and replace missing valve caps. Examine tracks for worn or bent guides, loose wedge nuts, and improper track adjustment.

(b) *Weekly.* Remove badly worn or injured tires for repair and tires worn smooth for retreading, and exchange for new or serviceable tires. Check for proper matching and irregular wear, and change position of tires as required. On tracks, tighten all loose wedge nuts securely. Check track blocks, connectors, and wedges for excessive wear. Check track adjustment according to specifications in vehicle manual. Adjust if necessary.

(16) **ITEM 69, *SPRINGS AND SUSPENSIONS.**

(a) Check the springs to see whether they have abnormal sag, broken or shifted leaves, loose or missing rebound clips, eyebolts, U-bolts, or shackles. Also check shock absorbers and any torque rods to see that they are secure and not damaged. On track vehicles, inspect bogie frame and arms, upper and lower rollers, and solid rubber tires for looseness, wear, or damage. Inspect the sprockets and idler wheels for loose mounting and assembly bolts, and loose spring-loaded idler lock nuts. Check for oil leaks at seals or gaskets. Remove all stones and trash lodged in the assemblies.

(b) *Weekly.* Tighten or report any springs that have abnormal sag, broken or shifted leaves, loose or missing rebound clips, eyebolts, U-bolts, shackles, and torque rods. On track vehicles, tighten bogie crab, connecting link, arm, roller bolt nuts, and spring-loaded idler lock nuts. Examine condition of the guides, sprockets, idlers, and rollers for wear and damage, and report any defects.

(17) **ITEM 70, STEERING LINKAGE.** Check the steering linkage to see whether parts are bent, loose, or inadequately lubricated. Note and report any steering stop screws which are not serviceable. Also check steering knuckles and steering gear cases for leaks.

(18) **ITEM 71, PROPELLER SHAFTS, CENTER BEARINGS, AND VENT.** Check these items for loose connections, lubricant leaks, and damage, paying particular attention to loose mountings and blocked vents.

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(19) **ITEM 72, *AXLE AND TRANSFER VENTS.**

(a) Check all axle housings and transfer vents to see that they are present, in good condition, and secure. Free all breather vents of obstructions.

(b) *Weekly.* Clean all vents thoroughly. If a vent is equipped with a cleaning element, it should be removed and cleaned in the same manner as any other air cleaner.

(20) **ITEM 73, LEAKS, GENERAL.** Check under the hood or in the engine compartment and beneath the vehicle for indications of fuel, oil, or water leaks. Check around brake drums and axle flanges for indications of lubricant leaks. Trace all leaks to their source and correct or report them.

(21) **ITEM 74, GEAR OIL LEVELS.** Check differentials, final drives, transmissions, and transfer units for lubricant level and leaks. Refer to vehicle manual for correct lubricant levels. This should not be done until these units have cooled, at least enough to permit the hand to be held on them. Hot or foamy lubricant will not give a true lubricant-level indication. Motorcycles should be on rear stand for this check.

(22) **ITEM 75, *AIR-BRAKE TANKS.**

(a) Open pet cocks to drain water (condensation). Check to see that tanks and air-line connections are secure.

(b) *Weekly.* Tighten tank mounting and all air-line connections that are loose. Clean air-line rubber hose of any grease or oil.

(23) **ITEM 76, FENDERS AND BUMPERS.** Check these items to see that they are in good condition and secure.

(24) **ITEM 77, *TOWING CONNECTIONS.**

(a) Inspect towing hooks, truck tractor fifth wheel, or pintle hook and safety chains for looseness or damage. Also check to see that the safety chains are connected correctly to vehicle and trailer.

(b) *Weekly.* Lower the trailer landing gear, observing whether it operates properly, is adequately lubricated, not damaged, and secure. Unhitch the trailer. Clean the contacting surfaces of the fifth wheel, upper plate, and king pin thoroughly. Inspect them for wear and damage, and apply a fresh coating of clean grease. Tighten all mounting bolts. Rehitch the trailer, noticing whether the hand lever works easily, and whether the latching mechanism closes completely and latches securely.

(25) **ITEM 78, BODY, LOAD, AND TARPAULIN.** Inspect the cargo body carefully for damage or loose parts. The load should be evenly distributed and secure. Tarpaulin should cover the load to protect it against the elements. All ropes should be lashed securely to hooks or rings. Check tarpaulin and curtains for rips or holes, missing or worn grommets, and ropes.

(26) **ITEM 79, ARMOR AND FRONT ROLLER.** Inspect for damage, broken welds, and loose mounting bolts, screws, or rivets. Check to see

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that the front roller can be revolved. Check door and windshield armor shields, compartment doors, and peep-hole and pistol-port covers for damage; also check their hinges, latches, and supports for proper functioning. Check radiator shutters for damage and proper operation of controls. Report any damaged or missing parts. Tighten all loose bolts, nuts, or screws securely.

(27) **ITEM 80, VISION DEVICES.** On combat vehicles, check all periscopes and protectoscopes for damage to covers, lenses, and prisms; see that they are secure in their holders and that all mountings are tight. If necessary, clean lenses and prisms according to specific instructions. See that adequate spares are present, in good condition, and properly stowed.

(28) **ITEM 81, TURRET AND GUN: MOUNTING AND ELEVATING, STABILIZER, TRAVERSING, AND FIRING CONTROLS.** The designated members of the crew should check all mounted guns to see that they are secure on their mounts, clean, lightly oiled, and in condition for immediate use. Check gun-elevating mechanism and firing controls for proper operation. Check the stabilizer and gun-traversing mechanism as follows: Check the level of oil in the reservoir (must be two-thirds full). Check all exposed wiring to see that it is secure and not damaged. Check packing glands, oil lines, piston and cylinder assembly, and drain plugs for leaks. Check both manual and hydraulic traversing mechanism to see that it is in good condition and operates properly. Report any deficiencies noted to proper authority.

(29) **ITEM 82, *TIGHTEN: WHEEL, RIM, AXLE DRIVE FLANGE AND SPRING U-BOLT NUTS.**

(a) Tighten all loose wheel mountings, rim nuts, and axle drive flange and spring U-bolt nuts, or any other point where inspection indicates the necessity. Report any damaged wheels, rims, rings, or flanges, or missing nuts and studs.

(b) *Weekly.* On duals, be sure to tighten the inner nuts as well as outer nuts.

(30) **ITEM 83, LUBRICATE AS NEEDED.**

(a) Items such as shackles, steering linkage, hinges, latches, and other points that are lubricated by the driver should be lubricated if inspection indicates it is necessary.

(b) *Weekly.* Lubricate in accordance with the Lubrication Guide. Lubricate all points shown on Lubrication Guide requiring weekly lubrication, and all other points where experience and inspection indicate a need for lubrication. The need for more frequent lubrication than is provided by the regular lubrication schedule is usually due to abnormally hot, wet, or dusty operating conditions.

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(31) ITEM 84, *CLEAN ENGINE AND VEHICLE.

(a) Clean dirt and trash from inside of cab and body. Remove excessive dirt or grease from the exterior of the engine. Thoroughly clean the interior of the fighting compartment on tanks also.

(b) *Weekly.* Wash the vehicle when possible. If not possible, wipe off thoroughly. Do not rub lusterless paint enough to create a shine that might cause reflection. If the vehicle is washed in a stream, river, or lake, care must be taken to see that water or dirt does not get into the wheel bearings, gear cases, or brakes.

(c) On tanks, clean all dirt, trash, fuel, and oil drippings from the engine compartment, being particularly careful to remove dirt and trash from between the lower cylinders of radial engines and the compartment floor. Also clean fighting compartment in same manner, being sure to remove all dirt or grease smears from the walls and floor.

(32) ITEM 85, *TOOLS AND EQUIPMENT.

(a) Check vehicle stowage lists to see that all tools and equipment assigned to vehicle are present and properly stowed or mounted.

(b) *Weekly.* Clean all tools and equipment of rust, mud, or dirt and see that they are in good condition. Report missing or unserviceable items to proper authority.

(33) ITEM 86, *AMPHIBIAN SERVICES (LAND OPERATION).

(a) Perform any additional amphibian services peculiar to the vehicle involved. Refer to vehicle manual for procedures. **NOTE:** *Check the hull compartments to see that they are properly ventilated and that there is no accumulation of explosive or inflammable gases indicated by strong gaseous odors. If there are any such odors, their source should be located, and the trouble corrected or reported to designated authority.*

(b) *Weekly.* Perform any additional weekly amphibian services peculiar to the vehicle involved. Refer to vehicle manual for procedures. Clean hull compartments thoroughly of all fuel, oil, or water, so that they will be free of explosive or inflammable gases. Report or correct excessive leaks to designated authority.

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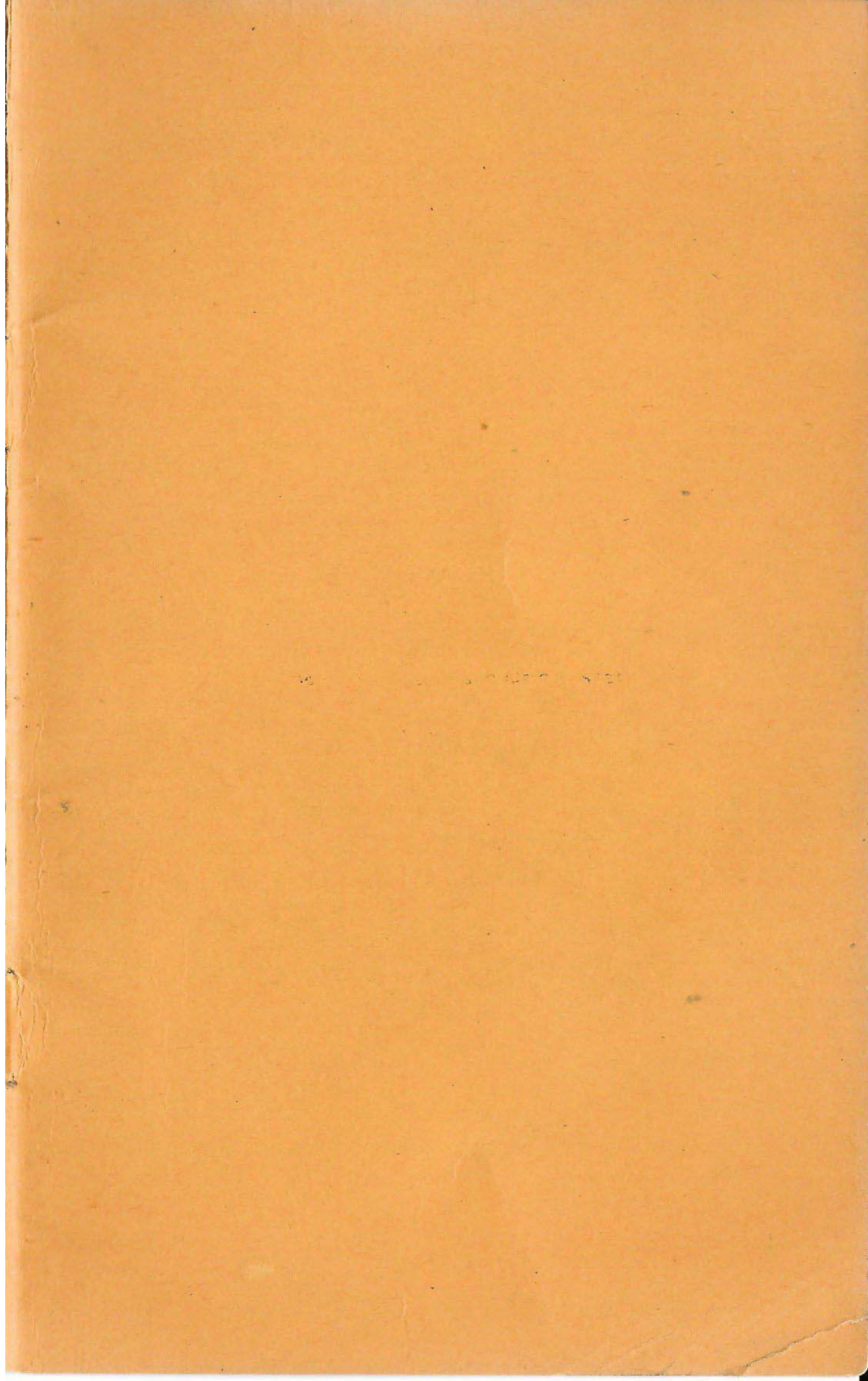
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