

***RESTRICTED***

**TM 9-1705**

**WAR DEPARTMENT**

**TECHNICAL MANUAL**



**ORDNANCE MAINTENANCE**

**POWER TRAIN**

**(AXLES, PROPELLER SHAFTS,  
TRANSFER CASE, TRANSMISSION)**

**FOR SCOUT CAR M3A1**

**August 20, 1942**



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**ORDNANCE MAINTENANCE**

**POWER TRAIN (AXLES, PROPELLER SHAFTS, TRANSFER  
 CASE, TRANSMISSION) FOR SCOUT CAR M3A1**

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**SECTION I****GENERAL**

	Paragraph
Scope.....	1

1. **Scope.**—*a. General.*—This manual is published for the information and guidance of ordnance maintenance personnel, and is the first of several maintenance manuals on these vehicles. It contains detailed instructions for inspection, disassembly, assembly, maintenance, and repair of the power train (axles, propeller shafts, transfer case, transmission) for scout car M3A1 supplementary to those in the Field Manuals and Technicals Manuals prepared for the using arms. Additional descriptive matter and illustrations are included to aid in providing a complete working knowledge of the matériel.

*b. Vehicle generally.*—Information is also included concerning the service maintenance, technical inspection, and lubrication of the entire vehicle.

*c. Chassis and body.*—For maintenance information concerning the chassis and body components, see TM 9-1709.

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*d. Power plant.*—For maintenance information concerning the engine and its accessories, see TM 9-1706 for the Hercules gasoline engine, model JXD; TM 9-1707, for the Hercules Diesel engine, model DJXD; and TM 9-1708, for the Buda Diesel engine, model 6DT317.

**SECTION II****SERVICE MAINTENANCE**

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**2. Objective.**—There is a distinct difference between the missions of organizational maintenance and those of service maintenance. Organizational maintenance by the using arms has for its prime objective the routine preventive maintenance, care, and adjustment of vehicles so they will be in good operating condition at all times with a minimum loss of time for repairs. Service maintenance by light and heavy maintenance organizations of the Quartermaster Corps and Ordnance Department has for its prime objectives supply, technical inspection, corrective action, and repair beyond the capacity of the using arms. This repair is accomplished by unit replacement, overhauling, rebuilding, reclaiming, manufacturing, or any other methods considered suitable.

**3. Scope.**—The scope of maintenance and repair by maintenance personnel is determined by the ease with which the project can be accomplished, the amount of time available, weather conditions, concealment, shelter, proximity to hostile fire, equipment, tools and parts available, and skill of the personnel. As all of these factors are variable, no exact system or procedure can be prescribed or followed.

**4. Allocation of repair jobs.**—The following operations augment those which may be performed by the using arms:

*a. Front and rear axles.*—(1) *Alinement.*—Check and adjust for camber and caster.

(2) *Axle assembly.*—Replace, repair, or rebuild.

(3) *Axle housings.*—Repair, weld, machine, and aline.

(4) *Gear and pinions.*—Adjust or replace.

(5) *Steering knuckles.*—Replace or rebush.

(6) *Wheel turning stop.*—Adjust.

*b. Body.*—See TM 9-1709.

*c. Brakes.*—See TM 9-1709.

*d. Cooling system.*—See TM 9-1706, 9-1707, or 9-1708.

- e. Electric generating and starting system.*—See TM 9-1707 or 9-1708.
- f. Electric ignition system.*—See TM 9-1706, 9-1707, or 9-1708
- g. Electric lighting system and accessories.*—See TM 9-1709.
- h. Engine.*—See TM 9-1706, 9-1707, or 9-1708.
- i. Frame.*—See TM 9-1709.
- j. Fuel system.*—See TM 9-1706, 9-1707, 9-1708, or 9-1709.
- k. Instruments.*—See TM 9-1709.
- l. Propeller shafts.*—Repair or rebuild.
- m. Springs and shock absorbers.*—See TM 9-1709.
- n. Steering gear.*—See TM 9-1709.
- o. Transfer case components.*—Replace, repair, or rebuild.
- p. Transmission.*—(1) *Shift levers.*—Repair.  
(2) *Transmission components.*—Replace, repair, or rebuild.
- q. Wheels.*—See TM 9-1709.

## SECTION III

## TECHNICAL INSPECTION

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**5. Description.**—Technical inspections are a follow-up and check on organizational maintenance, inspection, and other maintenance functions. They determine whether the vehicle should be continued in service or withdrawn for overhaul. These inspections are covered in AR 850-15.

**6. Inspection form** (fig. 1).—W. D., Q. M. C. Form No. 260 (Technical Inspection Report of Motor Vehicles) is the standard and official form for recording the inspection of all motor vehicles, including combat vehicles of the Ordnance Department. The extent to which use is made of this form or its modifications depends entirely on the technical ability of available personnel, the time factor, and test and shop equipment available.

**7. Practical application.**—This paragraph contains inspection operations that pertain only to the power train.

*a. External inspection of body and frame components.*—(1) *Toe-in.*—Check (see sec. V).

(2) *Caster and camber.*—Check (see sec. V).

*b. External inspection of chassis components.*—(1) *Front axle.*—Inspect for straightness. Shake wheels to check for “wobble.”

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WAR DEPARTMENT  
GMC Form No. 889  
App. Oct. 14, 1938

## TECHNICAL INSPECTION REPORT OF MOTOR VEHICLES

This form indicates the scope of complete technical inspection of all motor vehicles for all echelons. It does not prescribe a required routine of procedure. Items will be checked to the extent of ability of personnel and adequacy of equipment available.

Date \_\_\_\_\_

Vehicle nomenclature \_\_\_\_\_

U. S. A. Registration No. \_\_\_\_\_ Mileage \_\_\_\_\_

Organization \_\_\_\_\_ Station \_\_\_\_\_

Supply arm or service maintaining vehicle \_\_\_\_\_

(Check V, is satisfactory, X adjustment made, XX repair or replacement needed)

<b>EXTERNAL INSPECTION</b>	<b>HOIST VEHICLE (if practicable)</b> (Except full track and rear end of half-track vehicles)	94. Starting motor _____
1. Bumpers _____	49. Axle, front _____	95. Switch, battery* _____
2. Boards, running _____	50. Axle, frt. drive, lubr'n _____	96. Switch, ignition _____
3. Body _____	51. Axle, rear _____	97. Switch, mesh. starter* _____
4. Bows _____	52. Axle, rear, lubr'n _____	98. Switch, sol. starter* _____
5. Camber** _____	53. Body, bolts _____	99. Switch, starter _____
6. Carrier, tire _____	54. Engine, side pans _____	100. Tachometer* _____
7. Caster** _____	55. Frame, distortion _____	101. Tools _____
8. Curtains _____	56. Frame, rivets _____	102. Throttle _____
9. Doors _____	57. Joints, universal _____	103. Upholstery _____
10. Fenders _____	58. Lines, brake (hydr.-air) _____	104. Wiper, windshield _____
11. Gate, tail _____	59. Linkage, brake (mech.) _____	105. Viscometer _____
12. Glass _____	60. Linkage, steering _____	106. Voltmeter* _____
13. Guards, headlight _____	61. Shafts, propeller _____	107. _____
14. Guard, radiator _____	62. Spring, front assembly _____	108. _____
15. Hood _____	63. Spring, rear assembly _____	<b>HOOD UP (ENGINE RUNNING)</b>
16. Hooks, tow _____	64. Shock absorbers, fill _____	109. Engine noise _____
17. Lights _____	65. Tank, air _____	110. Engine, smoothness _____
18. Paint _____	66. Trf. case-sub-trans. _____	111. Engine mounting _____
19. Pintles _____	67. Trf. case-sub-tr, lubr'n _____	112. Gaskets (all) _____
20. Radiator _____	68. Transmission _____	113. Leaks, fuel _____
21. Tires _____	69. Transmission, lubr'n _____	114. Leaks, oil _____
22. Top _____	70. Wheels, front, adjustment and trueness _____	115. Leaks, water _____
23. Toe-in _____	71. Wheels, front, lubr'n _____	116. Valves, noise _____
24. _____	72. Wheels, rear _____	117. Wiring, ignition _____
25. _____	73. _____	118. Wiring, other _____
<b>HOOD UP (ENGINE STOPPED)</b>	74. _____	119. _____
26. Antifreeze _____	75. _____	120. _____
27. Assembly, breaker pt. _____	<b>INTERNAL INSP. (START ENGINE)</b>	121. _____
28. Baffles, inter-cyl.* _____	76. Ammeter _____	<b>ROAD TEST VEHICLE</b>
29. Battery _____	77. Accelerator _____	122. Body, noise _____
30. Belt, fan _____	78. Choke _____	123. Brakes, hand _____
31. Cleaner, air _____	79. Cut-out _____	124. Brakes, service _____
32. Compressor, air _____	80. Extinguisher, fire _____	125. Brakes, steering* _____
33. Engine, oil _____	81. Filter, trans. oil* _____	126. Clutch _____
34. Fan, cooling _____	82. Gage, air _____	127. Drive units, noise _____
35. Filter, fuel _____	83. Gage, fuel _____	128. Engine, noise _____
36. Filter, oil (external) _____	84. Gage, oil _____	129. Engine, smoothness _____
37. Filter, oil (in eng.)* _____	85. Generator _____	130. Engine, power _____
38. Fluid, brake _____	86. Horn _____	131. Gear shift _____
39. Governor, seal _____	87. Indicator, heat _____	132. Governor _____
40. Housing, steering gear _____	88. Insulation, hull* _____	133. Shock absorbers _____
41. Pump, water _____	89. Lights _____	134. Speedometer _____
42. Shroud, engine* _____	90. Pad, protecting* _____	135. Steering mechanism _____
43. Spark plugs _____	91. Protector, peep hole* _____	136. _____
44. Strainer, fuel pump _____	92. Pump, priming* _____	137. _____
45. Strainer, scavenge oil* _____	93. Seats, troop _____	138. _____
46. System, fire exting.* _____		139. _____
47. _____		140. _____
48. _____		

\* Ordnance vehicles.

\*\* Normally M4 and M4A3 echelons.

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RA PD 547A

FIGURE 1.—Technical inspection form.

Inspect cross tube. Check for oil leaks and cracked housings. Test all nuts with wrench. Inspect brush guards and universal joint dust shields. Check presence of necessary plugs and lubrication fittings and evidence of proper lubrication. Inspect breather.

(2) *Wheels*.—Check all wheel nuts with wrench. Check lubrication of bearings.

(3) *Transfer case*.—Inspect for leaks and cracked case. Test all bolts with wrench. Check presence of necessary plugs and lubrication of fittings and evidence of proper lubrication. Inspect breather.

(4) *Transmission*.—Inspect for leaks and cracked case. Test all bolts with wrench. Check presence of necessary plugs and lubrication of fittings and evidence of proper lubrication. Inspect breather.

(5) *Propeller shafts*.—Inspect for distortion and fractures. Examine flanges. Test all nuts with wrench. Tighten dust caps. Check lubrication and relief valves.

(6) *Rear axle*.—Check for oil leaks and cracked housings. Test all nuts with wrench. Check presence of necessary plugs and lubrication fittings and evidence of proper lubrication. Inspect breather.

(7) *Clutch*.—Check for smoothness of operation. Test for effectiveness by setting drive shaft brake, or using the service brakes, putting the vehicle in low gear, and releasing the clutch pedal gradually: if the clutch is efficient, the engine should stall.

(8) *Gear box*.—Listen to transmission and transfer case gears for a high-pitched whine or squeal which indicates internal misalignment or improper adjustment. In shifting gears, it is usual for the two lower speeds to be much noisier in operation than high gear. Unusual noises in the transmission when operating in the high gears should be investigated immediately to avoid severe damage.

(9) *Gear shift*.—Check to see that the gear shift levers are fastened firmly in their retaining sockets and that the gear shift forks on the lower end of the levers move properly through all gear changes selected.

## SECTION IV

### LUBRICATION

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**8. General.**—Lubrication is an essential part of preventive maintenance, determining to a great extent the serviceability of parts and

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assemblies. Lubrication or the lack of it influences repairs and operations materially and is one of the most important factors affecting dependable service and useful vehicle life. Refer to OFSB 6-1 for a description of the ordnance lubrication program.

**9. Schedules.**—*a. Records.*—A complete record of lubrication will be kept for every vehicle. Responsible personnel will execute a check sheet at regular intervals to indicate the actual mileage and date at which each component receives such attention as prescribed (fig. 2).

*b. Supplies.*—Lubricants and application equipment should conform to the recommendations of responsible manufacturers or the supply services concerned. Refer to OFSB 6-4 for the product guide. During field service, it may not be possible to supply a complete assortment of lubricants called for by the schedule to meet the recommendations, and it will be necessary to make the best use of those available, subject to inspection by the motor officer concerned in consultation with responsible ordnance personnel.

**10. Methods.**—*a. Application.*—Refer to OFSB 6-2 for general lubricating instructions.

*b. Low temperature lubrication.*—Refer to section III, OFSB 6-G-3, for information which supplements the lubrication guides in connection with chassis, crankcase, and gear lubricants utilized in temperatures below minus 10° F.

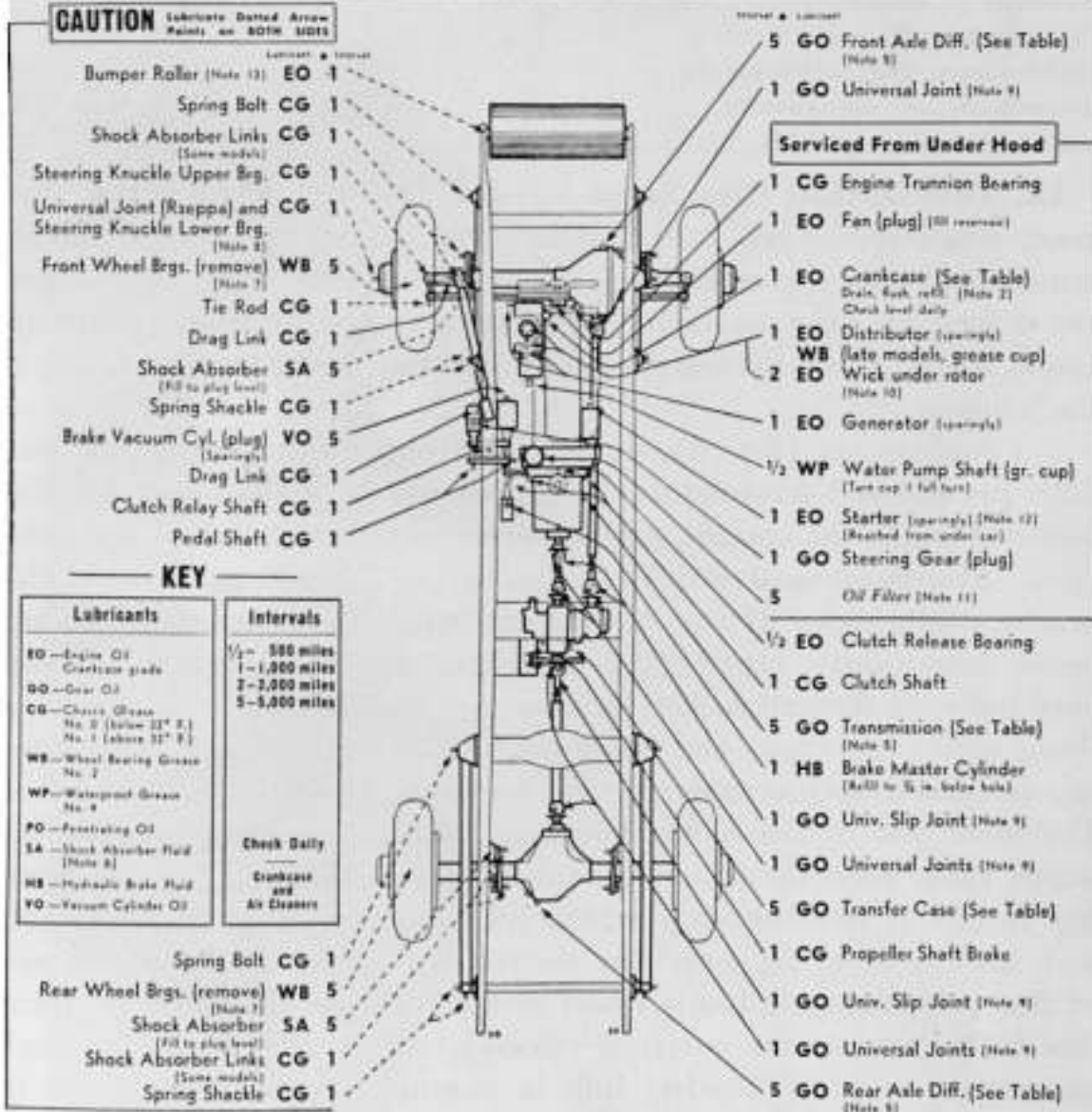
*c. Rubber parts.*—Friction and vibration tend to develop squeaks, groans, and improper fitting of rubber chassis parts, instrument panel accessories, and engine mounts. Lubricants such as mineral oil, castor oil, engine oil, or other greases must not be used because they tend to swell or rot the rubber. A satisfactory lubricant can be made by mixing colloidal graphite with ethylene glycol or glycerine and adding enough water to prevent rapid drying before the solution has penetrated. The solution can be applied with an ordinary spray, but a needle spray will be needed to force the lubricant between parts having close clearance. Rubber parts which are used to keep other parts from slipping or rotating should not be lubricated.

**11. Engine lubrication system.**—See TM 9-1706, 9-1707, or 9-1708.



TABLE OF CAPACITIES AND RECOMMENDATIONS

	Capacity	Lowest Expected Atmospheric Temperature					
		Above 90°	+32°	+10°	-10°	-30°	Below -30°
Crankcase	4 qt.	30	30	30	10	For operation in these temperature ranges, refer to OFSB 6-G-67 supplement.	
Transmission	5 qt.	140	140	90	60		
Differential (front)	4 1/2 qt.						
Differential (rear)	3 qt.						
Transfer Case	3 qt.						



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

1. **AIR CLEANERS**—(Engine) Check level and refill as required. Drain, clean and refill every 100 to 1,000 miles, depending on operating conditions. Every 2,000 miles, also remove air cleaner and wash all parts. (Brake Vacuum Cylinder) Every 3 months remove brake vacuum cylinder air cleaner, located under hood, clean hair and rest with EO.

2. **CRANKCASE**—Drain only when engine is hot. Flush with 4 qt. SAE 15, 16 or engine 5 minutes and drain. Refill to FULL mark on gage. CAUTION: Be sure pressure gage indicates oil is circulating. See Table.

3. **INTERVALS** indicated are for normal service. For extreme conditions of speed, heat, water, mud, snow, rough roads, dust, etc., change crankcase oil and lubricate more frequently.

4. **FITTINGS**—Clean before applying lubricant. Lubricate every 100 miles.

5. **GEAR CASES**—Check level every 1,000 miles, add lubricant if necessary. Drain, flush and refill at end of first 1,000 miles; thereafter as indicated at points on gage.

6. **SHOCK ABSORBERS**—(Models) Refill with Shock Absorber Fluid, Mervin. (Datsun) Refill with Shock Absorber Fluid, Light.

7. **WHEEL BEARINGS** (Front and rear)—Remove wheel, clean and inspect bearings.

8. **RZEPPA UNIVERSAL JOINTS** (Front wheels)—Remove level plug in rear of joint and fill through fitting in wheel hub to level of plug opening.

9. **UNIVERSAL JOINTS AND SLIP JOINTS**—Use same grades of GO as used for gear cases. Apply lubricant to joint until it overflows at relief valve, and to slip joint until lubricant attitudes.

10. **DISTRIBUTOR**—Wipe distributor breaker cam lightly with CG every 2,000 miles.

11. **OIL FILTER**—Remove filter element every 5,000 miles or after if necessary. After removing element, refill crankcase to FULL mark on gage.

12. **STARTER**—Remove starter every 5,000 miles, clean and lubricate. Bendix drive sparingly with PO.

13. **OIL CAN POINTS**—Lubricate throttle and spark control rod ends, clutches, hinges, latches, bumper roller and pinle with EO every 1,000 miles.

14. **POINTS REQUIRING NO LUBRICATION**—Springs, Shock Absorber Links (some models, rubber).

15. **POINTS TO BE LUBRICATED BY ORDNANCE MAINTENANCE PERSONNEL AT TIME OF GENERAL OVERHAUL**—Clutch Pin Bearing, Speedometer Cable.

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FIGURE 2.—Lubrication chart.

## SECTION V

## FRONT AXLE

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Reassembly of components .....	17
Installation of assembly .....	18

**12. Description** (figs. 3 and 4).—The front axle is a spiral bevel gear, single-reduction, full floating type, with a straddle-mounted pinion gear and a conventional type differential. The front wheels are driven by axle shafts through Rzeppa type universal joints inclosed within specially designed steering knuckles at the outer ends of the housing.

*a. Construction* (fig. 5).—(1) The front axle consists of steel tubes pressed and riveted into the gear housings at the inner ends and butt-welded to the sockets (or universal joint housings) at the outer ends. Hardened and ground kingpins are press-fitted and welded into opposite sides of the sockets and upon these are mounted opposed, heavy-duty, taper-roller bearings. These pivot bearings support the split-flanged socket housing and are adjustable by means of shims under the upper and lower bearing retaining caps. The upper cap and the drag link steering arm are integral on the left-hand side. The inner end of the socket housing incloses a steering-knuckle felt which rides upon the spherical wall of the socket. The socket housing carries a steering stop which limits the steering angle to 28°, and also a steering arm for tie rod attachment. The outer end of the socket housing has a wheel spindle or knuckle bolted to it and this fully incloses the constant-velocity, universal joint, drive shaft assemblies. A full floating hub is mounted upon the knuckle by means of tapered roller bearings so that the entire wheel end assembly carries the load independently of the shaft.

(2) The hub is attached by means of studs to the drive flange which in turn engages with the universal drive shaft by means of a long spline. A cap screw, which passes through the center of the flange and screws into the end of the drive shaft, holds the Rzeppa joint in its correct running position. The Rzeppa joint is lubricated by fitting in this screw hole. Removal of this drive flange permits adjusting the inner and outer wheel bearings by means of two nuts secured with