

TM 9-1706

WAR DEPARTMENT

TECHNICAL MANUAL



ORDNANCE MAINTENANCE

**HERCULES JXD GASOLINE ENGINE
FOR SCOUT CARS**

September 13, 1942

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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 one of several maintenance manuals on these vehicles. It contains detailed instructions for removal, disassembly, inspection, maintenance, repair, assembly, and installation of the Hercules JXD gasoline engine and all its accessories for scout car M3A1. These instructions are supplementary to those in the Field and Technical 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 concerning the service maintenance, technical inspection, and lubrication of the entire vehicle will be found in TM 9-705 and 9-1705.

c. Power train.—For maintenance information concerning the power train, refer to TM 9-1705.

d. Chassis and body.—For maintenance information concerning the chassis and body components, refer to TM 9-1709.

e. Diesel power plant.—For maintenance information concerning the Hercules Diesel engine, model DJXD, and all its accessories, see TM 9-1707.

SECTION II

SERVICE MAINTENANCE

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2. Objective.—There is a decided difference between the purpose of organizational maintenance and that of service maintenance. Organizational maintenance is performed by the using arms and has for its primary objectives the routine steps in preventive maintenance, together with the care and adjustment of vehicles and their equipment, so that the matériel will be in good operating condition and there will be a minimum of time lost for repairs. Service maintenance by light and heavy maintenance units of the Ordnance Department has for its primary objectives supply, technical inspection, and corrective action and in general all repairs beyond the capacity of the using arms. This work is accomplished either by unit replacement, overhauling, rebuilding, reclaiming, manufacturing, or any other necessary expedients.

3. Scope.—The scope of maintenance and repairs by maintenance personnel is determined by the amount of time available, weather conditions, cover and concealment, shelter, proximity or exposure to hostile fire, equipment tools and parts available, and skill of the personnel. Since all these factors are variable, no exact system or rules of procedure can be prescribed or followed.

4. Allocation of repair jobs.—The operations mentioned below augment those which may be performed by the using arms.

a. Clutch.

- (1) Clutch assembly----- Replace, repair, rebuild.
- (2) Clutch housing----- Replace.

b. Cooling system.

- (1) Fan assembly----- Repair.
- (2) Fan bushings or bearings----- Replace.

- (3) Radiator----- Repair.
- (4) Water pump----- Repair, replace, rebuild.
- c. Electrical—generator and regulator.*
- (1) Circuit breaker----- Adjust or repair.
- (2) Generator----- Repair or rebuild.
- (3) Voltage regulator----- Adjust, repair, rebuild.
- (4) Current regulator----- Adjust, repair, rebuild.
- d. Electrical—ignition system.*
- (1) Ignition switch----- Repair.
- (2) Distributor----- Repair, rebuild.
- e. Electrical—starter.*
- (1) Starting motor----- Repair, rebuild.
- (2) Starting switch----- Repair.
- f. Engine.*
- (1) Camshaft----- Replace.
- (2) Connecting rods----- Replace.
- (3) Connecting rod bearings----- Adjust and replace.
- (4) Crankshaft----- Grind, polish, straighten.
- (5) Cylinder----- Honeboring.
- (6) Crankshaft main bearings----- Replace.
- (7) Engine----- Rebuild, replace.
- (8) Flywheel----- Replace.
- (9) Pistons----- Grind and fit.
- (10) Piston pins----- Fit.
- (11) Piston rings----- Fit.
- (12) Piston assembly----- Replace.
- (13) Timing gears----- Replace.
- (14) Timing gear cover----- Replace.
- (15) Valves----- Reface, reseal, insert, and re-
place.
- (16) Valve guides----- Replace.
- g. Fuel system.*
- (1) Carburetor----- Repair and rebuild.
- (2) Fuel pump----- Repair and rebuild.
- (3) Fuel tank----- Repair.
- (4) Fuel gage----- Repair.
- h. Lubrication system.*
- (1) Internal oil lines----- Repair, replace.
- (2) Oil pump----- Repair, replace.

SECTION III

TECHNICAL INSPECTION

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

6. Inspection form.—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 a modification of it depends entirely on the technical ability of available personnel, the time factor, and the test and shop equipment available.

7. Practical application.—*a. External inspection of clutch.*—(1) Test foot lever and make sure of proper mounting. Examine return spring for wear or damage.

(2) Run vehicle to ascertain if clutch is smooth or jerky, or slips in operation.

b. Cooling system.—(1) Examine radiator and connections for signs of leakage, clogging, or damage.

(2) Inspect supporting bracket of fan and bushings and bearings.

(3) Look at water pump and casing for cracks and leaks and make sure gear on shaft is tight and shaft rotates freely.

c. Generator and regulator.—(1) Examine pulley for looseness.

(2) Check all shielding conduits and connections.

(3) Make sure all mounting and fastening screws are tight. Examine armature and brushes.

(4) Check voltage and correct output of generator.

(5) Inspect regulator contact points for burning and gap distance, and check tension of armature springs.

(6) Examine regulator case for cracks.

d. Ignition system.—(1) Inspect all harness and terminals for damage, wear, and looseness.

(2) Examine and test ignition switch.

(3) Look over distributor. Test for loose mounting or loose connection to knob on dash. Remove upper half shield and inspect cap

for cracks. Inspect breaker points and spring, high-tension rotor, and metal inserts in cap for pitting and burning. Try cam for evidence of wear, looseness, or breakage of governor springs.

e. Starting motor.—(1) Examine all connections and terminals.

(2) Inspect and test starting switch.

(3) Inspect commutator and brushes.

f. Engine.—(1) Check crankcase, block, head, and head gasket for cracks or leaks. See that all bolts are tight.

(2) Remove cover and examine valve push rods, springs, and valve clearances.

(3) Run engine and listen for slapping pistons, knock at bearings, or knock due to presence of carbon.

(4) Check oil pressure for steady and normal reading with engine running.

g. Fuel system.—(1) Inspect mounting and connections of fuel pump and check its operation. Examine fuel tanks for leaks or damage.

(2) Examine carburetor and air cleaner. Try all screws. Inspect connections to accelerator and dash.

(3) Check fuel gage and switch.

h. Lubrication system.—(1) Check oil pressure at gage.

(2) Check oil line connections and brackets for tightness.

SECTION IV

POWER PLANT TROUBLE SHOOTING AND TUNE-UP WHILE INSTALLED

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8. Trouble shooting.

<i>Symptom</i>	<i>Cause</i>
<i>a. Engine skips or misses.</i>	<p><i>a.</i> (1) Spark plugs cracked or dirty.</p> <p>(2) High-tension wires broken or shorted.</p> <p>(3) Distributor cap or rotor broken, damp, or dirty.</p> <p>(4) Faulty distributor points, condenser, or coil.</p> <p>(5) Valves adjusted too close or badly worn guides.</p>

<i>Symptom</i>	<i>Cause</i>
	(6) Leaking head gasket.
	(7) Cracked valve seat or water jacket.
	(8) Improperly adjusted carburetor.
	(9) Air leak in intake manifold or head.
	(10) Partially plugged gas line.
<i>b. Lack of power in engine.</i>	<i>b.</i> (1) Skipping motor.
	(2) Motor out of time.
	(3) Needs carbon removed and valves ground.
	(4) Low or uneven compression.
	(5) Motor overheats.
	(6) Mixture too rich.
	(7) Clutch slips.
	(8) Brakes dragging.
<i>c. Engine vibrates.</i>	<i>c.</i> (1) Motor mountings loose or badly worn.
	(2) Bad skip in motor.
	(3) Ignition and timing too far advanced.
	(4) Idle adjustment set too rich.
<i>d. Engine overheats.</i>	<i>d.</i> (1) Circulation plugged in radiator, causing cool spot in core.
	(2) Radiator and block dirty, retarding circulation.
	(3) Ignition late.
	(4) Brakes dragging.
	(5) Clutch slipping.
	(6) Fan belt slipping.
	(7) Thermostat bad.
	(8) Leak or lack of air circulation.
	(9) Radiator fins bent or clogged.

<i>Symptom</i>	<i>Cause</i>
<i>e. Engine knocks.</i>	<ul style="list-style-type: none"> e. (1) Carbon deposit in head. (2) Spark advanced too far. (3) Automatic spark advance stuck. (4) Governor weights stuck or springs weak. (5) Loose wristpins. (6) Connecting rod out of alinement. (7) Loose rod bearings. (8) Loose main bearings. (9) End play in cam shaft. (10) Loose tappets. (11) Sticky valve stems. (12) Loose spark plugs. (13) Flywheel loose.
<i>f. Grinding or scraping noise in engine.</i>	<ul style="list-style-type: none"> f. (1) Generator bearings worn. (2) Water pump bearings bad. (3) Lower fan pulley sprung or frame sprung so trunnion hits pulley. (4) Broken ring or piston. (5) Flywheel pan bent or dirt in flywheel pan hitting flywheel. (6) Timing chain loose and rubbing case. (7) Oil pan nuts in flywheel housing hitting against flywheel.
<i>g. Engine uses too much oil.</i>	<ul style="list-style-type: none"> q. (1) Piston ring gaps lined up. (2) Piston rings worn or carbon in ring grooves. (3) Vacuum pump diaphragm cracked or porous. (4) Rod or main bearing has too much clearance. (5) Oil slinger clearance too great or oil slinger oil seal in housing worn out. (6) Excessive cylinder wear.

<i>Symptom</i>	<i>Cause</i>
<i>h. Poor gas mileage.</i>	<i>h.</i> (1) Worn-out spark plugs. (2) Timing late. (3) Carburetor dirty and out of adjustment. (4) Motor idles too fast. (5) Brakes dragging. (6) Clutch slips. (7) Erratic driving. (8) Automatic choke out of adjustment. (9) Air cleaner dirty or too full of oil. (10) Automatic heat control frozen closed.
<i>i. Engine fails to start.</i>	<i>i.</i> (1) Fuel system clogged or fuel supply exhausted. (2) Defective fuel pump. (3) Air vent closed. (4) No spark at spark plugs.
<i>j. Generator fails to charge.</i>	<i>j.</i> (1) Drive belt loose. (2) Voltage regulator out of order. (3) Generator not operating properly. (4) Poor connections in circuit.
<i>k. Starting motion of vehicle jerky or delayed.</i>	<i>k.</i> (1) Worn clutch linkage. (2) Worn or oil-saturated clutch parts—may also be out of adjustment. (3) Play in universal joints.

9. Tune-up.—a. General.—Best results are obtained in an engine tune-up by using a systematic approach rather than a hit-or-miss search. Before a tune-up is attempted an engine compression test should be made. Successful tuning is impossible without a fairly even compression in the cylinders. Make compression test in the following manner:

- (1) Remove all spark plugs from the engine. Turn ignition switch off and fully open hand throttle.

(2) Insert an accurate compression gage in spark plug hole and crank engine a few turns with starting motor, noting highest gage reading. Do this at each cylinder.

(3) Compression should be the same in each cylinder within 5 pounds.

b. Procedure.—If compression is found to be correct in all cylinders, proceed with the tune-up in the following order:

(1) *Spark plugs.*—(a) Spark plugs should be Champion, model J8, type 14MM, or other make of same model and type.

(b) Clean the plugs thoroughly.

(c) Inspect closely for cracked porcelain.

(d) Set electrode gap between 0.025 and 0.028 inch. Use a round feeler gage. Bend side electrode when regapping.

(2) *Battery and ignition cables.*—(a) Clean both ends of each battery cable thoroughly. See that connections are tight.

(b) Inspect ignition system high- and low-tension cables. Terminal on each end must be clean and tight. If insulation shows evidence of deterioration, cable should be replaced.

(3) *Distributor.*—(a) Remove distributor cap and inspect it carefully for cracks and burned posts.

(b) Remove rotor, clean contact point, and make sure spring contacts secondary terminal.

(c) Clean distributor points with a flat point file. Inspect carefully and replace if cleaning does not remove pits and burns. Never use emery cloth to clean points.

(d) Adjust points with feeler gage to provide 0.018 to 0.020 inch clearance. Be sure that breaker cam is in position to have points fully separated.

(e) Check condenser. A weak condenser usually results in burned breaker points. A good check is the comparison test, replacing the old with a good condenser and observing for contrast in the spark. The spark from a faulty condenser will form an arc or drag between the points.

(f) Check ignition coil with coil tester. Replace weak coil.

(4) *Ignition tuning.*—Check ignition timing to be sure that No. 1 cylinder is firing according to flywheel markings. This is done by attaching one end of a neon timing light to No. 1 spark plug and grounding the other end. Run the engine at an idle speed and note whether the neon flashes coincide with the markings on the flywheel. Distributor can be retarded or advanced until neon flashes are perfectly synchronized with the flywheel markings.