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YPG REPORT 0049

INITIAL PRODUCTION TEST

OF

TRUCK, UTILITY, 1/4-TON, 4X4

M151A2

FINAL REPORT

BY

JOHN SHOEMAKER, SP4
SCIENTIFIC AND ENGINEERING
OCTOBER 1970

YUMA PROVING GROUND

YUMA, ARIZONA

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Director of Materiel Test

1 Incl
as

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ABSTRACT

An initial production test of three Trucks, Utility, 1/4-Ton, 4x4, M151A2 was conducted by Yuma Proving Ground during the period 6 April to 3 August 1970.

The purpose of the test was to determine contractor conformance to contractual requirements, investigate adequacy of quality assurance procedures and provide verification of safety of the vehicles with particular emphasis on vehicle stability.

After 1000 miles of break-in, each truck completed approximately 20,000 miles of durability operation. Cooling, dust, toxic hazard and various performance tests were run, and safety and maintenance evaluations were made. Tests were also undertaken to determine the effect of the new semi-trailing arm rear suspension on vehicle stability and handling.

It was concluded that:

a. Vehicle was not adequately suppressed for radio interference radiation.

b. The design and/or quality of the A-frame control arms and propeller shaft yokes are inadequate.

c. Uneven application and brake pulling observed throughout test constitutes a safety hazard.

d. The rear suspension redesign has substantially improved vehicle stability and handling.

It was recommended that the brake and A-frame problems be corrected and that all deficiencies and as many shortcomings as possible be corrected.

FOREWORD

Yuma Proving Ground was responsible for test planning, test execution, and test reporting.

SECTION 1. INTRODUCTION

1.1 BACKGROUND

The M151 series vehicles have been found unsafe under certain driving conditions, and have demonstrated a number of deficiencies.

A modified independent rear suspension consisting of semi-trailing arms to replace the lateral swing arms has been tested and evaluated. The trailing arm design eliminated oversteer and produces sufficient body roll to provide a warning of impending danger during turns.

Three successive but separate test programs, performed on 19 vehicles, accumulated a total of 340,000 miles. Major deficiencies included the transmission-transfer case, rear axle differentials and rear axle drive shaft universal joints. The first two test programs, an initial comparison test and a product improvement test, established the serious nature of these deficiencies. The third test, an extended inspection comparison test, disclosed correction of certain problems in the deficient components; however, other problems still persisted requiring additional testing to establish the merits of further improvements. The quality of the vehicles was poor; fasteners were improperly tightened and were incapable of maintaining torques or adjustments.

The M151A2 vehicles provided for this test have incorporated the modified independent rear suspension and other safety features as well as improvements to deficient components.

1.2 DESCRIPTION OF MATERIEL

The overall configuration of the Truck, Utility, 1/4-Ton, 4x4, M151A2 remains basically the same as previous models, but includes the modifications listed in Appendix I.11. Readily noticeable are the larger one-piece windshield and rear window, the deep dish steering wheel, the windshield washer and wipers, the larger class "A" lights, the mechanical fuel pump located on the right side of the engine and the trailing arm suspension at the rear and underside of the body.

The M151A2 vehicle dimensions, capacities, and weight remain unchanged from the M151A1. It is still powered by a four-cylinder, water-cooled gasoline engine, a four-speed forward transmission and selective front wheel drive. Performance characteristics, such as gradeability, maximum speed, braking, water fording and cross-country mobility, are the same as previous M151 series vehicles, although overall safety of the vehicle is improved. Characteristics are shown in Figure 1.

The test vehicles, USA Reg No. 02DU8170, 02DU8370 and 02DU8670, will hereafter be referred to as U81, U83 and U86, respectively.

1.3 OBJECTIVES

a. To provide evidence of contractor conformance to contractual requirements, capability of manufacturing methods, adequacy of quality assurance procedures and ability to maintain the required level of quality throughout the production cycle.

b. To provide information to support a USATECOM position on suitability for release as required by AMCR 700-34.

c. To provide verification of safety of the vehicles with particular regard to vehicle stability.

1.4 SCOPE

An initial production test of three M151A2 trucks was conducted from 6 April to 3 August 1970. Approximately 1000 miles of break-in operation and durability-reliability miles were completed by each vehicle. Cooling, dust, toxic hazard and various performance tests were run, and safety and maintenance evaluations were made. Tests were also undertaken to determine the effect of the new semi-trailing arm rear suspension on vehicle stability and handling.

1.5 SUMMARY OF RESULTS

1.5.1 Preparation for Test (Para. 2.2)

The three vehicles were received at Yuma Proving Ground on 1 April 1970. In the receiving inspection the seal on the truck van was found to be improperly secured. Batteries in U81 and U83 were connected and the latter was discharged because the ignition switch had been left on. One shortcoming was observed during the initial technical inspection; the toe-in for the front wheels was between 19/32 inch and 3/4 inch for all vehicles. No problems were observed during break-in operation, and a post break-in inspection was not deemed necessary.

1.5.2 Performance (Para. 2.3)

The cramping angle of one vehicle was 1 degree in excess of the specification. Two vehicles failed the radiation phase of the radio interference suppression tests in the lower frequency range.

1.5.3 Cooling Tests (Para. 2.4)

The engine coolant or oil temperatures exceeded specified or desireable limits in all runs in first gear.

The coolant temperature to the radiator exceeded the specified 232°F (7 psi radiator cap) at 1000 and 1800 rpm engine speed. The engine oil sump temperature exceeded the desirable maximum value of 270°F at 4000 rpm.

1.5.4 Dust Tests (Para. 2.5)

Service of the air cleaners under normal dust conditions was not required more frequently than the 1000-mile interval specified in the vehicle lubrication order. No serious dust contamination or damage to the engine or other vehicle components was observed as a result of normal dust operation.

In extreme dust tests the air cleaner reached maximum restriction in 3.75 hours. During this period the air cleaner ceased to function properly and only oil wetted dust was left on the air cleaner oil cup. Pullover of oil to the engine occurred. The inside of the intake air hose connecting the carburetor to the air cleaner was covered with dust. Dust deposits were observed on all spark plug electrodes and engine cylinder compression had dropped an average of 30 psi from pretest checks.

1.5.5 Toxic Hazard Tests (Para. 2.6)

There was no discernable concentration of carbon monoxide at any crewmember position.

1.5.6 Maintainability (Para. 2.7)

The ratio of total maintenance man-hours to operating hours (assuming 20 miles per operating hour) was 10.4 percent. Based on actual operating hours, this ratio was 12.3 percent.

No maintenance was required at the direct support level.

The manuals were generally adequate as were the tools. Maintenance presented no unusual problems.

1.5.7 Durability and Reliability (Para. 2.8)

The three vehicles completed a total of 63,164 miles over all courses as summarized in Table 1.

TABLE 1. Total Accumulated Mileages

	U81	U83	U86
Break-in	1,001	998	1,012
With trailer	10,001	10,027	10,034
Without trailer	10,023	10,023	10,045
Total overall	21,025	21,048	21,091

All of the reported mileages are higher than actually run because the odometers of all vehicles were reading high by 6 to 8 percent.

The overall fuel and oil consumption data are presented in Table 2.

TABLE 2. Fuel and Oil Consumption

Vehicle	Fuel Consumption (miles/gallon)	Oil Consumption (miles/quart)
U81	15.1	4205
U83	15.1	4210
U86	14.8	3515

There were two deficiencies observed during durability-reliability operation. The first was a propeller shaft failure on vehicle U83 at 17,170 test miles. The rear yoke broke and disabled the vehicle. The second was extensive brake pulling and uneven application experienced by all vehicles after 12,000 to 15,000 miles.

Twenty-five of the 28 shortcomings reported during the test were discovered during durability-reliability test. The most significant are summarized below.

a. There were three incidents of broken radio interference suppression wire mesh insulation on spark plug leads. (Two more leads were replaced for the same reason during the final inspection.)

b. The ignition coil retainer fasteners lost torque on two vehicles. There was also one instance of a broken retainer tab.

c. Four turn signal control assemblies failed.

d. Thirteen tire inner tubes failed due to separation at the seam.

e. The bushings in the front upper and lower A-frame control arms were badly worn on all vehicles.

f. Six shock absorbers were replaced because of leaks.

g. A hole was discovered at a spot weld in the oil cup of one vehicle's air cleaner.

h. The front suspension upper ball joint boots were cracked on all three vehicles.

i. All vehicles exceeded two or more steering geometry specifications.

j. The rear differential of one vehicle had spalled rollers in the right output roller bearing. Both the bearing and its race were considered unserviceable.

k. The wheel cylinder boots had been cut by burrs on the piston skirts.

1.5.8 Safety and Vehicle Stability (Para. 2.9)

The only safety hazard observed was brake pulling and uneven brake application experienced on all vehicles. The problem was accordingly classified as a deficiency.

A comparison of stability and handling between an M151A1 vehicle and an M151A2 revealed greater stability, increased control and easier handling with the M151A2 truck.

1.6 CONCLUSIONS

a. Vehicle preparation and security for shipment were not satisfactory.

b. Vehicles are not adequately suppressed for radio interference radiation.

c. Design and/or quality control of the front A-frame control arms is unsatisfactory.

d. Durability of the propeller shaft is not adequate.

e. Tire inner tubes are of poor quality.

f. Air cleaner is not adequate in extreme dust conditions.

g. Front suspension upper ball joint boots are not durable.

h. The brake pulling and uneven brake application constitutes a safety hazard.

i. The rear suspension redesign has substantially improved vehicle stability and handling feedback to the driver.

1.7 RECOMMENDATIONS

a. Quality control be improved.

b. A-frame control arm bushing wear and propeller shaft breakage be further investigated and corrected.

c. Brake problems be corrected.

d. As many of the shortcomings as possible be corrected.

SECTION 2. DETAILS OF TEST

2.1 INTRODUCTION

Test vehicles, USA Reg No. 02DU8170, 02DU8370 and 02DU8670 will hereafter be referred to as U81, U83 and U86, respectively.

2.2 PREPARATION FOR TEST

2.2.1 Objectives

a. To determine the adequacy of the blocking and packaging during shipment and to determine if any damage had been incurred during shipping.

b. To insure that the vehicle and all components are properly serviced, secured, and adjusted prior to test.

c. To record component serial numbers and other pretest data.

d. To install the necessary instrumentation.

e. To payload the test vehicle to the proper gross vehicle weight.

f. To conduct break-in operation.

g. To determine the curb and gross weights of the vehicles.

2.2.2 Criteria (Ref 6, App V)

a. Materials. The materials used shall be as specified in the applicable specifications and drawings.

b. Construction. Vehicle, components, sub-assemblies, and assemblies shall be fabricated and assembled into a complete vehicle in accordance with drawings listed or referred to in the applicable Engineering Parts List. All parts, sub-assemblies, and assemblies shall be identified in accordance with MIL-STD-130.

c. Performance. Trucks shall conform to the performance requirements specified herein after a break-in run of 2 miles (road). Vehicle shall be serviced as specified herein after a break-in run of 2 miles (road). Vehicle shall be serviced as specified in Reference 6, Appendix V.

d. Marking. Registration numbers and other markings shall be applied in accordance with MIL-STD-642. Color shall be lusterless white enamel, matching color chip 37875 of Federal Standard No. 595. Data plates and part number marking shall be in accordance with MIL-STD-130.

e. Workmanship. The workmanship shall produce vehicles free from fabrication defects which would affect the appearance, functioning, or operating life of the vehicle or any of its components. All seals and gaskets shall be so installed and retained that fluid seepage is minimized, and so that exhaust gases are prevented from escaping. All welds, rivets, bolts, nuts or other fasteners shall be torqued as indicated on drawings, or where not specifically detailed on drawings, to the extent consistent with their respective application in commercial vehicles of similar construction.

f. Preservation, packaging, and vehicle processing inspection. Each vehicle shall be inspected for conformance to Section 5 requirements of Reference 6, Appendix V and the contract as applicable.

g. Vehicle processing. Vehicle and equipment shall be processed for shipment and storage in accordance with MIL-STD-281 to the extent indicated on the applicable vehicle preservation data sheet or other implementation document, as specified by the procuring activity.

2.2.3 Method

A receiving inspection was performed to determine the effect of transporting on the vehicle components. Any damage incurred due to shipping or shipping procedures was reported and corrected during the initial technical inspection.

The initial inspection was performed in accordance with USATECOM MTP 2-2-502 and was limited to the receipt inspection described in vehicle technical manuals. Identifying data on major components were recorded.

An annual scheduled maintenance was performed in accordance with the technical manuals supplied with the vehicle. Lubricant samples were drawn from all sumps and analyzed.

Instrumentation required for subsequent testing and the on-equipment-material were installed on the vehicle.

A 1000-mile break-in run was conducted over hard surface and gravel roads at road speeds not in excess of 50 mph. No payload or trailed load was used during the break-in operation. After break-in operations were completed, the vehicle was payloaded and the weight recorded.

2.2.4 Results

During the receiving inspection, the truck van security seal was found to be improperly closed and therefore ineffective. The batteries were connected on vehicles U81 and U83; the ignition switch of the latter was on, and battery discharged. Detailed results of the receiving inspection are contained in Appendix I-1.

As a result of the visual and functional inspection during the initial technical inspection, no component teardown or disassembly was deemed necessary. The analyses of the oil samples taken at this time are presented in Appendix I.3. The major problems discovered during this inspection were as follows:

a. Toe-in was 19/32 inch to 3/4 inch for the front wheels of all vehicles. It was adjusted to 1/8 inch specification.

b. U81 and U86 had the old style rear windows rather than the modified full view rear window.

c. None of the vehicles had the new inside rear view mirror.

d. No Processing Forms (Form 1397) were received with the vehicles.

The excessive toe-in was classified as a shortcoming (App III, Sec 2, Group 10). A complete summary of the initial inspection is presented in Appendix I.2.

A list of instrumentation installed on the vehicles is included as Appendix I.4.

The initial break-in was accomplished. A spot break-in inspection was not considered necessary.

The curb and payloaded weights of the vehicles were as shown in Table 3.

TABLE 3. Vehicle Weights

Vehicle No.	Curb Weight (lb)	Payloaded Gross Vehicle Weight (lb)*	
		Highway	Cross-country
U81	2520	3600	3200
U83	2480	3610	3210
U86	2520	3600	3200

*Includes driver

2.2.5 Analysis

The excessive toe-in might have caused difficulty in steering and increased tire wear otherwise all other criteria were met.

Curb weights were taken with a roll bar installed, accounting for the additional curb weight shown in Table 3. The vehicles were payloaded to a GVW of 3200 pounds or 3600 pounds, including driver, rather than adding 800 or 1200 pounds to the curb weights for cross-country or highway payloads, respectively.

2.3 PERFORMANCE TESTS

2.3.1 Objectives

a. To determine the maximum and minimum road speeds.

b. To obtain data on the service and parking brakes.

c. To determine the turning diameter.

d. To determine the shallow water fording capabilities.

e. To determine the ascent grade speed.

f. To conduct fuel supply capability tests during longitudinal and side slope operations.

g. To conduct radio interference suppression tests.

2.3.2 Criteria

a. Payload. Truck payload shall include driver and personnel and shall be as specified in Table 4.

b. Towing Load. Towed load performance requirements for the M151A2 shall be met when coupled to a M416 tactical-type trailer, and shall be as specified in Table 4.

TABLE 4. Weights and Loads, Pounds

	M151A2
Curb weight	2400
Rated payload (including personnel):	
Highway	1200
Cross-country	800
Gross vehicle weight (GVW):	
Highway	3600
Cross-country	3200
Rated towed load:	
Highway	1300
Cross-country	1000

c. Level road speeds. The truck, including cross-country payload and with cross-country towed load, shall be capable of sustaining a speed of not less than 60 miles per hour (mph); a low speed of not more than 2-1/2 mph in low gear, when operated on smooth, dry, level, hard-surfaced roadway. Drumming, shimmy or tramping shall not occur throughout this speed range.

d. Grade speeds. The truck, including cross-country payload and with cross-country towed load, shall be capable of negotiating grades up to 6-1/2 percent at a speed of 30 mph when operated over a smooth, dry, hard-surfaced roadway. Without towed load, truck, including cross-country payload, shall be capable of negotiating grades up to 60 percent at a speed of 2-1/2 mph when operated over a smooth, dry, hard-surfaced roadway.

e. Slopes. The truck, including cross-country payload, shall be operated on side slopes, sloping right or left, up to 40 percent.

f. Shallow water fording. The vehicle, without fording equipment and with rated cross-country payload and towed load, shall ford a hard-bottomed, relatively level crossing in fresh or salt water to a depth of at least 21 inches. The vehicle without fording equipment, or modification, shall meet all requirements of 3.5.7.1 of MIL-T-45331C, except the depth shall be 21 inches.

g. Service brakes. Service brakes shall stop the vehicle within 30 feet from a speed of 20 mph, on dry, hard, relatively level, smooth road, free from loose material. Service brakes shall control and hold the vehicle on an incline of 60 percent.

h. Parking brake. The parking brake shall hold the vehicle on a dry, concrete incline of 40 percent with highway payload; and on a dry, concrete incline of 60 percent with cross-country payload.

i. Maneuverability. The vehicle shall demonstrate a maximum turning radius of 18.5 feet, measured from the center line of the outside front wheel, when negotiating full turns to right and left.

j. Radio interference suppression. Each vehicle shall be radio interference suppressed in accordance with the tactical vehicle requirements of MIL-E-55301.

2.3.3 Method

2.3.3.1 Maximum and Minimum Speeds. The vehicle, with cross-country payload (800 pounds) and cross-country towed load (1000 pounds) was operated at reduced speeds until all components reached normal operating temperature. The vehicle was then operated at full throttle in the highest gear (fourth) until maximum road speed was attained. The minimum speed was determined in the lowest gear range at the lowest engine speed in which vehicle would operate smoothly without application of the brakes. All speeds were measured using a calibrated fifth wheel.

2.3.3.2 Stopping Distance. The brake performance test was conducted with highway payload (1200 pounds) at a road speed of 20 mph. The distance from the point of brake application to complete stop was measured with a fifth wheel and pousometer. Six stops were attempted and the results averaged.

2.3.3.3 Slopes. The vehicle, with highway payload (1200 pounds), was stopped and held on a 60 percent incline by the service brakes.

The vehicle, with cross-country payload (800 pounds), was operated on side slopes of up to 40 percent, sloping right or left.

The holding ability of the parking brake was checked on the 40 percent incline with the vehicle highway payloaded, and on the 60 percent incline with the vehicle cross-country payloaded.

Since an actual 6-1/2 percent slope was not available, it was simulated using the field dynamometer to measure drawbar pull or reserve power for climbing hills. To determine if the vehicle could meet the specified criteria, the drawbar pull of each truck was measured at 30 mph. The drawbar pull figures were then converted to determine the maximum slope each vehicle would ascend at 30 mph.

The vehicles with cross-country payloads were driven up a 60 percent grade and the road speeds were measured.

2.3.3.4 Cramping Angle and Turning Radius. The vehicle negotiated full 360-degree turns at slow speeds to the right and left, with the turning diameter measured from the center line of the outside front wheel. Degree plates were used in determining the maximum swing-arc of the front wheels.

2.3.3.5 Shallow Water Fording. The vehicle, without fording equipment and with rated cross-country payload and towed load when applicable, forded a hard-bottom, relatively level crossing in fresh water to a depth of 21 inches. The fording operation covered a period of 15 minutes.

2.3.3.6 Radio Interference Suppression. The vehicle was checked for radio interference suppression in accordance with tactical vehicle requirements of MIL-E-55301.

2.3.4 Results

2.3.4.1 The maximum and minimum vehicle speeds are presented in Table 5.

TABLE 5. Maximum and Minimum Road Speeds

Vehicle No.	Maximum Speed (mph) (4th gear)	Minimum Speed (mph) (1st gear)
U81	61.9	2.1
U83	60.9	1.6
U86	60.5	2.0
Criteria	60.0 Minimum	2.5 Maximum

Maximum speed tests were first run just prior to a 12,000-mile maintenance. Although U86 passed at that time, U81 and U83 failed with average speed of 58.2 and 57.0 mph, respectively. After a tune-up at the 12,000-mile maintenance, U81 and U83 met the criteria with results shown in Table 5.

2.3.4.2 The average stopping distances at 20 mph are shown in Table 6.

TABLE 6. Stopping Distance

Vehicle No.	Stopping Distance (ft)
U81	18.8
U83	19.6
U86	19.3
Criteria	30.0 Maximum

2.3.4.3 Slope Operations. All vehicles were successfully held on a 60 percent incline with the service brakes when loaded with a highway payload (1200 pound).

The parking brakes held all vehicles on both the 60 percent and 40 percent slopes under the specified loading conditions.

The vehicles negotiated the side slopes without difficulty, and ascended the 60 percent slopes at the speeds shown in Table 7.

TABLE 7. Road Speeds Ascending 60 Percent Slope

Vehicle No.	Speed (mph)
U81	5.6
U83	6.2
U86	5.2
Criteria	2.5 Minimum

The simulated grades that each vehicle would ascend at 30 mph are summarized in Table 8.

TABLE 8. Simulated Slope Performance at 30 MPH

Vehicle No.	Percent Slope
U81	8.2
U83	7.9
U86	8.0
Criteria	6.5 Minimum

2.3.4.4 Cramping angles and turning radii are presented in Table 9.

TABLE 9. Cramping Angles and Turning Radii

Vehicle No.	Cramping Angle (°) Left	Cramping Angle (°) Right	Turning Radii (ft) Left	Turning Radii (ft) Right
U81	31	31	17.6	17.5
U83	32	30	17.9	17.8
U86	29-1/2	28-1/2	18.0	18.3
Specification	31 Max.	31 Max.	18.5 Max.	18.5 Max.

2.3.4.5 Fording operations and post-fording checks were satisfactory for all vehicles.

2.3.4.6 Radio Interference Suppression. All vehicles passed the conduction test. In the radiation test, U81 exceeded the passing limit at frequencies of 3, 5 and 8 megacycles. U83 similarly exceeded the passing limit at frequencies of 3 and 5 megacycles. Complete test data are contained in Appendix I.7

2.3.5 Analysis

All performance tests met the specified criteria except for the radiation phase of the radio interference suppression tests. It is believed that the generators were responsible for the excessive noise on the two failing vehicles. Two check tests were attempted with the generator disconnected, but the ambient noise level was too high to obtain valid readings.

The rolling resistance of the trailer in the slope simulation test was calculated to be 37 pounds and is included in the results.

The cramping angle of the left wheel on vehicle U83 was 1 degree in excess of the specification. Cramping angles in excess of the specification can result in damage to the steering gear.

2.4 COOLING CHARACTERISTICS

2.4.1 Objective

To determine the cooling characteristics of the engine and power train under full load conditions.

2.4.2 Criteria

a. Engine. The engine shall conform to MIL-E-45332, except that the section covering preparation for delivery shall not apply. The vehicle shall meet all performance requirements specified herein with engine installed.

b. Extreme climatic operation. The vehicle shall be capable of having the engine started and normal operation maintained, in still air having any ambient air temperature from -25°F to +120°F, without external aid, in altitudes from sea level to a 3000 feet elevation above sea level.

c. High temperature operation. The vehicle shall be capable of having the engine started and normal operation maintained, in still air having ambient air temperatures and altitudes specified in Table I, without external aids, and with a relative humidity as low as 5 percent. The vehicle fuel system shall function without evidence of vapor lock, and the engine coolant temperature shall remain below the boiling point. The engine coolant temperature limit specified at Paragraph 3.5.1.3 of MIL-T-45331C considers coolant boiling point with a pressurized system.

TABLE I. Elevation Temperature Chart

Elevation	Minimum Ambient Air Temperature
4000 feet	108°F
5000 feet	100°F
6000 feet	97°F
7000 feet	93°F
8000 feet	90°F

2.4.3 Method

2.4.3.1 Road Load Cooling. During operation on all test courses, the following temperatures were monitored: coolant from the engine, engine oil sump, transmission oil sump, front and rear differential oil sumps, and ambient air temperature. The maximum temperature reached by each component was recorded on every shift. The coolant temperature drop across the radiator was also monitored, but not recorded.

2.4.3.2 Full Load Cooling. One vehicle, payloaded to the maximum gross vehicle weight (3600 pounds) was operated with a mobile field dynamometer at the engine speeds and corresponding road speeds shown in Table 10. All tests were conducted on a paved, near level (0.8 percent upgrade from south to north), 2-mile course.

TABLE 10. Full Load Cooling Engine and Road Speeds

Gear	Engine Speed (rpm)	Road Speed (mph)
1	1000	2.9
1	1800	6.2
1	4000	11.6
2	1800	9.6
2	2600	14.2
2	2900	15.9
2	3300	17.9
2	3600	20.0
3	1800	18.3

The cooling runs were made after completion of the 20,000 miles of durability reliability operations, and with the thermostat blocked open. Each run was continued until temperature stabilization was reached, temperatures exceeded the maximum allowable limits, or imminent failure was apparent (the criteria for stability if a component temperature are that the three temperature readings taken in each of two directions of the test course vary by no more than 5°F and that any reading taken in one direction vary no more than 10°F with any reading taken in the other direction). An attempt was made to stabilize engine oil and engine coolant temperatures on all runs. In addition, stabilization of the transmission was attempted at an engine speed of 1800 rpm in second and third gear ranges, and stabilization of the differential temperatures was attempted at 1800 rpm in first gear. Cooling runs were made in ambient temperature of not less than 95°F. Individual component temperatures were then extrapolated to 120°F by adding 1 degree to the recorded ambient temperature for each degree of that temperature below 120°F.

2.4.4 Results

2.4.4.1 Road Load Cooling. The maximum component temperatures are summarized in Table 11, along with the environmental conditions present at the time the temperature was recorded.

TABLE 11. Road Load Cooling Data (Not Extrapolated)

Vehicle	Component	Max. Temp Recorded	Amb Temp	Course
U81	Coolant from engine	210°	100°	Hilly cross-country with trailer
	Engine oil	225°	100°	Paved without trailer
	Transmission oil	230°	100°	Paved without trailer
	Front differential	180°	100°	Paved without trailer
	Rear differential	300°	90°	Winding gravel (break-in)
U83	Coolant from engine	205°	105°	Level cross-country without trailer
	Engine oil	225°	102°	Tank gravel without trailer
	Transmission oil	200°	108°	Paved without trailer
	Front differential	185°	107°	Hilly cross-country with trailer
	Rear differential	275°	95°	Paved with trailer
U86	Coolant from engine	205°	100°	Level cross-country without trailer
	Engine oil	200°	105°	Winding gravel without trailer
	Transmission oil	300°	105°	Winding gravel without trailer
	Front differential	195°	105°	Winding gravel without trailer
	Rear differential	305°	95°	Winding gravel (break-in)

In the early stages of full load cooling, the rear differential overheated after an extremely short period of operation. Since this did not appear normal, brief road load cooling runs were made. The temperature of the rear differential could not be stabilized to 4-wheel drive on paved road, even at speeds as low as 30 mph. In 2-wheel drive the temperature of the rear differential stabilized at 342°F, 92° above the sustained temperature limit. A check at 50 mph on gravel roads resulted in temperature of the rear differential stabilizing at 260°F and front differential at 175°F (4-wheel drive).

In view of the difference in temperatures experienced between operation on paved and gravel road, the rolling circumference of the tires was measured. One tire was found to have about 2 inches less rolling circumference per revolution than the other three. The mismatched tire was replaced, and road load cooling tests were run once again on paved road in 4-wheel drive and at 50 mph, the temperature of the front and rear differentials stabilized at 180° and 212°, respectively. In 2-wheel drive on the same course, the temperature of the rear differential stabilized at 237°. With the overheating problem solved, the vehicle was returned to full load cooling operation.

2.4.4.2 Full Load Cooling. The data for the cooling tests are included in Table 1 of Appendix I.5. Extrapolated temperature versus time curves for component temperatures that did not stabilize are presented in Figures 1, 2, and 3 of Appendix I.5. Points which do not lie on the curves may be attributed to sudden changes in wind direction or velocity.

During these tests, a run was started at 1800 rpm, second gear, for which it was desired to stabilize the transmission oil sump temperature. During this test the transmission failed at a temperature of 393°. A teardown revealed that the rear output seal and the throwout bearing had failed. The transmission input gear which is on the helical spur gear shaft had many chipped teeth (Fig. 6, App I.9), the second speed helical gear was heavily surface fatigued, and the transfer input shaft helical gear had four sheared teeth (Fig. 7, App I.9). It is hypothesized that the excessive temperature damaged the rear seal, resulting in a loss of lubricant. The vehicle was running at maximum torque (1800 rpm) in second gear, and the force and minimal lubrication on the transmission input gear caused it to chip away. These chips probably jammed other gears, causing the transfer input gear teeth to shear.

Eight full load cooling tests were conducted prior to the transmission failure mentioned above. At this time it was discovered that the transmission oil and differential oil sump thermocouple leads had been unknowingly damaged prior to the start of these tests, such that these thermocouples gave incorrect readings. Thus the transmission was probably at a high temperature during these runs as well, for three were unsuccessful runs at 3300 rpm, first gear. Upon replacement of the transmission, the runs mentioned above were repeated. The data for these final runs appear in Table 1, of Appendix I.5. During an inspection after completion of full load cooling tests, engine dry compression was observed to have dropped from the specification of 135 psi, pressured before test, to an average of 86 psi. Wet compression after test was about 50 psi higher than the dry compression, indicating worn piston rings.

2.4.5 Analysis

2.4.5.1 Road Load Cooling. The engine coolant ran consistently at the upper end of the 170° to 190°F operating range for all vehicles throughout the test. Several times temperatures exceeded 200°F, but checks at those times revealed no problems in the system. These coolant temperatures are not considered serious.

The engine, transmission and oil temperatures remained consistently below critical limits. Although temperatures were high in a few instances (the U86 transmission in Table 11, for example), the overall road load cooling of these components was satisfactory.

The rear differential shows some improved road load cooling performance over that in previous M151A1's where temperatures of 503°F were obtained (Ref 13, App V). The only excessive temperatures recorded in durability operation occurred during break-in.

The abnormal differential temperatures observed in road load cooling check during full load cooling operations emphasize that the differentials cannot tolerate a major difference in tire rolling circumferences. In the case of the present test where overheating occurred, the two tires causing the problem were of the same nominal tire size, same tread pattern, produced by the same tire manufacturer, and had approximately the same tread wear, but had a rolling circumference difference of more than 2 inches. This is a serious consequence because a 3-inch difference in rolling circumference between a new and worn tire can easily be realized.

2.4.5.2 Full Load Cooling. The engine coolant or oil temperatures exceeded specified or desirable limits in all runs in first gear.

The coolant temperature to the radiator exceeded the specified 232°F (7 psi radiator cap) at 1000 and 1800 rpm engine speeds. The engine oil sump temperature exceeded the desirable maximum value of 270°F at 4000 rpm.

The transmission oil sump operated at 300 to 340°F except at high engine speeds (4000 rpm). The transmission temperatures were stabilized on four runs. The temperature difference between the front and rear differential sumps was quite apparent (100° or more) in all runs and the difference increased as each run continued. This may have been caused by more hot air from the engine reaching the rear differential than the front, increased loading on the rear differential due to weight transfer of the vehicle as it pulled the dynamometer truck, or a breakdown of the lubricant during previous tests. The rear differential exceeded its temperature limitations several times but only two occasions were recorded since the others were caused by a leaking output seal and a set of tires with different rolling radii. The rear differential overheated at 1800 rpm in first gear and 2600 rpm in second gear. Both of these tests were run the same day (14 July 1970) with a third test following. Coolant and engine oil

temperatures stabilized on this third run, but not before the rear differential reached its limit. Curves of the temperature rise for the front and rear differentials may be found in Figures 1, 2 and 3 of Appendix I.5. They indicate a temperature rise of 6°F/minute in the rear differential.

During one run at 1000 rpm in first gear the vehicle began to exhibit signs of vapor lock. This occurred in a turn and some recirculation of hot air through the radiator was occurring. The vehicle was stopped and the engine nearly died. About 3 minutes earlier, temperature of the fuel after the pump was only 100°F and fuel pump pressure was 4.5 psi. After a cool-down period the test was resumed without difficulty.

The temperatures from top to bottom and side to side of the radiator varied little except in the lower left corner. Air at this point was 10 to 20° hotter than at the other points in front of the radiator. Some hot air from the engine probably recirculated to the front of the radiator. After the air passes through the radiator the upper left corner becomes 10° hotter than the other points behind the radiator. This is due to the coolant entering the radiator at the upper left corner.

At the end of the test the engine was observed to have low compression pressures (Para. 2.8.3). The effect of the low engine compression would be less power, hence less generated heat. Thus, some of the engine temperatures taken in the latter part of the test may be slightly lower than would be observed with an engine having satisfactory compression.

In summary, the engine coolant temperature exceeded its limit. There was one occasion of vapor lock. The transmission and rear differentials lubricants of one vehicle exceeded their limits thus did not meet the criteria set down in Paragraph 3.5.1.3 of MIL-T-45331C.

2.5 DUST TESTS

2.5.1 Objective

To determine the operating life of the air cleaner between required service intervals under normal and extreme dust conditions.

To determine the effect of dust contamination on vehicle components.

2.5.2 Criteria

a. Servicing. Design and construction of the air cleaner shall permit quick and convenient disassembly for cleaning and servicing of the oil cup and filter element without removing or disturbing the clean air chamber or its connections to the engine and without the use of special tools (Ref MIL-A-13488A (Ord)).

b. Resistance to Air Leakage. The air cleaner shall not leak air when properly assembled and tested to a vacuum of 50 inches of water (Ref MIL-A-13488A (Ord)).

2.5.3 Method

2.5.3.1 Normal Dust Conditions. Air cleaner servicing requirements were recorded during durability test operations. After completion of the durability mileage an inspection was made to determine if dust had caused any damage to on-equipment-material, controls or other components. The cylinder head of vehicle U81 was removed to facilitate a visual inspection of the valves, cylinder walls and combustion chambers.

2.5.3.2 Extreme Dust Conditions. The oil bath air cleaner for the M151A2 truck has two major components. The upper element consists of the cover and attached filter element, and the weathercap. It excludes the air duct hose and hose clamp. The lower element includes the oil cup, removable wire mesh filter and the canister body. The two major components were washed and dried. The oil cup in the lower element was filled to the proper level and then both components were weighed.

The air cleaner was installed on vehicle U83 and an initial restriction taken. The vehicle then began dust operations behind a lead vehicle, pulling off to the side of the course every 15 minutes to take restriction readings. All restriction readings were taken in second gear at 4000 rpm while accelerating (maximum air demand).

After a restriction of 24 inches water was attained, the air cleaner was removed, and the unserviced upper and lower elements were individually weighed in the same manner as before. The lower element was disassembled and thoroughly cleaned in a solvent bath, while the upper element was shaken, but not washed, to clean. The air cleaner was reassembled, weighed and reinstalled on the vehicle. A restriction reading was taken to compare with initial restriction data.

Air leakage tests were conducted both before and after the dust operation by covering the air intake to the air cleaner while the engine was idling to determine if stalling would result.

2.5.4 Results

2.5.4.1 Normal Dust Conditions. The original air cleaners installed in the vehicles were not airtight and were leaking dust into the engines. New assemblies were obtained and installed. No additional dust leakage was observed during the remainder of the test.

Service to the air cleaner under normal dust conditions was not required more frequently than the 1000-mile interval specified in the vehicle lubrication order.

An inspection of the vehicles not involved in the extreme dust tests at the end of durability-reliability operation revealed no detrimental effects of dust to any component.

Traces of dust were found in the combustion chamber of U81, but the valves and cylinder walls were in excellent condition.

2.5.4.2 Extreme Dust Condition. The air cleaner reached maximum restriction after 3.75 hours of operation in extreme dust. The air cleaner component weights before and after test are presented in Table 12.

TABLE 12. Air Cleaner Dust Capacity

Component	Before Test	After Test	Weight Quantity Collected (gm)	After Servicing
Upper element	1215	1340	125	1280
Lower element	3630	6865	3235	3760
Total assembly	4845	8205	3360	5040

The plot of restriction versus time is presented in Figure 1. Detailed data are included in Table 1 of Appendix I.6.

The quantity of dust that the air cleaner failed to remove could not be accurately determined since an absolute filter was not used. The engine was damaged by dust ingestion during this short period of operation as indicated by a loss of engine compression as shown in Table 13.

TABLE 13. Engine Compression Before and After Dust Test

	Compression (psi)	
	Before Test	After Test
Cylinder No. 1	120	75
Cylinder No. 2	115	95
Cylinder No. 3	115	105
Cylinder No. 4	120	75

Dust deposits were also observed on the electrodes of all four spark plugs. The inside air duct hose from the air cleaner to the carburetor was covered with dust and a sample was analyzed to determine the size of the particles that were being ingested into the engine. A graph of the distribution by size of these particles is shown in Figure 2. Detailed data are presented in Table 2 of Appendix I.6.

The upper wire mesh element was saturated with dry dust (Fig. 4 and 5, App I.9).

As a result of the extensive residues in the lower element, it had to be removed from the vehicle for cleaning.

Total removal, cleaning, and installation time was approximately 55 minutes.

There was no air leakage observed during the stall tests conducted before and after operation in extreme dust.

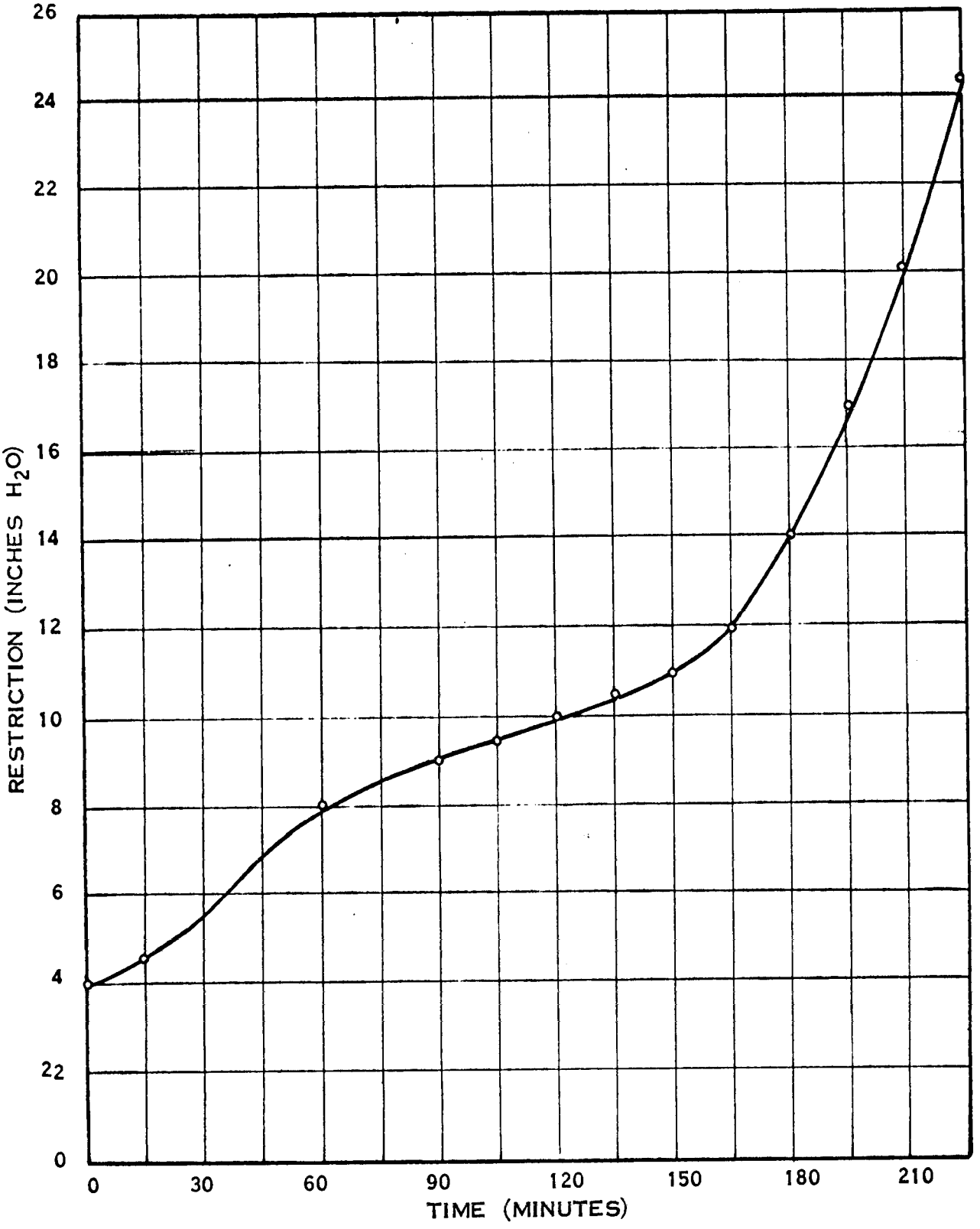

FIGURE 1. AIR CLEANER RESTRICTION CHARACTERISTICS DURING DUST TESTS, VEHICLE NO. 02DU8370, 27 JUNE 70.

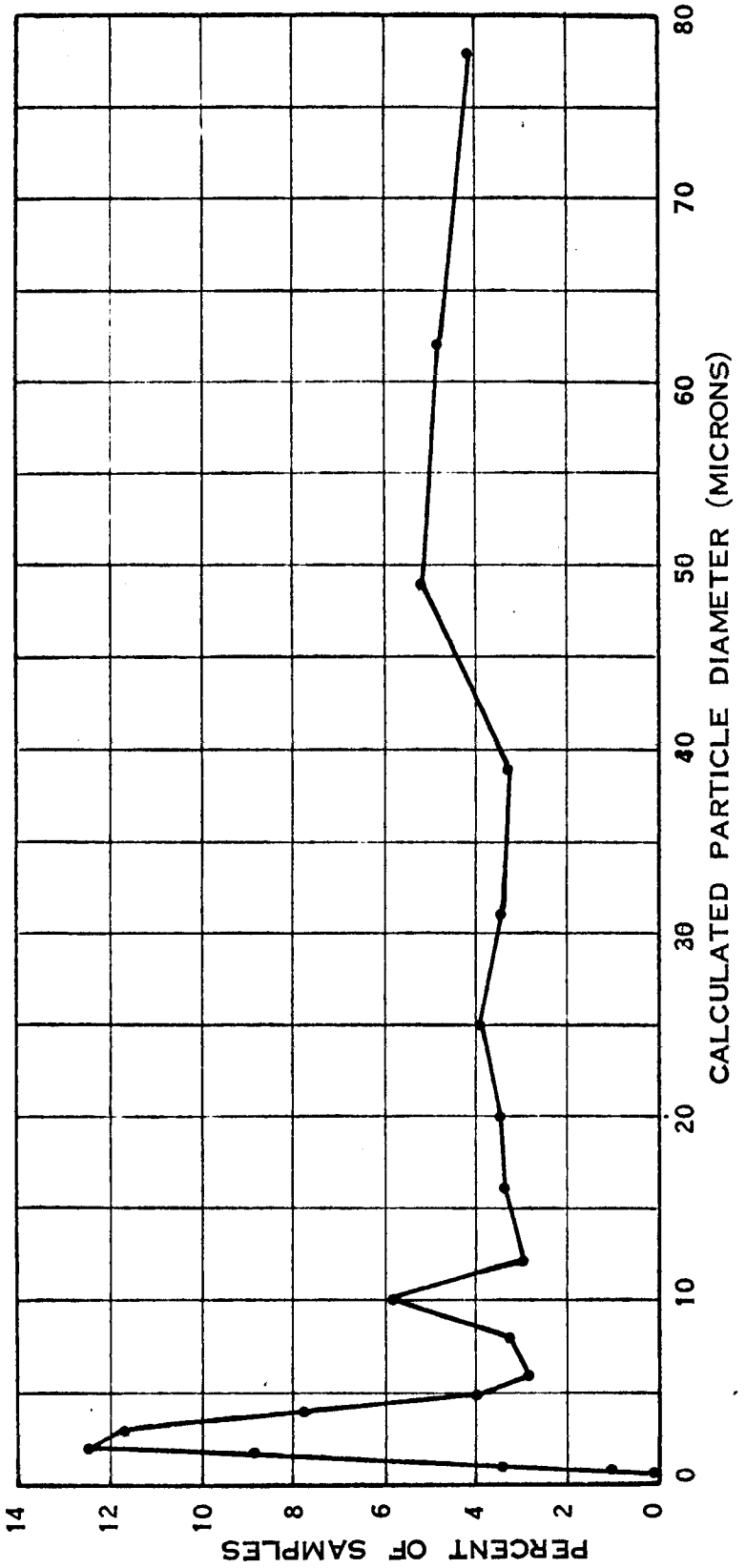

FIGURE 2. DISTRIBUTION BY PARTICLE SIZE OF DUST PARTICLES IN INTAKE AIR DUCT HOSE.

During the post-test inspection it was also observed that the inside of the distributor was covered with dust. There was no liquid oil left in the oil cup, only oil wetted dust.

2.5.5 Analysis

2.5.5.1 Assembly Problem. Apparently the vendor of the air cleaner was matching upper and lower canister elements to provide an airtight seal for the air pressure acceptance testing. The contractor was not retaining the match during his assembly, however, so that a different top and bottom were being installed on the vehicle. The assembly method was changed by the contractor to retain matched pieces, and new air cleaners were shipped and installed.

The change in assembly methods resulted in a significant improvement in air cleaner effectiveness for normal dust operation.

2.5.5.2 Air cleaner Functioning. Military Standard MIL-A-13488A(Ord) specifies a test of 24 inches of water to determine dust capacity. The extreme dust test was run to simulate the laboratory test condition. The lack of oil in the cleaner at the end of test indicates that the air cleaner had ceased to function properly sometime before the 24-inch restriction was attained, and unfiltered air was entering the engine. The oil level was such that oil was lost by being "pulled over" into the engine. The restriction versus time graph in Figure 1 indicates the possibility that the air cleaner probably lost its effectiveness after 2.5 hours of operation at a restriction of 11 inches of water, as evidenced by the rapid rate of rise after that point.

The post-test servicing required removal of the air cleaner chamber from the vehicle, rather than the oil cup and filter element alone.

These observations indicate that the service interval during extreme dust operation would actually be about 2-1/2 hours.

Dust tests during initial production and inspection comparison tests of the M151A1 truck produced results similar to those experienced in this test, i.e., oil pullover, channelling of airflow, and dust ingestion into the engine with severe damage to the engine after periods of operation as short as 1 hour in extreme dust conditions.

Product improvement tests of a dry-type air cleaner for the M151A1 truck conducted at Yuma Proving Ground (Ref 14, App V) indicated improved filtering with reduced engine wear and in addition provides "fail-safe" protection to the engine in the event that the dust capacity is exceeded.

2.6 TOXIC HAZARD TEST

2.6.1 Objective

To identify hazardous carbon monoxide concentrations in the personnel compartment of the vehicle.

2.6.2 Criteria

While in the cruise condition the maximum carbon monoxide concentration in any occupied part of the vehicle shall not exceed 0.005 percent (Ref MTP 2-2-614).

2.6.3 Method

The vehicle was operated on a figure 8 paved course at approximately 25 mph without side curtains, but with top installed. Air samples were then taken with a Saf-Co-Meter carbon monoxide tester (manufactured by Mine Safety Appliance Co., PN 47113) at each crew member position. The procedure was repeated at 15 mph.

2.6.4 Results

There was no perceptible concentration of carbon monoxide at any crew member position.

2.6.5 Analysis

The vehicle met the toxic hazard criteria.

2.7 MAINTAINABILITY

2.7.1 Objective

To determine the maintainability of the vehicle when operated over the test courses.

2.7.2 Criteria

Failure of either test vehicle to comply with any of the requirements specified or any deficiency of workmanship of materials nature during or as a result of the 20,000-mile test, shall be cause for rejection of the vehicle. Further, the government may refuse to continue acceptance of production vehicles until evidence has been provided by the contractor that corrective action has been taken to eliminate the deficiency. Any deficiency found during or as a result of 20,000-mile test shall be prima facie evidence that all vehicles already accepted prior to completion of the 20,000-mile test are similarly deficient unless evidence satisfactory to the government is furnished by the contractor that they are not similarly deficient. Such deficiencies on all vehicles shall be corrected by the contractor at no cost to the government regardless of location.

2.7.3 Method

A maintenance evaluation, in accordance with USATECOM Regulation 750-15, was conducted throughout the initial production tests.

The amount, frequency and level of maintenance required was recorded. A record of the amount of operation and maintenance during each shift was kept. Where more than one type of maintenance was required, a separate job was shown for each type.

Throughout the test, maintenance instructions in the technical manuals and manuscripts, maintenance charts, and lubrication orders were analyzed for adequacy at the intended maintenance level. The adequacy of the tools and the need for special training were also recorded.

2.7.4 Results

A summary of maintainability data is presented in Table 14.

TABLE 14. Maintainability Data Summary

	U81	U83	U86	Total
Test miles	21025	21048	21091	63164
Actual operating hours	857.2	940.9	872.0	2670.1
Maintenance man-hours	108.9	104.3	116.2	329.4
Active maintenance downtime	79.0	74.6	78.0	231.6
Scheduled maintenance hours	54.9	55.2	69.1	179.0
Unscheduled maintenance hours	54.0	49.1	47.1	150.4
Scheduled maintenance actions	17	21	23	61
Unscheduled maintenance actions	35	23	37	95
Total chargeable component failures	58	38	49	145
Operating hours (assuming utilization of 20 mph)	1051.2	1052.4	1054.6	3158.2

Maintenance indicies derived from the data in Table 14 are shown in Table 15.

TABLE 15. Maintainability Indicies*

	U81	U83	U86	Total
Average speed (mph)	24.5	22.3	24.2	23.7
Mean time between maintenance (hr)	16.5	21.4	14.5	17.1
Mean miles between maintenance (mi)	404.3	478.4	351.5	404.9
Mean active maintenance downtime (hr)	1.5	1.7	1.2	1.5
Maintenance ratio (%) MMH/actual operating hr	12.7	11.1	13.3	12.3
Achieved availability (%)	91.6	92.6	92.7	92.0
Maintenance ratio, MMH/operating hr (assuming avg speed of 20 mph)(%)	10.4	9.9	11.0	10.4
Maintenance ratio criteria, (less than)	-	-	-	7.0

*For definitions, see USATECOM Regulation 750-15

The manuals and tools were generally adequate. However, the specification for the torque on the wheel lifting eye and locking nut is not included in the maintenance manual.

No special training was required.

The vehicles met the maintainability criteria.

2.8 DURABILITY AND RELIABILITY

2.8.1 Objective

To determine component reliability and general durability of the vehicle when operated over the test courses.

2.8.2 Criteria

Failure of any test vehicle to comply with any of the requirements specified or any deficiency of workmanship of materials nature during or as a result of the 20,000-mile test, shall be cause for rejection of the vehicle. Further, the government may refuse to continue acceptance of production vehicles until evidence has been provided by the contractor that corrective action has been taken to eliminate the deficiency. Any deficiency found during or as a result of 20,000-mile test shall be prima facie evidence that all vehicles already accepted prior to completion of the 20,000-mile test are similarly dificient unless evidence satisfactory to the government is furnished by the contractor that they are not similarly deficient. Such deficiencies on all vehicles shall be corrected by the contractor at no cost to the government regardless of location.

2.8.3 Method

Subsequent to a 1000-mile break-in operation, the vehicle underwent durability cycles consisting of the following:

Course	Miles
Paved	750
Level cross-country	500
Hilly cross-country	500
Secondary road (gravel)	350
Winding secondard road (gravel)	325
Belgian block (equivalent)	75
Total	2500

The vehicles completed eight cycles of 2500 miles each, for a total of 20,000 miles over the durability test courses. For highway operation the payload was 1200 pounds and trailed load was 1300 pounds. For secondary roads and cross-country the payload was 800 pounds and the trailed load was 1000 pounds. The trailed load was towed approximately 50 percent of the miles on each course. At least 1000 miles of operation were to be made with the front axle drive engaged, preferably when marginal traction conditons existed.

Scheduled organizational maintenance was performed in accordance with the maintenance directive. This included servicing, preventive maintenance, and adjustments prescribed therein.

The vehicles were given a thorough visual and functional inspection. Teardown on one differential and one transmission was accomplished, and the cylinder head was removed from one engine. Observations on wear, corrosion and loss of adjustment were made and recorded.

2.8.4 Results

A summary of mileage accumulated by test course is presented in Table 16.

TABLE 16. Summary of Course Operation (mi)*

Test Course	Vehicle U81	Vehicle U83	Vehicle U86
Paved			
with trailer	3001	3010	3003
without trailer	3000	3008	3018
Level cross-country			
with trailer	2000	2001	2005
without trailer	2010	2005	2003
Hilly cross-country			
with trailer	2000	2009	2016
without trailer	2005	2007	2007
Straight secondary			
with trailer	1400	1407	1400
without trailer	1406	1400	1410
Winding secondary			
with trailer	1300	1300	1305
without trailer	1303	1300	1307
Belgian block equivalent			
with trailer	300	300	305
without trailer	300	303	300
Break-in (without trailer)	1001	998	1012
Total with trailer	10001	10027	10034
Total without trailer	10023	10023	10045
Total accumulated mileage	21025	21048	21091

NOTE: At least 1500 miles, both with and without trailer, was run in 4-wheel drive by each vehicle on hilly and level cross-country courses.

*All mileages are higher than actual because the odometers of all vehicles were reading high by 6 to 8 percent (see App III, Sec 2, Group 47).

A summary of fuel consumption by test course is presented in Table 17.

TABLE 17. Fuel Consumption by Test Course*

Test Course	Avg Fuel Consumption (mpg)* U81	U83	U86
Paved			
with trailer	16.0	15.2	
without trailer	18.7	18.5	16.6
Level cross-country			
with trailer	13.9	13.2	13.0
without trailer	13.7	15.4	12.9
Hilly cross-country			
with trailer	11.4	11.8	11.9
without trailer	13.4	14.0	13.5
Straight secondary			
with trailer	17.8	15.9	15.6
without trailer	17.3	17.7	20.1
Winding secondary			
with trailer	14.4	15.4	15.5
without trailer	16.8	17.5	17.8
Belgian block (equivalent)			
with trailer	14.6	16.6	13.3
without trailer	19.5	21.4	14.2
Total with trailer	14.5	14.1	14.1
Total without trailer	15.9	16.4	15.5
Total overall	15.1	15.1	14.8

*Fuel (and oil) consumption figures have not been corrected for the 6 to 8 percent odometer error.

The oil consumption of U81 was 4205 miles per quart, U83 was 4210 miles per quart, and U86 was 3515 miles per quart.

Oil samples were taken from all reservoirs during each 6000-mile maintenance. The analyses are presented as Appendix I.3.

There were two deficiencies observed during durability-reliability operation. A rear yoke on the propeller shaft of vehicle U81 broke at 17,170 miles, diasbling the vehicle. This was the only mission failure observed during the test, and it required two men 1.5 hours to make the necessary repairs. All vehicles experienced extensive brake pulling (uneven application) to the left or right after 12,000 to 15,000 miles had been accumulated. For complete information on these deficiencies, see Appendix III, Section 1, Deficiencies.

Of the 28 shortcomings reported, 25 were discovered during durability-reliability operations. All shortcomings are presented in Section 2, Shortcomings, of Appendix III. The most important are summarized below, with the reference relating to the standard government group under which the shortcoming is located in Appendix III.

a. There were three incidents of broken radio interference suppression wire mesh insulations on spark plug leads (Group 06).

b. Ignition coil retaining tabs broke on vehicle U83. The retaining tab fasteners came loose on vehicles U81 and U83 (Group 06).

c. Four turn signal control assemblies failed for mechanical or electrical reasons (Group 06).

d. At the end of test on vehicle U81, the right output roller bearing and race in the rear differential were considered unserviceable (Group 11) (Fig. 1, App I.9).

e. There were 13 tire inner tube failures due to separation at the seam (Group 13).

f. The bushings in the front upper and lower A-frame control arms were badly worn on all vehicles (Fig. 3, App I.9). Problem was discovered about 17,500 test miles (Group 13).

g. Six shock absorbers were replaced (Group 16).

h. The odometers of all vehicles were found to be reading higher mileage than actual by 6 to 8 percent (Group 47).

The results of the limited engine teardown on U81 to check for dust damage are included in Section 2.5.4.

Detailed results of the final inspection are presented in Appendix I.10. The most important observations are summarized below:

a. A hole was discovered at a spot weld in the air cleaner oil cup (see App III, Sec 2, Group 3).

b. The disassembled transmission from vehicle U81 was in good condition.

c. The front suspension upper ball joint boots were cracked on all vehicles.

d. U81 had a castor of -1 1/2° on the left front wheel. U86 had -3/4° and +2° castor angles on the front wheels.

e. U83 had 0° and -1/2° camber and U86 had -1 1/2° and -1 3/4° camber.

f. U83 had a swing arc of 32° on the left wheel.

g. The toe-in measurements for U81, U83 and U86 were +1/2 inch, +5/8 inch and -3/8 inch, respectively.

h. The disassembled rear differential had spalled rollers in the right output roller bearing (Fig. 1, App I.9). The bearing and race were considered unserviceable (see App III, Sec 2, Group 11).

i. All vehicles pulled to the left or right while braking during pre-inspection road tests (Para. 2.9.4 and 2.9.5).

j. The rear brake cylinders and pistons in U81 were found to be in good condition. One front cylinder had a trace of rust. The pistons were tarnished and their skirts were slightly rough. The front boots had cuts occurring where they roll back over the piston skirt.

k. The front brake cylinders from U86 were also torn down and inspected. The cylinder, pistons and boots were all in good condition.

2.8.5 Analysis

The specified durability mileage (20,000) was not completed by 1200 to 1600 miles because of the odometer errors in all vehicles. The vehicles had an advantage because the test was shortened. For example, the rear differential could have failed over that period because of the spalled bearings found during final inspection, and would have thereby been classified as a deficiency.

The overall fuel consumptions of the three vehicles were within 0.3 mile/gallon of each other. The fuel consumption inconsistencies for any given course, such as level cross-country, are the result of varying driver habits, and inaccuracies in fuel usage per course reporting. These factors tend to balance out over all of the courses, resulting in consistant overall figures.

The broken yoke on the propeller shaft was classified as a deficiency because the vehicle was disabled. The brake pulling, although not a serious hazard on YPG's dry pavement and gravel courses, would be extremely dangerous on wet or icy roads. This safety hazard is the basis for deficiency classification.

The single mission failure over the 63,164 miles and 2,670 hours accumulated by all three vehicles results in the reliability figures shown in Table 18. Repair of the failure took 1.5 hours, thus the mean-time-to-repair figure is 1.5 hours/failure.

TABLE 18. Reliability Data

	Confidence Level	
	90 Percent	95 Percent
75-mile mission reliability	.995	.994
Mean time between failures at 20 mph utilization	809.9	664.0
Mean miles between failure	16197	13280

Although the worn A-frame control arm bushings were not discovered until about 17,500 test miles, it is likely that the problem had existed for several thousand miles. It had been theorized that the excessive negative camber (up to -5° on one vehicle) resulting from the worn bushings was responsible for the brake pulling problems which began between 12,000 and 15,000 miles. Two vehicles were shimmed back into correct camber, but the problem persisted. By the end of test, all vehicles had shims in the front control arms in excess of 5/8 inch. The result of this excessive negative camber was very poor tire wear.

The lack of a torque specification for the wheel lifting eye is particularly important because insufficient torque on the eye can result in water leakage into the hub during fording, even if the self-locking nut is tight.

The hole in the air cleaner oil cup resulted in a loss of about one-third of the oil in the cup, and thereby significantly reduced the effectiveness of the cleaner. The problem was not classified as a deficiency because some degree of filtering was occurring.

Since the steering arm ball joints are lubricated for life at the time of manufacture the cracks in the ball joint boots could result in damage to the joints by allowing dust contamination of the grease.

Even though all vehicles had in excess of 5/8 inch of shims because of the worn control arm bushings at the end of test, only U81 was within camber specifications. All vehicles were either above or below toe-in specifications by 11/32 to 15/32 inch. Vehicles U81 and U83 were castor specifications by 1/4 to 1-1/2 degrees.

The purpose of correct castor, camber and toe-in is to provide good handling and ride characteristics, optimum tire wear, and to minimize stresses on the front suspension. The failure of the vehicles to meet these specifications is correspondingly detrimental to those characteristics.

The cramping angle on the left wheel of vehicle U83 was 1 degree in excess of specifications. Cramping angles in excess of the specification can cause damage to the steering gear.

It is probable that the spalled roller bearings in the rear differential of vehicle U81 would have resulted in a differential failure within another 1000 miles.

2.9 SAFETY EVALUATION AND VEHICLE STABILITY

2.9.1 Objective

a. To determine if any safety hazards exist

b. To test and evaluate the effect of the trailing arm suspension on vehicle stability, maneuverability, steering, ease of handling and riding characteristics.

2.9.2 Criteria

USATECOM Regulation 385-6.

2.9.3 Method

Throughout all testing, observations were made with respect to difficulties experienced in operation of the test vehicles and safety hazards encountered.

Eleven persons were used to test the stability, handling and ride characteristics of one of the M151A2 test vehicles which had accumulated approximately 5000 test miles against an M151A1 which had undergone a 4000-mile inspection comparison test. Test personnel consisted of regular drivers, as well as project engineers who had been previously been involved with M151A1 testing.

The test course was a composite of five individual test courses, consisting of sections of the hilly cross-country, level cross-country and winding gravel course. In addition, one course was laid out in a dry wash to emphasize maneuvering characteristics, and another consisted of a paved figure 8 around a two-block area. All courses were run without a trailer and in addition, the paved and level cross-country courses were negotiated with a trailer. A questionnaire as contained in Appendix I.10 was completed by each driver at the end of each run. A summary of these driver comments is contained in Paragraph 2.9.4.2.

2.9.4 Results

2.9.4.1 Brake Problems. All vehicles encountered braking problems in the form of a pull or uneven application to the left or right after completing 12,000 to 15,000 miles of durability operation. The brake shoes were sanded, cleaned with a variety of cleaners, and replaced. Drums were checked for concentricity, and drum-to-shoe clearance was measured. Brake cylinders were removed and examined. The negative front wheel camber, resulting from worn A-frame control arm bushings, was corrected by shimming to determine if it was a contributing factor. None of these efforts provided a complete answer to the problem and further investigation was undertaken after the final inspections had been completed.

In this effort one factor at a time was checked on a vehicle exhibiting brake pulling characteristics. For example the front brake shoes were replaced. The pulling persisted so the original shoes were reinstalled. By this process of elimination, the problem was isolated to the wheel cylinder.

All front wheel cylinder boots had small cuts resulting from metal burrs which had not been removed from the rear of the piston skirts. These cuts allowed dust and moisture to contaminate the cylinders, thereby hindering their operation.

Detailed results are shown in the Final Inspection Data in Appendix I.8, Group 12.

2.9.4.2 Safety and Handling Evaluation Without Trailer.

a. Hilly Cross-Country. This course consisted of very uneven virgin terrain and steep, washboarded gravel roads which were traversed at 5 to 15 mph. The M151A1 pitched more over the virgin terrain as the vehicle traversed the abrupt rises and depressions, and it "walked" slightly sideways on the washboarded hills. The former occurrence was somewhat disconcerting to many of the drivers. The M151A2 exhibited neither of these characteristics. Over all courses the drivers preferred the larger grip and smaller diameter of the M151A2 steering wheel.

b. Level Cross-Country. This course consisted of winding, bumpy roads covered with loose gravel and sand. It was one of the more revealing courses in terms of comparison because of the high speeds attained (15 to 45 mph). The M151A2 provided a more positive feeling of stability and control for three principal reasons. First, when the M151A2 was set into a turn, it would track perfectly without wandering or trying to break away. At the same speeds the M151A1 would consistently slide, with the rear end sliding to the outside of the turn. Second, at these higher speeds over washboarded roads, the drivers did not feel that the M151A1 was making secure contact with the road. A few described it as a feeling of being partially airborne. Finally, over very bumpy portions of the course, the rear end of the M151A1 tended to hop, instead of hugging the road as the M151A2 did. This was deemed particularly dangerous when a large bump was encountered during, or immediately prior, to a turn.

It should be noted that this was the only test course over which the drivers preferred the ride of the M151A1. This may be due in part to a weak suspension in the particular M151A2 vehicle used (U86) causing it to "bottom out." Later, it was found that U86 had front springs 1/4 inch shorter than specification.

c. Gravel Road, Winding. This course was run at slower speeds (15 to 35 mph) than normal to determine if a difference could be detected between the vehicles when they were driven well below critical stability limits. The concensus was that the M151A2 still gave a greater feeling of confidence.

d. Dry Wash. This was a test of manuvering over virgin, sandy terrain. Drivers found that there was excessive feedback to the steering wheels of both vehicles, but because the steering wheel in the M151A2 was smaller, the overall effect was worse in the M151A2. The oversteer characteristics of the M151A1 were advantageous in negotiating sharp turns in the soft sand, but the overall stability and ride in the M151A2 somewhat balanced these overall evaluations.

e. Paved Figure 8. In the turns around the paved figure 8 course, the M151A2 was felt to have greater adhesion to the road, giving a feeling of much greater stability. The M151A2 leaned much more than the M151A1. The M151A1 did not lean, but the front end oversteered and the rear end seemed to want to slide. The result was that the M151A1 tires started to squeal through many of the turns while the M151A2 tires did not. The brakes on the M151A1 were very hard requiring much more effort than those on the M151A2. Course speeds were 15 to 25 mph.

2.9.4.3 Safety and Handling Evaluation with Trailer. The drivers indicated that no comparative differences in stability and handling with or without the trailers were evident.

2.9.5 Analysis

The brake pulling was never serious enough to be considered a severe safety hazard on the dry pavement and gravel courses. However, such a condition could definitely be dangerous on wet or icy roads and was therefore classified as a deficiency.

The modified steering wheel and rear suspension have resulted in a greater stability, easier handling and more control over all types of terrain. The drivers higher confidence in the M151A2 was due to the leaning of the vehicle which indicated how fast they were negotiating a turn. The M151A1 does not have such a pronounced indicator and can break away or slide out unexpectedly, thus reducing the confidence in it. The leaning of the M151A2, then, is a definite advantage regarding safety of operation.

Item: Truck, Utility, 1/4-Ton, 4x4, M151A2

Date Received: 1 April 1970
Shipper: ONC Hopper Truck Lines
Tractor No. 1543; Trailer No. 20-7572

USA Reg No.	02DU8170	02DU8370	02DU8670
Serial No.	24573	24575	24578
Odometer reading	13.0	12.9	13.1
Vehicle blocking	In rear and front wheels	In rear and front wheels	In rear and front wheels
Vehicle anchoring	None	None	None
Damage due to lifting or rigging	None	None	None
Evidence of shock	None	None	None
Seals of openings	In truck van	In truck van	In truck van
Exposed metal coverings	In truck van	In truck van	In truck van
Locks: closed, locked, or sealed	Seal not fastened	Seal not fastened	Seal not fastened
Vehicle cover	In truck van	In truck van	In truck van
OVE anchor and blocking	Strapped in rear seat	Strapped in rear seat	Strapped in rear seat
OVE security and marking	Adequate	Adequate	Adequate
Oil or grease seal leaks	None	None	None
Battery disconnected	No	No. Switch on; battery dead	Yes
General appearance	New - good condition	New	New - good condition
Maintenance package publication	In vehicle	In vehicle	In vehicle

APPENDIX I.2. INITIAL TECHNICAL INSPECTION

		USA Registration No.		
		02DU8170	02DU8370	02DU8670
SNL Group: 01, Engine				
Idle speed (rpm)		525	450	600
Manifold vac at idle		20	21.5	21
	Engine Speed (rpm)			
Oil pressure (psi) at:	Idle	36	40	38
All oil pressures were	1000	40	44	41
taken at operating tem-	1500	42	45	42
perature. Specification	2000	43	45	45
is 35-45 psi at oper-	3000	46	49	48
ating speed	4000	48	51	51
	Cylinder No.			
Compression (psi) during	1	115	125	125
cranking at approximately	2	122	132	130
230 rpm. Specification is	3	124	132	130
135-145 psi.	4	130	130	130
Spark plug gap (in.)	1	0.030	0.032	0.030
Specification is 0.029	2	0.035	0.032	0.025
to 0.032 inch.	3	0.033	0.032	0.027
	4	0.035	0.032	0.025

All other engine components met the necessary specification requirements.

SNL Group: 02, Clutch

S a t i s f a c t o r y

SNL Group: 03, Fuel System

Fuel pressure (psig)	4.75	4.75	5
Specification is 5-6 psig			

SNL Group: 04, Exhaust System

S a t i s f a c t o r y

USA Registration No.		
02DU8170	02DU8370	02DU8670

SNL Group: 05, Cooling system

S a t i s f a c t o r y

SNL Group: 06, Electrical System

Headlight adjustments (in.)
Specification is 0 inch right, 5 inches down

Left	Right	Left	Right	Left	Right
5 L	5-1/2 D	2-1/2 L	5-1/2 L	7 L	7 L
7 D	9 D	2-1/2 D	10 D	10 D	10 D

L = left D = down

Headlamp and parking lamp wiring was poorly secured on all vehicles.

Lead to the oil pressure transmitter was too long.

The electrical cable from the starter foot switch was rubbing against the throttle linkage, thereby interfering with the throttle return. The loop in the cable which should clear the linkage had not been installed high enough to prevent contact.

SNL Groups: 07, 08 and 09

All items were satisfactory on all vehicles.

SNL Group: 10, Front Axle

Specifications for steering geometry are as follows:

	Left	Right	Left	Right	Left	Right
Caster, -1/2° to +1/2°	1/4°	0°	0°	3/4°	0°	0°
Camber, 1/2° to 1-1/2°	0°	1°	1°	1°	1°	0°
Toe-in, 1/8 inch	5/8 in.	5/8 in.	19/32 in.	19/32 in.	3/4 in.	3/4 in.
Swing arc, 31°	31°	31°	31°	30°	30°	31°

All measurements were made on the vehicle without payload.

USA Registration No.		
02DU8170	02DU8370	02DU8670

SNL Groups: 11 through 18

All items were satisfactory on all vehicles.

SNL Group: 22, Miscellaneous Body, Cab, Chassis, Hull and Accessories

The modified top with full view rear window was not received. The inside rearview mirror was not received with any vehicles.

APPENDIX I.3. OIL ANALYSIS SUMMARY

PROJECT ENGINEER Shoemaker VEHICLE M151A2 USA REG. No. 02DU8170 WORK ORDER No. 0850

DATE	4 Apr 70	24 Apr 70	14 May 70	5 Jun 70	1 Jul 70			
SAMPLE No.	70-2198	70-2265	70-2367	70-2464	70-2671			
SAMPLE SOURCE	Engine	Engine	Engine	Engine	Engine			
ODOMETER	17.0	6001.0	12010.3	16942.1	21058			
ENGINE HOURS								
PRODUCT								
GRADE								
SPECIFICATION MIL-								
TESTS								
API GRAVITY	25.8	21.2	16.9	20.5	23.3			
CORROSION (ASTM No.)					1B+			
FLASH POINT (°F)		400	420	390	405			
SEDIMENT (%)								
WATER (%)								
CARBON RESIDUE (%)		3.89	5.54	5.38	2.11			
SULFATED ASH (%)		1.22	3.93	3.80	1.79			
KINEMATIC VISCOSITY (cs)								
AT -40°F								
AT 0°F								
AT 100°F	84.60	115.4	112.1	107.0	110.5			
AT 210°F	9.59	10.59	11.26	10.58	10.34			
VISCOSITY INDEX		78	94	87	79			
PENTANE INSOLUBLES (%)		4.59	7.16	5.89	0.84			
BENZENE INSOLUBLES (%)		3.42	6.11	5.61	0.76			
SPECTROGRAPHIC ANALYSIS (PPM)								
ALUMINUM	5	12	19	9	5			
IRON	14	68	139	105	38			
SILICON	7	11	34	2	0			
COPPER	31	110	15	8	6			
CHROMIUM	1	6	19	16	3			
~~NICKEL~~ Magnesium	4	4	3	2	2			
LEAD	195	4000	4100	2900	1535			
TIN								
ZINC								
SILVER	0	0	0	0	0			
FOAM TEST								
SEQ. I (ML.)								
SEQ. II (ML.)								
SEQ. III (ML.)								
CLOUD POUR POINT (°F)								
REMARKS: Fuel Dilution %		1.6	1.2	1.6	1.4			

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OIL ANALYSIS SUMMARY

PROJECT ENGINEER Shoemaker VEHICLE M-151A2 USA REG. No. 02DU8170 WORK ORDER No. 0850

DATE	4 Apr 70	24 Apr 70	14 May 70	5 Jun 70	1 Jul 70			
SAMPLE No.	70-2199	70-2266	70-2368	70-2506	70-2672			
SAMPLE SOURCE	Transmission---	---	---	---	---			
ODOMETER	17.0	6001.0	12010.3	17156.7	21058			
ENGINE HOURS								
PRODUCT								
GRADE								
SPECIFICATION MIL-								
TESTS								
API GRAVITY	27.1	28.1	24.6		22.3			
CORROSION (ASTM No.)					1B+			
FLASH POINT (°F)		380	390		375			
SEDIMENT (%)								
WATER (%)				27.2	Trace			
CARBON RESIDUE (%)		1.13	1.46		1.74			
SULFATED ASH (%)								
KINEMATIC VISCOSITY (cs)								
AT -40°F								
AT 0°F								
AT 100°F	59.98	71.84	119.8		244.4			
AT 210°F	8.19	9.22	12.27		17.33			
VISCOSITY INDEX		111	101		81			
PENTANE INSOLUBLES (%)		0.10	0.46		1.28			
BENZENE INSOLUBLES (%)		0.07	0.37		0.22			
SPECTROGRAPHIC ANALYSIS (PPM)								
ALUMINUM	4	11	13	2	3			
IRON	32	151	585	235	290			
SILICON	0	14	13	0	8			
COPPER	19	135	310	38	32			
CHROMIUM	1	2	12	3	2			
xnxzxz Magnesium	1	2	2	1	1			
NICKEL								
LEAD	12	35	33	21	61			
TIN								
ZINC								
SILVER	0	0	0	0	0			
FOAM TEST								
SEQ. I (ML.)								
SEQ. II (ML.)								
SEQ. III (ML.)								
CLOUD POUR POINT (°F)								
REMARKS								

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OIL ANALYSIS SUMMARY

PROJECT ENGINEER Shoemaker VEHICLE M-151A2 USA REG. No. 02DU8170 WORK ORDER No. 0850

DATE	4 Apr 70	24 Apr 70	14 May 70	1 Jul 70
SAMPLE No.	70-2200	70-2267	70-2369	70-2673
SAMPLE SOURCE	Front Differential			
ODOMETER	17.0	6001.0	12010.3	21058
ENGINE HOURS				
PRODUCT				
GRADE				
SPECIFICATION MIL-				
TESTS				
API GRAVITY	25.0	25.9	23.2	22.6
CORROSION (ASTM No.)				1B+
FLASH POINT (°F)		325	385	380
SEDIMENT (%)				
WATER (%)				
CARBON RESIDUE (%)		2.17	1.86	2.11
SULFATED ASH (%)				
KINEMATIC VISCOSITY (cs)				
AT -40°F				
AT 0°F				
AT 100°F	181.5	209.0	229.4	243.0
AT 210°F	16.15	19.93	17.66	18.12
VISCOSITY INDEX		113	90	89
PENTANE INSOLUBLES (%)		0.57	0.59	2.14
BENZENE INSOLUBLES (%)		0.52	0.45	1.64
SPECTROGRAPHIC ANALYSIS (PPM)				
ALUMINUM	30	33	24	26
IRON	154	121	980	1750
SILICON	39	64	33	49
COPPER	50	137	83	107
CHROMIUM	2	17	39	69
~~NICKEL~~ Magnesium	1	4	3	5
LEAD	2	21	17	30
TIN				
ZINC				
SILVER	0	0	0	0
FOAM TEST				
SEQ. I (ML.)				
SEQ. II (ML.)				
SEQ. III (ML.)				
CLOUD POUR POINT (°F)				
REMARKS				

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OIL ANALYSIS SUMMARY

PROJECT ENGINEER Shoemaker VEHICLE M-151A2 USA REG. No. 02DU8170 WORK ORDER No. 0850

DATE	4 Apr 70	24 Apr 70	15 May 70	1 Jul 70				
SAMPLE No.	70-2201	70-2268	70-2370	70-2674				
SAMPLE SOURCE: Rear Differential								
ODOMETER	17.0	6001.0	12010.3	21058				
ENGINE HOURS								
PRODUCT								
GRADE								
SPECIFICATION MIL-								
TESTS								
API GRAVITY	25.0	24.9	22.0	22.7				
CORROSION (ASTM No.)				3B				
FLASH POINT (°F)		415	380	380				
SEDIMENT (%)								
WATER (%)								
CARBON RESIDUE (%)		2.76	2.66	2.14				
SULFATED ASH (%)								
KINEMATIC VISCOSITY (cs)								
AT -40°F								
AT 0°F								
AT 100°F	180.4	234.3	268.4	243.3				
AT 210°F	16.10	23.35	24.48	18.63				
VISCOSITY INDEX		119	115	93				
PENTANE INSOLUBLES (%)		2.94	3.14	2.20				
BENZENE INSOLUBLES (%)		2.70	2.98	2.38				
SPECTROGRAPHIC ANALYSIS (PPM)								
ALUMINUM	41	61	45	17				
IRON	275	3840	6000	1899				
SILICON	59	112	150	26				
COPPER	95	462	354	92				
CHROMIUM	2	15	26	10				
~~NICKEL~~ Magnesium	2	17	11	3				
LEAD	5	18	17	11				
TIN								
ZINC								
SILVER	0	0	0	0				
FOAM TEST								
SEQ. I (ML.)								
SEQ. II (ML.)								
SEQ. III (ML.)								
CLOUD POUR POINT (°F)								
REMARKS								

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OIL ANALYSIS SUMMARY

PROJECT ENGINEER shoemaker VEHICLE M-151A2 USA REG. NO. C2DU8370 WORK ORDER NO. 0851

DATE	4 Apr 70	25 Apr 70	15 May 70	3 Jun 70	5 Jun 70	9 Jun 70	22 Jun 70	1 Jul 70
SAMPLE NO.	70-2202	70-2269	70-2375	70-2500	70-2465	70-2481	70-2511	70-2670
SAMPLE SOURCE	Engine	Engine	Engine	Engine	Engine	Engine	Engine	Engine
ODOMETER	23.2	6005.2		16447.0		17836	21084.6	21198.7
ENGINE HOURS								
PRODUCT								
GRADE								
SPECIFICATION MIL-								
TESTS								
API GRAVITY	25.7	23.3	18.7	21.5	22.3	21.3	25.3	26.5
CORROSION (ASTM No.)								1B
FLASH POINT (°F)		365	395	385	410	370	390	420
SEDIMENT (%)								
WATER (%)								
CARBON RESIDUE (%)		2.48	5.35	4.15	4.36	4.23	3.58	2.86
SULFATED ASH (%)		2.12	3.47	3.33	2.68	3.07	2.73	2.48
KINEMATIC VISCOSITY (cs)								
AT -40°F								
AT 0°F								
AT 100°F	85.50	126.4	108.5	95.76	98.95	101.7	97.30	95.20
AT 210°F	9.63	11.65	10.41	10.19	10.15	10.47	10.77	10.57
VISCOSITY INDEX		85	83	94	89	92	103	102
PENTANE INSOLUBLES (%)		2.98	6.90	5.96	4.40	5.72	4.91	1.80
BENZENE INSOLUBLES (%)		1.76	5.58	4.80	3.53	5.41	3.85	1.64
SPECTROGRAPHIC ANALYSIS (PPM)								
ALUMINUM	5	15	18	7	7	8	5	917
IRON	14	57	132	91	65	92	55	1025
SILICON	20	12	37	6	5	0	5	6
COPPER	24	117	14	8	7	8	5	6
CHROMIUM	1	7	10	25	6	9	33	11
NICKEL XXX Magnesium	4	5	3	2	2	1	2	17
LEAD	143	3000	2700	3431	2500	3000	3000	1950
TIN								
ZINC								
SILVER	0	0	0	0	0	0	0	0
FOAM TEST								
SEQ. I (ML.)								
SEQ. II (ML.)								
SEQ. III (ML.)								
CLOUD POUR POINT (°F)								
REMARKS Fuel Dilution %		1.6	1.2	2.0	1.6	2.0	1.6	2.4

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OIL ANALYSIS SUMMARY

PROJECT ENGINEER Shoemaker VEHICLE M-151A2 USA REG. No. 02DU8370 WORK ORDER No. 0851

DATE	4 Apr 70	25 Apr 70	15 May 70	9 Jun 70	22 Jun 70			
SAMPLE No.	70-2203	70-2270	70-2376	70-2482	70-2512			
SAMPLE SOURCE	Trans.	Trans.	Trans.	Trans.	Trans.			
ODOMETER	23.2	6005.2	12	17836	21084.6			
ENGINE HOURS								
PRODUCT								
GRADE								
SPECIFICATION MIL-								
TESTS								
API GRAVITY	27.3	28.0	22.7	22.6	22.5			
CORROSION (ASTM No.)								
FLASH POINT (°F)		400	380	370	375			
SEDIMENT (%)								
WATER (%)								
CARBON RESIDUE (%)		1.22	2.06	1.89	1.87			
SULFATED ASH (%)								
KINEMATIC VISCOSITY (cs)								
AT -40°F								
AT 0°F								
AT 100°F	63.40	81.86	211.9	248.1	247.4			
AT 210°F	8.35	9.79	16.26	19.18	18.04			
VISCOSITY INDEX		106	85	95	86			
PENTANE INSOLUBLES (%)		0.10	0.92	0.90	1.28			
BENZENE INSOLUBLES (%)		0.07	0.54	0.69	0.23			
SPECTROGRAPHIC ANALYSIS (PPM)								
ALUMINUM	2	7	5	8	10			
IRON	20	168	1460	260	279			
SILICON	1	10	10	23	37			
COPPER	14	122	260	31	31			
CHROMIUM	1	3	34	3	4			
~~NICKEL~~ Magnesium	1	1	2	1	1			
LEAD	9	25	25	51	39			
TIN								
ZINC								
SILVER	0	0	0	0	0			
FOAM TEST								
SEQ. I (ML.)								
SEQ. II (ML.)								
SEQ. III (ML.)								
CLOUD POUR POINT (°F)								
REMARKS								

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OIL ANALYSIS SUMMARY

PROJECT ENGINEER Shoemaker VEHICLE M151A2 USA REG. No. 02DH8370 WORK ORDER No. 0851

DATE	4 Apr 70	25 Apr 70	15 May 70	9 Jun 70	22 Jun 70			
SAMPLE No.	70-2204	70-2271	70-2377	70-2483	70-2513			
SAMPLE SOURCE	Differential Front	Front	Front	Front	Front			
ODOMETER	23.2	6005.2		17836	21084.6			
ENGINE HOURS								
PRODUCT								
GRADE								
SPECIFICATION MIL-								
TESTS								
API GRAVITY	25.0	24.7	22.7	22.0	22.2			
CORROSION (ASTM No.)								
FLASH POINT (°F)		410	390		370			
SEDIMENT (%)								
WATER (%)				3.2	0.8			
CARBON RESIDUE (%)		2.44	2.03	2.06	2.20			
SULFATED ASH (%)								
KINEMATIC VISCOSITY (cs)								
AT -40°F								
AT 0°F								
AT 100°F	182.5	220.3	234.1	271.1	257.2			
AT 210°F	16.18	20.70	17.72	23.51	19.79			
VISCOSITY INDEX		113	89	111	96			
PENTANE INSOLUBLES (%)		0.82	2.32	3.42	4.92			
BENZENE INSOLUBLES (%)		0.70	1.34	1.74	2.07			
SPECTROGRAPHIC ANALYSIS (PPM)								
ALUMINUM	21	36	20	21	24			
IRON	108	2500	1650	1673	21			
SILICON	22	68	31	33	49			
COPPER	51	140	140	56	67			
CHROMIUM	1	10	73	16	20			
~~NICKEL~~ Magnesium	1	4	4	3	2			
LEAD	5	26	22	48	40			
TIN								
ZINC								
SILVER	0	0	0	0	0			
FOAM TEST								
SEQ. I (ML.)								
SEQ. II (ML.)								
SEQ. III (ML.)								
CLOUD POUR POINT (°F)								
REMARKS								

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OIL ANALYSIS SUMMARY

PROJECT ENGINEER Shoemaker VEHICLE M-151A2 USA REG. No. 02DU8370 WORK ORDER No. 0851

DATE	4 Apr 70	25 Apr 70	15 May 70	9 Jun 70	22 Jun 70			
SAMPLE No.	70-2205	70-2272	70-2378	70-2484	70-2514			
SAMPLE SOURCE	Differential Rear	Rear	Rear	Rear	Rear			
ODOMETER	23.2	6005.2		17836	21084.6			
ENGINE HOURS								
PRODUCT								
GRADE								
SPECIFICATION MIL-								
TESTS								
API GRAVITY	25.0	24.8	22.2	23.0	22.4			
CORROSION (ASTM No.)								
FLASH POINT (°F)		375	385		375			
SEDIMENT (%)								
WATER (%)				21.0				
CARBON RESIDUE (%)		2.89	2.45	1.52	2.24			
SULFATED ASH (%)								
KINEMATIC VISCOSITY (cs)								
AT -40°F								
AT 0°F								
AT 100°F	183.7	267.4	259.1	247.1	246.8			
AT 210°F	16.34	30.28	21.77	27.65	19.80			
VISCOSITY INDEX		128	107	127	100			
PENTANE INSOLUBLES (%)		3.92	2.57	5.22	2.52			
BENZENE INSOLUBLES (%)		3.56	2.03	2.21	2.10			
SPECTROGRAPHIC ANALYSIS (PPM)								
ALUMINUM	40	41	28	5	24			
IRON	183	3600	3357	805	1165			
SILICON	52	117	50	4	40			
COPPER	7 5	380	181	23	68			
CHROMIUM	2	17	10	2	20			
NICKEL xxxxx Magnesium	2	23	8	4	2			
LEAD	6	20	15	22	38			
TIN								
ZINC								
SILVER	0	0	0	0	0			
FOAM TEST								
SEQ. I (ML.)								
SEQ. II (ML.)								
SEQ. III (ML.)								
CLOUD POUR POINT (°F)								
REMARKS								

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OIL ANALYSIS SUMMARY

PROJECT ENGINEER Shoemaker VEHICLE M-151A2 USA REG. NO. 02DU8670 WORK ORDER NO. 0852

DATE	4 Apr 70	25 Apr 70	15 May 70	4 Jun 70	8 Jun 70	17 Jun 70	16 Jul 70
SAMPLE NO.	70-2206	70-2273	70-2371	70-2466	70-2477	70-2501	70-2766
SAMPLE SOURCE	Engine	Engine	Engine	Engine	Engine	Engine	Engine
ODOMETER	21.4	5997.7	12094.9	17046.3	18639	21123.4	22436.8
ENGINE HOURS							
PRODUCT							
GRADE							
SPECIFICATION MIL-							
TESTS							
API GRAVITY	25.8	22.6	18.2	21.5	20.8	21.5	23.2
CORROSION (ASTM No.)						1B+	1B+
FLASH POINT (°F)		410	420	390	375	390	395
SEDIMENT (%)							
WATER (%)							
CARBON RESIDUE (%)		2.63	5.67	3.90	3.86	3.59	1.99
SULFATED ASH (%)		1.19	3.68	3.29	3.53	2.61	1.61
KINEMATIC VISCOSITY (cs)							
AT -40°F							
AT 0°F							
AT 100°F	84.99	121.1	105.6	104.3	109.8	116.4	99.59
AT 210°F	9.62	11.61	10.27	10.86	10.76	10.75	9.65
VISCOSITY INDEX		89	84	96	87	79	78
PENTANE INSOLUBLES (%)		2.92	6.81	5.64	6.98	3.81	2.14
BENZENE INSOLUBLES (%)		1.30	5.70	5.06	5.76	3.06	1.66
SPECTROGRAPHIC ANALYSIS (PPM)							
ALUMINUM	1	26	34	7	13	6	8
IRON	15	65	161	93	118	71	65
SILICON	11	12	23	9	13	6	20
COPPER	11	150	16	6	12	4	10
CHROMIUM	1	7	58	14	56	53	23
~~NICKEL~~ Magnesium	4	5	2	2	4	2	2
LEAD	194	3000	3000	2400	4500	1876	1350
TIN							
ZINC							
SILVER	0	0	0	0	0	0	0
FOAM TEST							
SEQ. I (ML.)							
SEQ. II (ML.)							
SEQ. III (ML.)							
CLOUD POUR POINT (°F)							
REMARKS Fuel Dilution %		1.0	1.0	1.2	1.8	2.2	3.2

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OIL ANALYSIS SUMMARY

PROJECT ENGINEER Shoemaker VEHICLE M-151A2 USA REG. NO. 02DU8670 WORK ORDER NO. 0852

DATE	4 Apr 70	25 Apr 70	15 May 70	8 Jun 70	17 Jun 70	1 Jul 70	16 Jul 70
SAMPLE NO.	70-2207	70-2274	70-2372	70-2478	70-2502	70-2542	70-2767
SAMPLE SOURCE	Trans.	Trans.	Trans.	Trans.	Trans.	Trans.	Trans.
ODOMETER	21.4	5997.7	12094.9	18639	21123.4	21244	22436.8
ENGINE HOURS							
PRODUCT							
GRADE							
SPECIFICATION MIL-							
TESTS							
API GRAVITY	27.3	27.5	24.7	23.0	22.7	22.3	24.1
CORROSION (ASTM No.)					1A	2C	2A
FLASH POINT (°F)		390	395	385	375	445	350
SEDIMENT (%)							
WATER (%)							
CARBON RESIDUE (%)		1.15	1.47	1.74	1.80	3.05	0.62
SULFATED ASH (%)							
KINEMATIC VISCOSITY (cs)							
AT -40°F							
AT 0°F							
AT 100°F	68.79	91.05	119.6	223.3	231.0	282.3	185.9
AT 210°F	8.77	10.21	11.84	17.40	19.68	21.98	15.01
VISCOSITY INDEX		101	95	90	104	102	86
PENTANE INSOLUBLES (%)		0.18	0.51	1.25	1.05	6.10	1.42
BENZENE INSOLUBLES (%)		0.10	0.21	0.79	0.48	5.28	0.76
SPECTROGRAPHIC ANALYSIS (PPM)							
ALUMINUM	7	28	27	4	6	12	0
IRON	26	184	340	93	66	4200	77
SILICON	3	28	32	18	8	64	11
COPPER	17	138	240	35	35	700	17
CHROMIUM	2	3	8	2	1	38	0
~~NICKEL~~ Magnesium	1	1	1	1	0	0	0
LEAD	6	23	23	32	26	67	8
TIN							
ZINC							
SILVER	0	0	0	0	0	0	0
FOAM TEST							
SEQ. I (ML.)							
SEQ. II (ML.)							
SEQ. III (ML.)							
CLOUD POUR POINT (°F)							
REMARKS							

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OIL ANALYSIS SUMMARY

PROJECT ENGINEER Shoemaker VEHICLE M-151A2 USA REG. No 02DU8670 WORK ORDER No. 0852

DATE	4 Apr 70	25 Apr 70	15 May 70	8 Jun 70	17 Jun 70	16 Jul 70		
SAMPLE No.	70-2208	70-2275	70-2373	70-2479	70-2503	70-2768		
SAMPLE SOURCE	Differential Front	Front	Front	Front	Front	Front		
ODOMETER	21.4	5997.7	12094.9	18639	21123.4	22436.8		
ENGINE HOURS								
PRODUCT								
GRADE								
SPECIFICATION MIL-								
TESTS								
API GRAVITY	24.9	24.0	22.9	22.9	22.4	23.0		
CORROSION (ASTM No.)					1A	1B		
FLASH POINT (°F)		380	385	375	375	420		
SEDIMENT (%)								
WATER (%)								
CARBON RESIDUE (%)		2.33	2.05	1.77	1.82	1.62		
SULFATED ASH (%)								
KINEMATIC VISCOSITY (cs)								
AT -40°F								
AT 0°F								
AT 100°F	187.4	220.3	244.3	247.0	244.0	244.7		
AT 210°F	16.38	21.74	18.01	18.39	17.73	16.37		
VISCOSITY INDEX		117	87	89	84	70		
PENTANE INSOLUBLES (%)		0.88	0.72	0.44	0.30	4.06		
BENZENE INSOLUBLES (%)		0.67	0.48	0.39	0.23	3.58		
SPECTROGRAPHIC ANALYSIS (PPM)								
ALUMINUM	39	53	19	14	8	5		
IRON	189	2550	1327	672	465	940		
SILICON	28	82	28	14	22	29		
COPPER	100	161	150	45	35	50		
CHROMIUM	2	5	39	15	9	6		
~~NICKEL~~ XXXX Magnesium	1	3	3	1	1	1		
LEAD	4	18	18	52	30	12		
TIN								
ZINC								
SILVER	0	0	0	0	0	0		
FOAM TEST								
SEG. I (ML.)								
SEG. II (ML.)								
SEG. III (ML.)								
CLOUD POUR POINT (°F)								
REMARKS								

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OIL ANALYSIS SUMMARY

PROJECT ENGINEER Shoemaker VEHICLE M-151A2 USA REG. No. 02DU8670 WORK ORDER No. 0852

DATE	4 Apr 70	25 Apr 70	15 May 70	8 Jun 70	17 Jun 70	16 Jul 70		
SAMPLE No.	70-2209	70-2276	70-2374	70-2480	70-2504	70-2769		
SAMPLE SOURCE Differential	Rear	REar	Rear	Rear	Rear	Rear		
ODOMETER	21.4	5997.7	12094.9	18639	21123.4	22436.8		
ENGINE HOURS								
PRODUCT								
GRADE								
SPECIFICATION MIL-								
TESTS								
API GRAVITY	25.0	23.4	22.4	23.1	20.6	22.7		
CORROSION (ASTM No.)					1B+	3B+		
FLASH POINT (°F)		405	375		380	440		
SEDIMENT (%)								
WATER (%)								
CARBON RESIDUE (%)		2.87	2.31	8.8 2.38	3.46	3.29		
SULFATED ASH (%)								
KINEMATIC VISCOSITY (cs)								
AT -40°F								
AT 0°F								
AT 100°F	185.3	231.3	257.2	244.5	273.5	398.7		
AT 210°F	16.39	24.55	20.51	17.80	21.37	28.52		
VISCOSITY INDEX		123	101	85	100	105		
PENTANE INSOLUBLES (%)		3.53	2.38	9.36	3.50	3.21		
BENZENE INSOLUBLES (%)		3.02	1.86	7.47	2.95	2.90		
SPECTROGRAPHIC ANALYSIS (PPM)								
ALUMINUM	2	53	27	46	98	39		
IRON	330	3630	2300	1500	7500	7250		
SILICON	78	119	48	92	267	107		
COPPER	130	500	380	52	96	523		
CHROMIUM	3	17	29	12	50	39		
Nickxx Magnesium	4	19	6	5	0	7		
LEAD	3	20	13	60	34	11		
TIN								
ZINC								
SILVER	0	0	0	0	0	0		
FOAM TEST								
SEQ. I (ML.)								
SEQ. II (ML.)								
SEQ. III (ML.)								
CLOUD POUR POINT (°F)								
REMARKS								

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APPENDIX I.4. THERMOCOUPLE LOCATIONS

Thermocouples (IC)		Location
1.	Coolant to radiator	At engine coolant outlet
2.	Coolant from radiator	At radiator coolant outlet
3.	Engine oil sump	At drain plug
4.	Transmission oil sump	At drain plug
5.	Front differential oil sump	At drain plug
6.	Rear differential oil sump	At drain plug
7.	Fuel from pump	In front of carburetor
8.	Air inlet after air cleaner	In air horn
9	Air before radiator	4 inches down, 4 inches from right side, 1/2 inch in front
10	Air before radiator	4 inches down, 4 inches from left side, 1/2 inch in front
11	Air before radiator	4 inches up, 4 inches in from right side, 1/2 inch in front
12.	Air before radiator	4 inches up, 4 inches in from left side, 1/2 inch in front
13	Air before radiator	Center, 1/2 inch in front
14.	Air after radiator	4 inches down, 4 inches in from right side, 1/2 inch to rear
15.	Air after radiator	4 inches down, 4 inches in from left side, 1/2 inch to rear
16.	Air after radiator	4 inches up, 4 inches in from right side, 1/2 inch to rear
17.	Air after radiator	4 inches up, 4 inches in from left side, 1/2 inch to rear
18	Air after radiator	Center, 1/2 inch in front.

Vehicle: M151A2

Temperatures in °F; pressures in psi, unless noted.
Data extrapolated to 120°F

Date (1970)		8 Jul	14 Jul	1 Jul	1 Jul	14 Jul	10 Jul	14 Jul	13 Jul	13 Jul
Road speed (mph)		2.9	6.2	11.6	9.6	14.2	15.9	17.9	20	18.3
Engine speed (rpm)		1000	1800	4000	1800	2600	2900	3300	3600	1800
Drawbar pull (lb)		1725	1876	1300	1129	1125	971	875	775	550
Gear		1	1	1	2	2	2	2	2	3
Extrapolation factor		+24	+25	+30	+22	+9	+15	+13	+10	+7
Ambient temperature (°F)		96	95	90	98	111	105	107	110	113
Time (MST)		1430	0930	1000	1115	1300	1400	1115	1230	1430
THERMOCOUPLES										
	Short Period Limits									
1. Coolant to radiator	232	254[a]	236[b]	213	220	214[b]	212	206	205	213
2. Coolant from radiator		245[a]	228[b]	207	214	207[b]	206	200	199	206
3. Engine oil sump	270	259[a]	283[b]	280	261	259[b]	262	258	262	248
4. Transmission oil sump	300	273[a]	302[b]	356[c]	344	300[b]	338	310[c]	302	289
5. Front differential oil sump	300	230[a]	279[b]	297[c]	226	262[b]	267	251[c]	243	237
6. Rear differential oil sump	300	282[a]	373[b]	262[c]	334	416[b]	276	412[c]	372[c]	281
7. Fuel from pump		140[a]	129	138	152	148[b]	144	139	151	149
8. Air inlet after air cleaner		116[a]	194	171	174	153[b]	171	164	175	171
9. Air before radiator, top right		154[a]	132	122	122	117	123	115	119	120
10. Air before radiator, top left		147[a]	123	122	122	117	122	115	119	120

Date (1970)	8 Jul	14 Jul	1 Jul	1 Jul	14 Jul	10 Jul	14 Jul	13 Jul	13 Jul
THERMOCOUPLES (Concluded)									
11. Air before radiator, bottom right	157[a]	130	122	123	118	124	115	119	121
12. Air before radiator, bottom left	194[a]	156	139	132	129	135	127	132	123
13. Air before radiator, center	150[a]	129	121	121	117	121	115	119	119
14. Air after radiator, top right	220[a]	187	162	181	162	164	155	157	171
15. Air after radiator, top left	233[a]	204	171	189	177	176	168	168	182
16. Air after radiator, bottom right	217[a]	185	159	174	159	164	154	158	172
17. Air after radiator, bottom left	221[a]	186	159	175	161	165	154	158	172
18. Air after radiator, center	235[a]	206	177	189	176	179	173	172	179
PRESSURE GAGES									
1. Drop across air cleaner (in. H_2O)	0	3.0	4.5	3.9	4.0	4.0	5.0	5.0	2.0
2. Engine oil	22	35	39	34	38	37	39.5	39.0	34
3. Fuel after pump	4.5	4.0	4.5	4.0	4.0	4.0	4.0	4.0	4.0
4. Radiator top tank	5.0	4.0	6	3.0	3.0	3.3	2.4	4.5	3.5

Date (1970)	8 Jul	14 Jul	1 Jul	1 Jul	14 Jul	10 Jul	14 Jul	13 Jul	13 Jul
METEOROLOGICAL DATA									
Temperature (°F)	96	101	90	98	111	105	107	110	113
Relative humidity (%)	32	30	40	44	22	25	31	23	23
Soil temperature (°F)	114	128	116	130	146	140	124	145	150
Barometric pressure (in. Hg)	29.75	29.68	29.74	29.74	29.67	29.73	29.69	29.69	29.66
Wind speed (mph)	8	3	3	4	6	11	3	7	6
Wind direction	NE	S	S	S	SW	S	S	SW	SW

NOTE: [a]Coolant overheated before temperatures stabilized.
[b]Rear differential overheated before temperatures stabilized.
[c]Did not stabilize; highest temperature recorded.

Lubricant temperature limits for the various components are listed below. They were taken from a letter dated 24 October 1967 from AMXCC-FL (see Appendix V, References).

	Sustained	Short Period*
Engine oil	250°	270°
Radiator coolant	215°	
Transmission and differentials	250°	300°

*15 minutes or less.

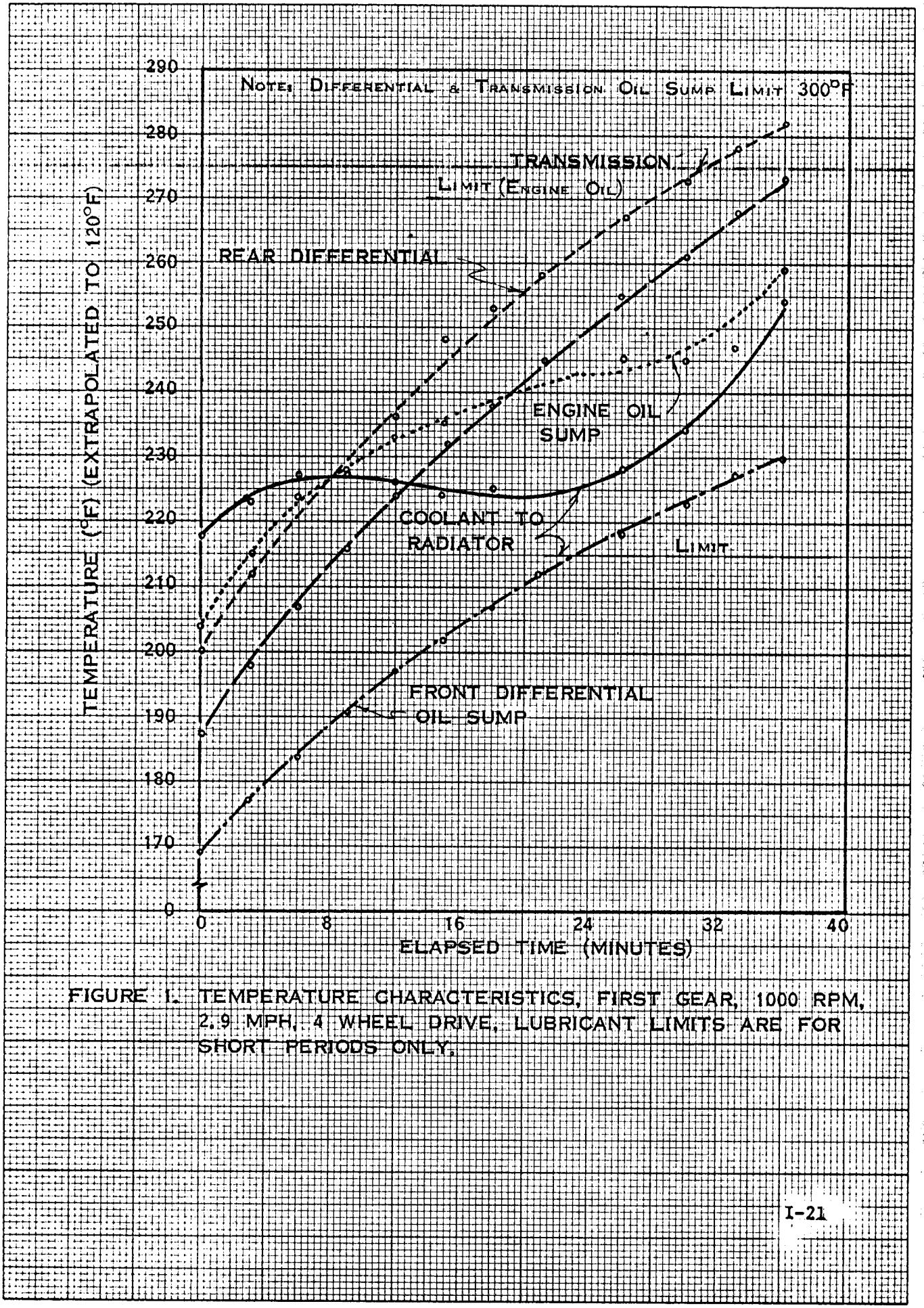


FIGURE 1. TEMPERATURE CHARACTERISTICS, FIRST GEAR, 1000 RPM, 2.9 MPH, 4 WHEEL DRIVE, LUBRICANT LIMITS ARE FOR SHORT PERIODS ONLY.

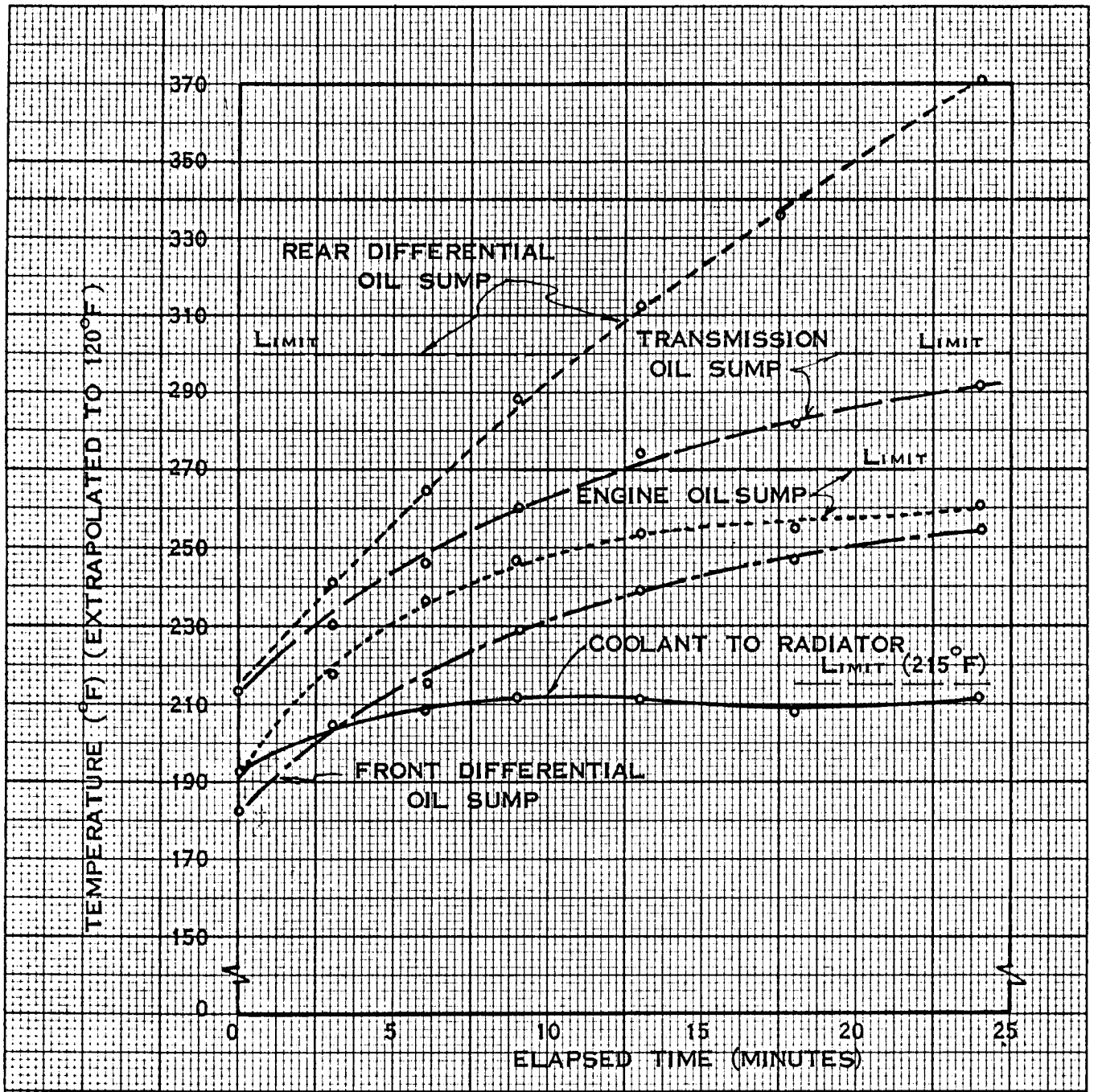


FIGURE 2. TEMPERATURE CHARACTERISTICS, SECOND GEAR, 2600 RPM, 14.2 MPH, 4 WHEEL DRIVE, LUBRICANT LIMITS FOR SHORT PERIODS ONLY.

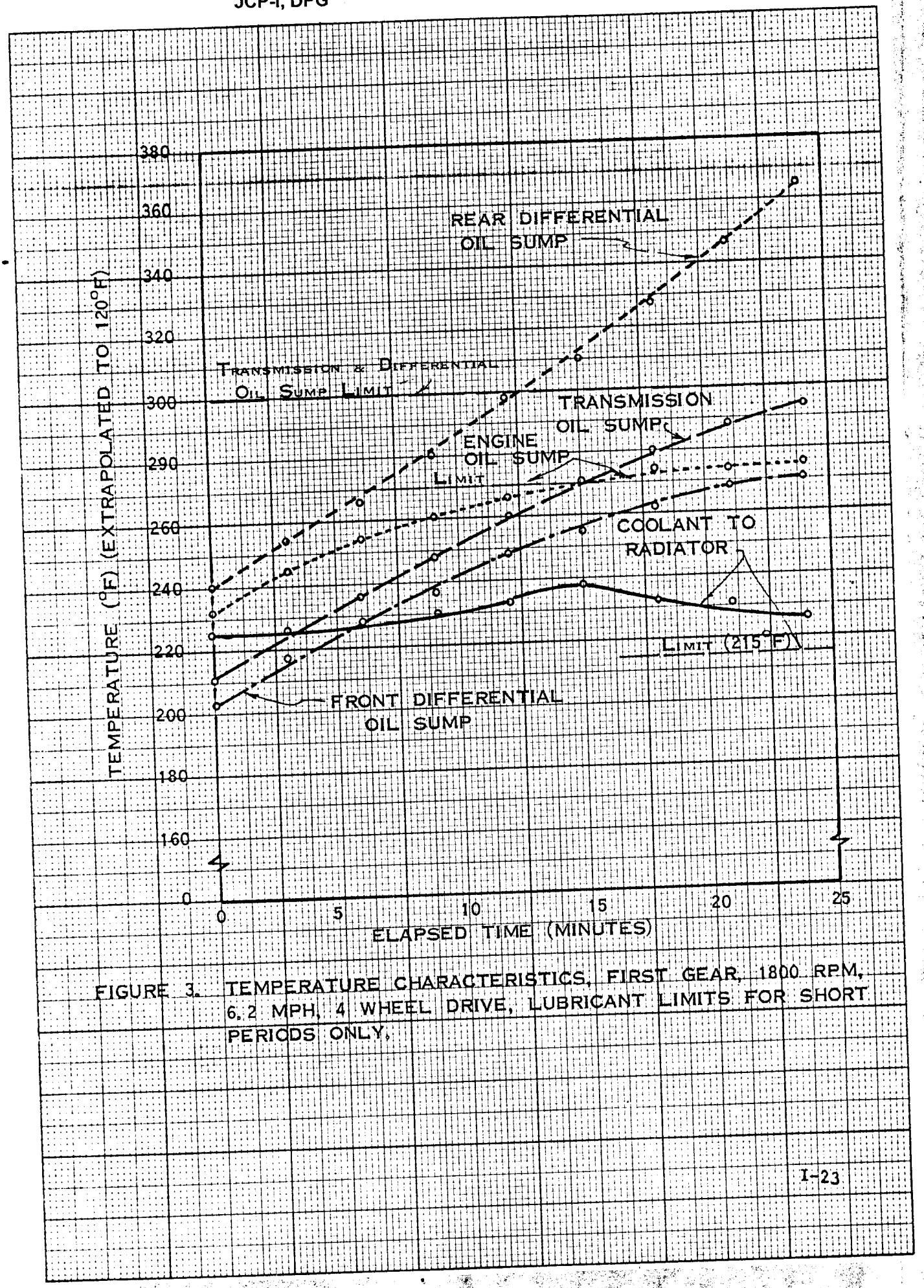


FIGURE 3. TEMPERATURE CHARACTERISTICS, FIRST GEAR, 1800 RPM, 6.2 MPH, 4 WHEEL DRIVE, LUBRICANT LIMITS FOR SHORT PERIODS ONLY.

APPENDIX I.6. DUST TEST DATA

TABLE 1. Air Cleaner Restriction Data

Cumulative Operating Time (min)	Cumulative Miles	Restriction (in. H_2O)
0	0	4
15	5.1	4-1/2
30	10.1	Broken gage
45	15.8	Broken gage
60	21.0	8.0
75	25.3	8.5
90	30.8	9.0
105	36.1	9.5
120	41.2	10.0
135	46.4	10.5
150	51.7	11.0
165	55.8	12.0
180	59.7	14.0
195	63.9	17.0
210	68.0	20.5
225	72.0	24.5
After servicing	72.0	4.0

TABLE 2. Dust Particle Size

Date: 1 July 1970
Vehicle: USA Reg No. 02DU8370
Note: Sample taken from inside air cleaner, air duct hose to engine.

Particle Size (microns)*	Percent
78.0	4.1
62.0	4.8
49.0	5.2
39.0	3.3
31.0	3.5
25.0	3.9
20.0	3.5
16.0	3.3
12.0	2.9
10.0	5.8
8.0	3.3
6.0	2.8
5.0	3.9
4.0	7.3
3.0	11.8
2.0	12.4
1.7	8.7
1.3	4.9
1.0	3.5
0.8	1.0
0.7	0.1
	100.0

*Particle diameter calculated; determined by Coulter Counter Model M.

APPENDIX I.7. RADIO INTERFERENCE DATA

Specification: MIL-E-55301

Test Area: 60 percent slope
Test Equipment: AN/URM 85, S/N 40

Radiation Test - DB*

Freq (mcs)	Veh U81			Veh U83			Veh U86		
	A	P	a	A	P	a	A	P	a
.15	-	86	-	-	86	-	-	86	-
.35	-	86	-	-	86	-	-	86	-
1.5	-	66	-	-	66	-	-	66	-
3	64	66	81+	60	66	81+	-	66	-
5	60	60	63	59	60	81+	-	60	-
8	60	60	65	-	60	-	-	60	-
12	-	60	-	-	60	-	-	60	-
16	-	60	-	-	60	-	-	60	-
20	48	54	50	47	54	a	55	54	a
24	48	|	52	50	|	|	53	|	|
28	51	|	a	49	|	|	49	|	|
30	47	|	|	49	|	|	45	|	a
35	47	|	|	38	|	|	39	|	41
38	47	|	|	41	|	|	39	|	a
40	47	|	|	47	|	|	47	|	48
45	50	|	|	51	|	|	46	|	a
50	45	|	|	43	|	|	40	|	|
55	48	|	|	49	|	|	44	|	|
60	52	|	|	39	|	|	37	|	|
65	53	|	a	37	|	a	37	|	|
70	36	|	38	36	|	38	37	|	a
75	34	|	38	39	|	41	35	|	40
80	34	|	a	34	|	36	35	|	a
85	34	|	36	35	|	38	35	|	37
90	35	|	a	35	|	42	35	|	a
95	38	|	a	36	|	49	35	|	37
100	40	54	48	37	54	49	35	54	a

Freq (mcs)	Veh U81			Veh U83			Veh U86		
	A	P	a	A	P	a	A	P	a
110	42	54	a	34	54	a	34	54	a
120	38	|	|	37	|	a	37	|	40
130	40	|	|	39	|	a	40	|	44
140	43	|	|	44	|	46	47	|	a
150	47	|	|	46	|	a	47	|	52
160	46	|	|	46	|	|	46	|	52
170	44	|	a	45	|	|	45	|	47
180	43	|	45	44	|	|	45	|	48
190	41	|	47	42	|	|	43	|	46
200	41	|	a	41	|	|	42	|	a
220	39	|	|	43	|	|	39	|	|
240	32	|	|	35	|	|	37	|	|
260	29	|	|	29	|	|	30	|	|
280	32	|	|	32	|	|	33	|	|
300	46	|	|	45	|	|	46	|	|
350	36	|	a	35	|	|	36	|	a
400	32	|	39	38	|	|	32	|	40
450	39	|	a	38	|	a	38	|	a
500	37	|	39	37	|	40	38	|	a
550	39	|	a	38	|	40	38	|	a
600	34	|	|	34	|	|	35	|	a
650	38	|	|	37	|	|	35	|	37
700	35	|	|	35	|	40	35	|	a
750	36	|	|	35	|	37	36	|	|
800	36	|	|	34	|	36	35	|	|
850	36	|	|	35	|	a	35	|	|
900	35	|	|	35	|	|	37	|	a
950	40	|	|	39	|	|	38	|	40
1000	45	54	a	43	54	a	42	54	a

LEGEND: A - Ambient noise level
P - Passing limit
a - Interference noise level at ambient
- - Ambient noise level to high
* Decibels above one microvolt per megacycle of bandwidth

NOTE: Vehicle USA Reg No. 02DU8170, 7 May 1970, mileage: 9410.0
Vehicle USA Reg No. 02DU8370, 6 May 1970, mileage: 9239.9
Vehicle USA Reg No. 02DU8670, 5 May 1970, mileage: 8523.9

Conduction Test - DB*

Freq (mcs)	Vehicle U81			Vehicle U83			Vehicle U86		
	A	P	a	A	P	a	A	P	a
.15	76	86	a	76	86	a	73	86	76
.35	73	86	a	76	86	a	79	86	a
1.5	57	83	72	63	83	75	78	83	a
3	59	83	70	65	83	74	75	83	a
5	50	80	70	65	80	72	76	80	a
8	51	80	67	63	80	a	77	80	a
12	55	74	61	61	74	64	73	74	a
16	61	74	a	64	74	a	64	74	a
20	61	74	a	52	74	a	52	74	a
24	48	74	55	40	74	46	40	74	46
28	35	74	55	30	74	51	35	74	40
30	31	74	50	20	74	46	29	74	34
35	25	74	51	20	74	46	32	74	35
38	25	74	53	20	74	42	32	74	38
40	31	74	33	36	74	39	34	74	40
45	33	74	a	39	74	a	35	74	39
50	30	74	38	30	74	33	30	74	32
55	26	74	28	30	74	a	30	74	32
60	26	74	a	25	74	a	26	74	a
65	26	74	a	25	74	a	26	74	a

APPENDIX I.8. FINAL INSPECTION

		Vehicle Registration No. 02DU8170	02DU8370	02DU8670
SNL Group: 01, Engine				
	Engine Speed (rpm)			
Oil pressure (psi) at: All oil pressures were taken at operating temperature. Specification is 35-45 psi at operating speed	Idle	38 (525 rpm)	35 (650 rpm)	36 (600 rpm)
	1000	40	38	39
	1500	41	39	41
	2000	43	41	42
	3000	47	45	45
	4000	48	48	47
	Cylinder No.			
Engine compression (psi) Readings taken at cranking speed of approximately 225 rpm. Specification is 135-145 psi	1	125	120	135
	2	125	115	140
	3	125	115	135
	4	120	120	130

Vehicle 02DU8170: Cylinder head pulled and intake valves removed to check for dust damage. Valves in good condition; cylinder walls in excellent condition. Traces of dust were observed in the combination chambers.

Two exhaust manifold fasteners were under-torqued 5 and 7 lb-ft, respectively.

Vehicle 02DU8370: All exhaust manifold fasteners were at 0 lb-ft torque.

Two intake manifold fasteners were under-torqued 5 and 7 lb-ft, respectively.

	Vehicle Registration No.		
	02DU8170	02DU8370	02DU8670
SNL Group: 02, Clutch			
	Satisfactory	Satisfactory	Satisfactory
SNL Group: 03, Fuel System			
	Satisfactory.	A hole was discovered at a spot weld in the air cleaner oil cup. Oil was leaking down into the bottom of the air cleaner canister. (See App III, Sec 2, Group 03) The tailpipe to muffler connection was loose. The rear tailpipe hanger bracket was bent and loose.	There was excessive side play in the carburetor mixture adjustment crew. The rear tailpipe hanger bracket was broken.
SNL Group: 05, Cooling System			
	Satisfactory.	Satisfactory.	Satisfactory.
SNL Group: 06, Electrical System			
Headlamp adjustment (in.) Specification is 0 inch left and 3 inches down.	Left / Right 4 L / 2 L 10 D / 10 D	Left / Right 2 R / 0 L 10 D / 10 D	Left / Right 1 R / 1-1/2 R 9 D / 9 D
	L = left	R = right	D = down
	Right turn signal/stoplight bracket was broken.	The No. 1 and 3 sparkplug leads were replaced because of broken wire mesh insulations. Turn signal control would not move to the left turn position smoothly.	The spring tension on the ignition points was only 10 ounces. They replaced. Specification is 18-20 ounces.

	Vehicle Registration No.		
	02DU8170	02DU8370	02DU8670
SNL Group: 07, Transmission			
	Transmission was removed and disassembled. Rear output seal was worn and leaking, but overall, transmission appeared to be in very good condition.	Satisfactory.	Satisfactory.
SNL Group: 08, Transfer			
	Satisfactory.	Satisfactory.	Transfer rear seal was worn to the point of replacement.
SNL Group: 09. Propeller Shaft and Universal Joint			
	Satisfactory.	Satisfactory.	Satisfactory.
SNL Group: 10, Front Axle			
	Both upper front suspension ball joint boots were cracked.	Both upper front suspension ball joint boots were cracked.	The upper right front suspension ball joint boot was cracked and and broken open.
	All bushings for the front upper and lower "A" frame control arms were badly worn. Arms were heavily shimmed to offset the wear.		

Specifications for steering geometry are as follows:

	Left	Right	Left	Right	Left	Right
Caster, -1/2° to +1/2°	-1 1/2°	-1/2°	-1/2°	+1/4°	-3/4°	-2°
Camber, 1/2° to 1-1/2°	1-1/2°	3/4°	0	-1/2°	-1 1/2°	-1 3/4°
Swing arc, 31° maximum	31°	31°	32°	30°	29-1/2°	28-1/2°
Toe-in, 1/32 to 5/32	1/2 in.	1/2 in.	5/8 in.	5/8 in.	3/8 in.	3/8 in.

USA Registration No.		
02DU8170	02DU8370	02DU8670
SNL Group: 11, Rear Suspension		
Rear differential was removed and disassembled. Right output bearing had several spalled rollers. Bearing and race were considered unserviceable. (See App III, Sec 2, Group 11).	Satisfactory.	Satisfactory.
Left and right control arm to body bracket bolts were at 20 and 35 lb-ft torques, respectively. Specification is 45-60 lb-ft.		
SNL Group: 12, Brakes		
Brakes pulled to the left during the pre-inspection road test but appeared to be satisfactory upon inspection.	Brakes pulled to the right during the pre-inspection road test but appeared to be satisfactory upon inspection.	Brakes pulled slightly to the left during the pre-inspection road test but appeared to be satisfactory upon inspection.
Left rear brake line was not being retained by the outboard clip on the suspension arm.	The front wheel cylinders were torn down and inspected. The primary piston on the left side was found to be frozen as a result of dust and moisture contamination. All pistons and cylinders were similarly contaminated, but not frozen. The boots were cut in several places as a result of metal burrs on the piston skirts.	Parking brake was is satisfactory condition, but out of adjustment attainable by the operators lever.
The wheel cylinders were disassembled and and examined. The rear cylinders and pistons were in excellent condition. Front pistons were tarnished, and slight rust was observed in the forward bore of the right front cylinder. Piston skirts were rough and irregular. The front boots showed many small cuts, mostly at the point where the boot rolls over the piston skirt. Rear boots were in good condition.		All pistons and cylinders showed dust and water contamination. The boots were cut in several places as a result of metal burrs on the piston skirts.

USA Registration No.		
02DU8170	02DU8370	02DU8670
SNL Group: 13, Wheels, Hubs and Drums		
Satisfactory.	Satisfactory.	Right front wheel was squeaking during the road test. The drive shaft seal was found to be very dry, but appeared to be in good condition. There was no shortage of grease, and the reason for the problem was not apparent.
SNL Group: 14, Steering and Controls		
		The steering gear assembly was seaping lubricant.
SNL Group: 15, Frame and Brackets		
Satisfactory.	Satisfactory.	Satisfactory.
SNL Group: 16, Springs and Shock Absorbers		
Left rear drive shaft and suspension spring showed they had experienced light contact.	Satisfactory.	Satisfactory.

APPENDIX I.9. PHOTOGRAPHS

FIGURE 1. Spalled right output roller bearing and race (0ZDU8170).

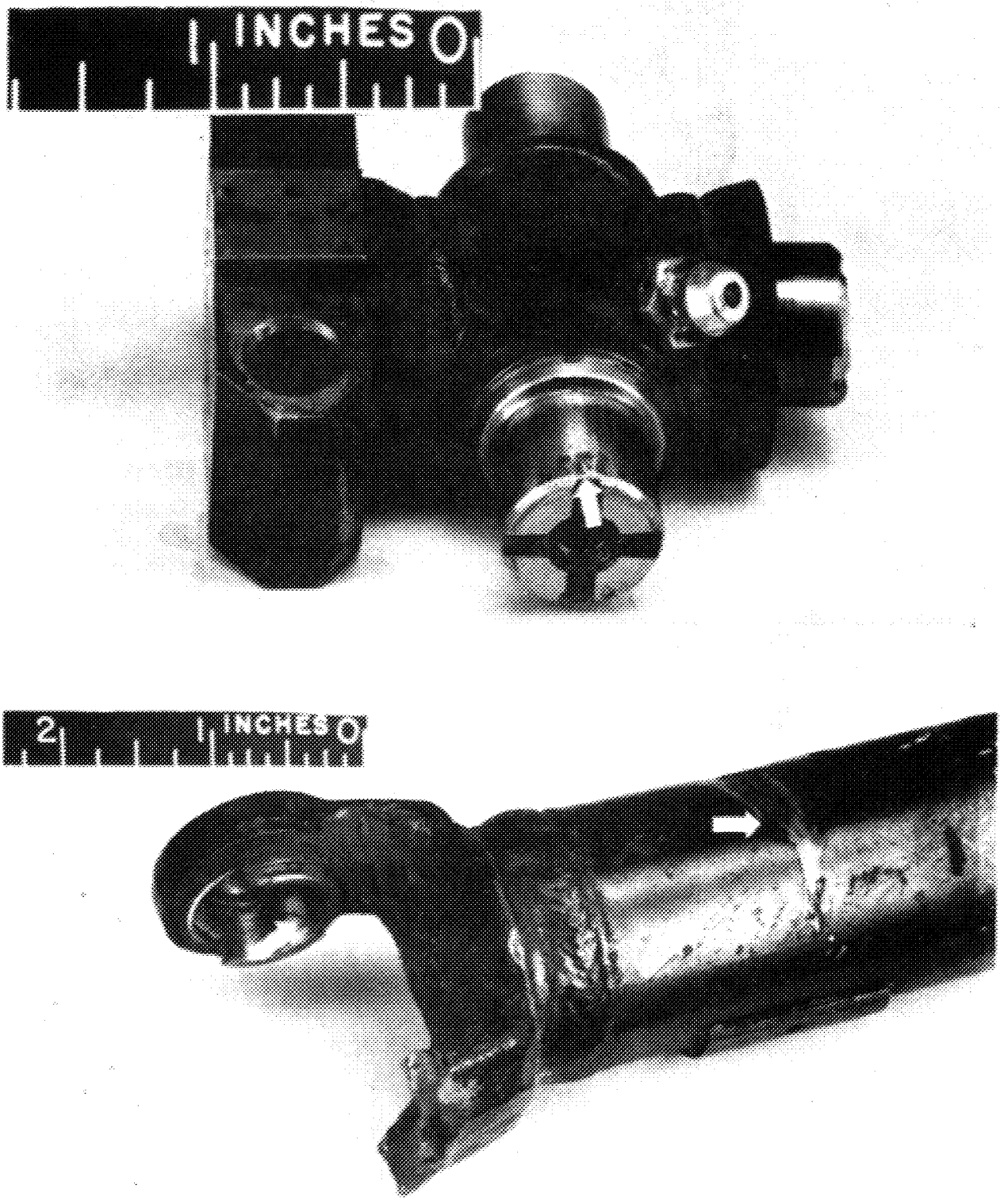
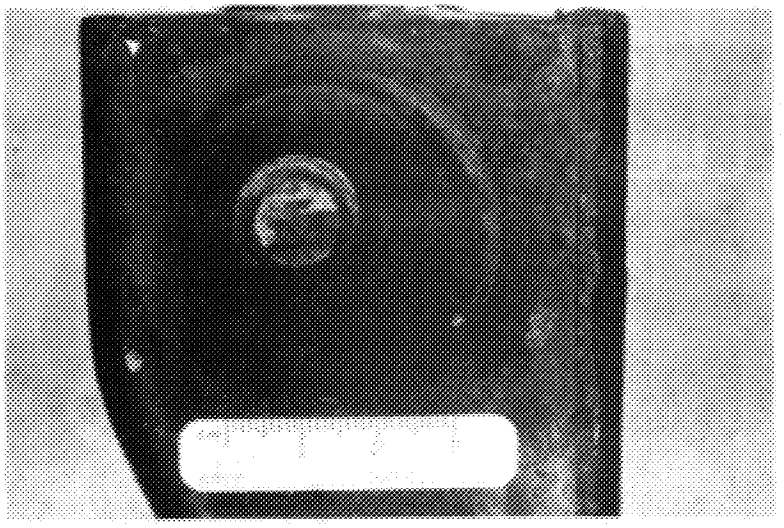


FIGURE 2. Railed rear yoke on propeller shaft (02DU8170).



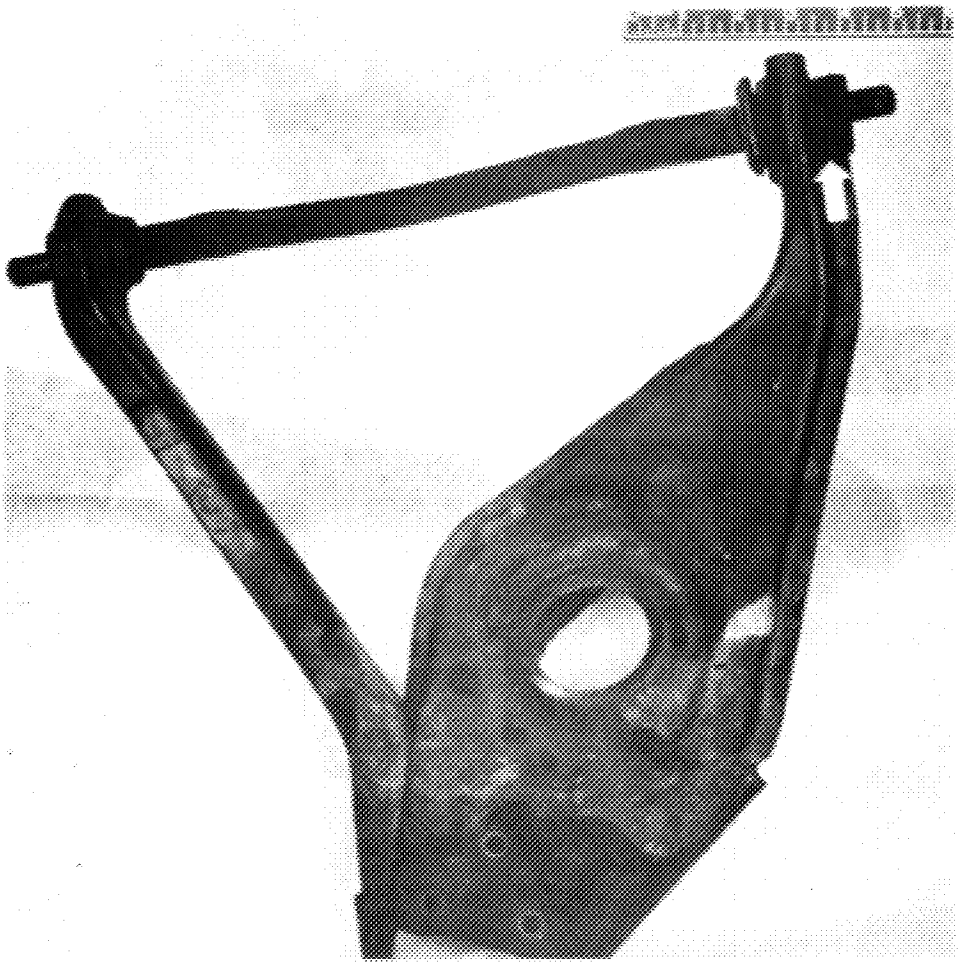


FIGURE 3. Failed A-frame control arm bushings (all vehicles).

FIGURE 4. Air cleaner upper element after extreme dust operation (02DU8370).

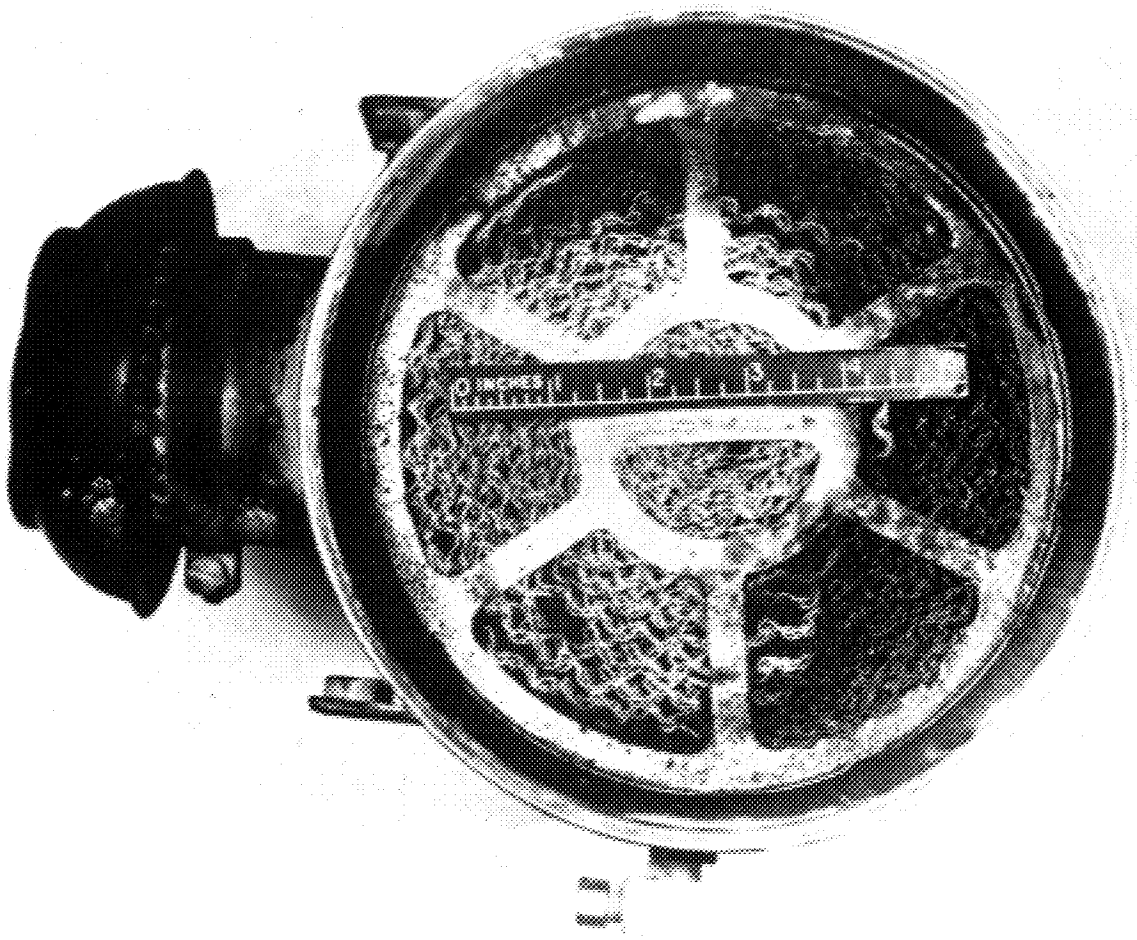


FIGURE 5. Air cleaner lower element after extreme dust operation (02DW8370).

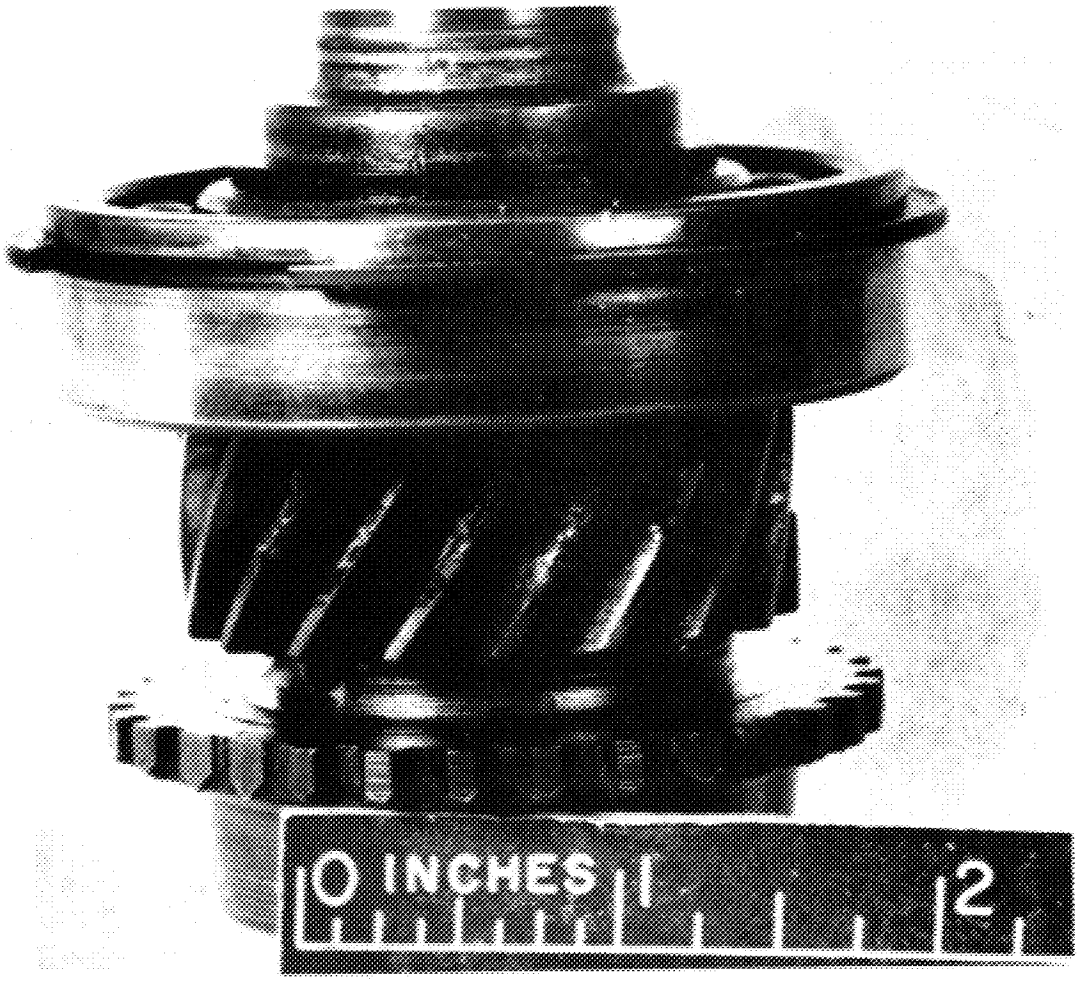


FIGURE 6. Chipped teeth on transmission input shaft helical gear after transmission overheated during full load cooling runs (02DU8670).

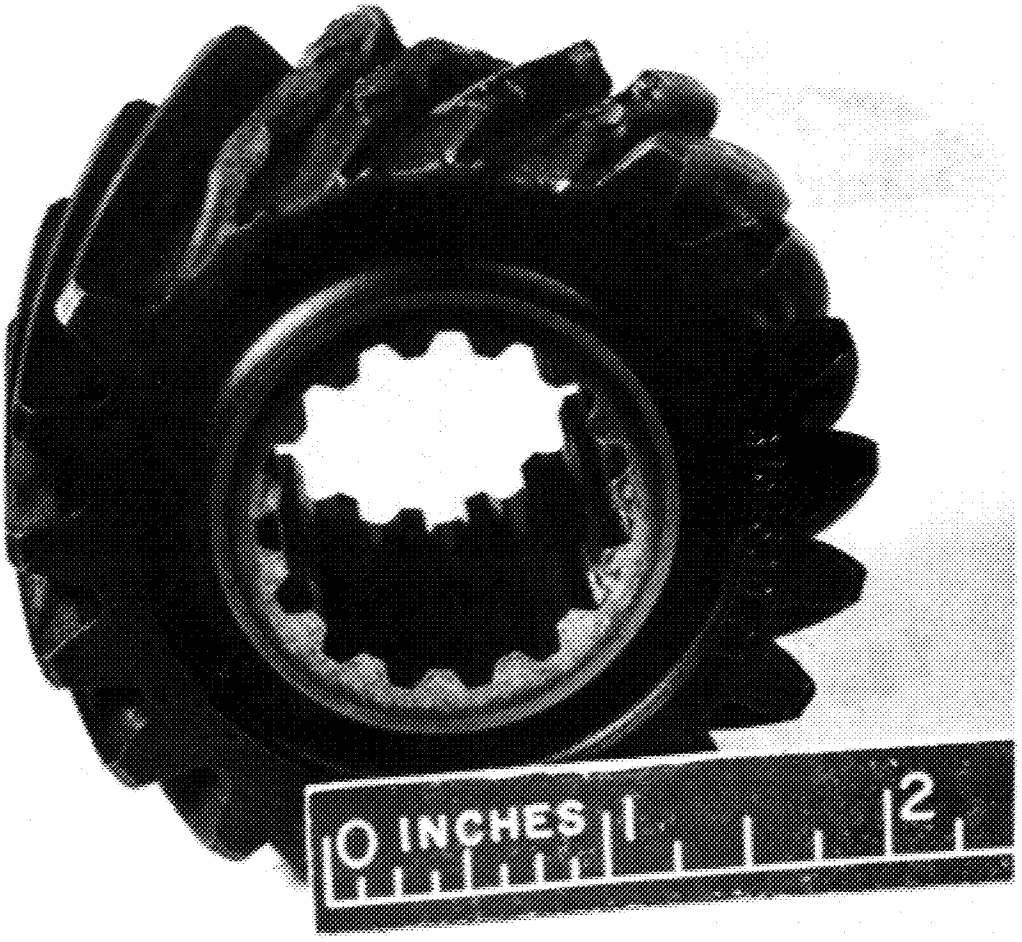


FIGURE 7. Sheared teeth on transfer input shaft helical gear after transmission overheated during full load cooling runs (02DU8670).

APPENDIX I.10. SAMPLE QUESTIONNAIRE

M151A2 Test Vehicle, USA Registration No. _____

M151A1 Comparison Vehicle USA Registration No. 02CL6169

Driver's Name _____

Course _____

	Test Vehicle	Standard Vehicle	Both Same
1. Which vehicle has a more comfortable ride?			
2. Which vehicle steers the easiest?			
3. Which vehicle seems to lean more during turns?			
4. With which vehicle do you have the greatest stability and control during turns?			
5. With which vehicle do you have the greatest stability and control when braking?			
6. If you were required to travel this course as fast as possible, which vehicle would you choose?			

Why? _____

_____

_____

REMARKS:

_____

_____

_____

_____

APPENDIX I.11. LIST OF VEHICLE CHANGES

Truck, Utility, 1/4-Ton, 4x4, M151A2

1. Modified independent rear suspension (trailing arm design)
2. Service brake wheel cylinders, front (3/4 inch to 1 inch diameter)
3. Mechanical fuel pump
4. Clutch cross shaft nylon bearings
5. Deep dish steering wheel
6. Steering linkage and suspension ball joint lube-for-life
7. Rag joint steering shaft
8. Spun steel crankshaft and water pump pulleys
9. Front cross member spacer-shims
10. Class "A" lights
11. Two speed electrical windshield wipers
12. Windshield washer
13. One piece windshield
14. Full view rear window
15. Inside rear view mirror
16. Rear lift points
17. Wheel studs, 1/2 inch
18. Scissors type jack, handle and wheel wrench
19. Side reflector, stick-on
20. Transmission-transfer case improvements
21. Differential improvements
22. Rear axle drive shaft improvements

APPENDIX II. TEST FINDINGS

Item	Source (Para.)	Requirement	Met	Not Met	Subtest Paragraph	Remarks
	MIL-T-45331C					
1	3.3	Materials. The materials used shall be as specified in the applicable specifications and drawings.	X		2.2.5	
2	3.4	Construction. Vehicle, components, subassemblies, and assemblies shall be fabricated and assembled into a complete vehicle in accordance with drawings listed or referred to in the applicable Engineering Parts List and as supplemented herein. All parts, subassemblies, and assemblies shall be identified in accordance with MIL-STD-130.	X		2.2.5	
3	3.4.1	Engine. The engine shall conform to MIL-E-45332, except that the section covering preparation for delivery shall not apply. The vehicle shall meet all performance requirements specified herein with engine installed.		X	2.3.4.6	Failed radio interference suppression tests.
4	3.4.2	Soft top. The complete soft top furnished and installed in accordance with applicable drawings for the M151A2 shall provide the maximum protection for the personnel when vehicle is operating in adverse climatic conditions. The manufacturer shall provide at least the soft top and back panel for the M151A2.	X		2.2.4	The modified soft top with full view rear window was not provided for one vehicle.
5	3.5	Performance. Trucks shall conform to the performance requirements specified herein after a break-in run of 2 miles (road). Vehicle shall be serviced as specified herein.	X			Vehicle performed satisfactorily during initial inspection.
6	3.5.1.1	Extreme climatic operation. The vehicle shall be capable of having the engine started and normal operation maintained, in still air having any ambient air temperature from minus 25°F to plus 120°F, without external aid, in altitudes from sea level to a 3000-foot elevation above sea level.		X	2.4.5	Engine coolant and oil, transmission, and rear differential overheat.
7	3.5.1.3	High temperature operation. The vehicle shall be capable of having the engine started and normal operation maintained, in still air having any ambient air temperature and altitudes specified in Table I, without external aids, and with a relative humidity as low as 5 percent. The vehicle fuel system shall function without evidence of vapor lock, and the engine coolant temperature shall remain below the boiling point. The engine coolant temperature limit specified at Paragraph 3.5.1.3 of MIL-T-45331C consider coolant boiling point with a pressurized system.		X	2.4.5	Engine coolant and oil, transmission, and rear differential overheated.
8	3.5.2.2	Payload. Truck payload shall include driver and personnel and shall be as specified in Table II.	X		2.2.4.4	
9	3.5.2.3	Towing load. Towed load performance requirements for the M151A2 shall be met when coupled to an M-416 tactical-type trailer, and shall be as specified in Table II.	X		2.2.4.4	
10	3.5.3.1	Level road speeds. The truck, including cross-country payload and with cross-country towed load, shall be capable of sustaining a speed of not less than 60 miles per hour (mph); a low speed of not more than 2-1/2 mph in low gear, when operated on smooth, dry, level, hard-surfaced roadway. Drumming, shimmy or tramping shall not occur throughout this speed range.	X		2.3.4.1	

Table I - Elevation Temperature Chart

Elevation	Minimum Ambient Air Temperature
4000 feet	108°F
5000 feet	100°F
6000 feet	97°F
7000 feet	93°F
8000 feet	90°F

Table II. Weights and Loads, Pounds

	M151A2
Curb weight:	2400
Rated payload (including personnel):	
Highway	1200
Cross-country	800
Gross vehicle weight (GVW):	
Highway	3600
Cross-country	3200
Rated towed load:	
Highway	1300
Cross-country	1000

Item	Source (Para.)	Requirement	Met	Not Met	Subtest Paragraph	Remarks
11	3.5.3.2	Grade speeds. The truck, including cross-country payload and with cross-country towed load, shall be capable of negotiating grades up to 6-1/2 percent at a speed of 30 mph when operated over a smooth, dry, hard-surfaced raodway. Without towed load, truck, including cross-country payload, shall be capable of negotiating grades up to 60 percent at a speed of 2-1/2 mph when operated over a smooth, dry, hard-surfaced roadway.	X		2.3.4.3	
12	3.5.5	Slopes. The truck, including cross-country payload, shall be operated on side slopes, sloping right or left, up to 40 percent.	X		2.3.4.3	
13	3.5.7.2	Shallow water fording. The vehicle, without fording equipment and with rated cross-country payload and towed load, shall ford a hard-bottomed, relatively level crossing in fresh or salt water to a depth of at least 21 inches. The vehicle without fording equipment, or modification, shall meet all requirements of 3.5.7.1, except the depth shall be 21 inches.	X		2.3.4.5	
14	3.5.8.1	Service brakes. Service brakes shall stop the vehicle within 30 feet from a speed of 20 mph, on dry, hard, relatively level, smooth road, free from loose material. Service brakes shall control and hold the vehicle on an incline of 60 percent.	X		2.3.4.2	
15	3.5.8.2	Parking brake. The parking brake shall hold the vehicle on a dry, concrete incline of 40 percent with highway payload; and on a dry, concrete incline of 60 percent with cross-country payload.	X		2.3.4.2	
16	3.5.9	Maneuverability. The vehicle shall demonstrate a maximum turning radius of 18.5 feet, measured from the center line of the outside front wheel, when negotiating full turns to right and left.	X			See results in Paragraph 2.3.4.4.
17	3.8	Radio interference suppression. Each vehicle shall be radio suppressed in accordance with the tactical vehicle requirements of MIL-E-55301.		X	2.3.4.6 2.3.5	Failed the radiation phase in the low frequency range.
18	3.9.2	Marking. Registration numbers and other markings shall be applied in accordance with MIL-STD-642. Color shall be lusterless white enamel, matching color chip 37875 of FEDERAL STD No. 595. Data plates and part number marking shall be in accordance with MIL-STD-130.	X			
19	3.10	Workmanship. The workmanship shall produce vehicles free from fabrication defects which would affect the appearance, functioning, or operating life of the vehicle or any of its components. All seals and gaskets shall be so installed and retained that fluid seepage is minimized, and so that exhaust gases are prevented from escaping. All welds, rivets, bolts, nuts or other fasteners shall be torqued as indicated on drawings, or where not specifically detailed on drawings, to the extent consistent with their respective application in commerical vehicles of similar construction.		X	2.2.4	A male connector was not installed on the No. 21 wire in the stoplight/taillight assembly of one vehicle (see App III, Sec 2, Group 06). The toe-in and headlight alignment did not meet specification requirements on all vehicles.
20	4.2.2	Examination of vehicle. After a 2-mile break-in, (road test) each completed vehicle of each model shall be operated for a distance of not less than 5 miles, at the place of manufacturer, by the contractor and subjected to visual and dimensional inspection of characteristics listed in Table IV (including exhaust leaks) for conformance to applicable drawings and this specification. Vehicle shall be driven in reverse gear a minimum of 50 feet. Vehicle shall meet all performance requirements specified without malfunction.	X			
21	4.2.3.1	Test failure. Failure of either test vehicle to comply with any of the requirements specified or any deficiency of workmanship of materials nature during or as a result of the 20,000-mile test, shall be cause for rejection of the vehicle. Further, the Government may refuse to continue acceptance of production vehicles until evidence has been provided by the contractor that corrective action has been taken to eliminate the deficiency. Any deficiency found during or as a result of 20,000-mile test shall be prima facie evidence that all vehicles already accepted prior to completion of the 20,000-mile test are similarly deficient unless evidence satisfactory to the Government is furnished by the contractor that they are not similarly deficient. Such deficiencies on all vehicles shall be corrected by the contractor at no cost to the Government regardless of location.		X	App III, Sec I	Propeller shaft failure and extensive brake problems were classified as deficiencies.
22	5.1	Vehicle processing. Vehicle and equipment shall be processed for shipment and storage in accordance with MIL-STD-281 to the extent indicated on the applicable vehicle preservation data sheet or other implementation document, as specified by the procuring activity.		X	App I.1, Receiving Inspection	Batteries were connected on two vehicles. One battery was discharged because the ignition switch had been left on.
	MIL-A-13488A(Ord)					
23	3.3.2	Servicing, design and contruction of the air cleaner shall permit quick and convenient disassembly for cleaning and servicing of the oil cup and filter element without removing or disturbing the clean air chamber or its connections to the engine and without the use of special tools.		X	2.5.4.2 2.5.5	Entire air cleaner had to be removed for cleaning after extreme dust testing.
24	3.4.1	Resistance to air leakage. The air cleaner shall not leak air when properly assembled and tested to a vacuum of 50 inches of water.	X		2.5.4.2	

APPENDIX III. DEFICIENCIES AND SHORTCOMINGS

Deficiency	Suggested Corrective Action	Remarks
1. Deficiencies		
Group 09: Propeller Shaft and U-Joints		
1. The rear yoke on the propeller shaft of U81 broke away from the U-joint assembly at 17,170 test miles. One side broke off completely and the other showed a small crack.	None.	There were several scratches on the rear third of the propeller shaft. However, they were rusted and evidently occurred well before the failure. A check showed the rear differential to be properly positioned and all fasteners to be tight.
Group 12: Brakes		
2. All vehicles exhibited extensive brake grabbing in the front brakes beginning between 12,000 and 15,000 test miles. In most cases the vehicles would pull to the left or right.	Implement manufacturing process to eliminate burrs on wheel cylinder piston skirts.	Investigation after the final inspection revealed that the rubber boots, which roll back over the wheel cylinder piston skirts, were being cut by burrs on the skirts. This led to dust and moisture contamination of the cylinders, causing the uneven application.
2. Shortcomings		
Shortcomings*		
Group 01: Engine		
None		
Group 02: Clutch		
None		
Group 03: Fuel System		
1. Fuel was leaking past the fuel tank filler cap. The filler cap gasket was observed to be cracked in several places.	Nore.	It appeared that the gasket was being distorted when the cap was tightened. U86 - 8475 test miles and U81 - 17,158 test miles.
2. A hole was discovered at a spot weld in the air cleaner oil cup on U83 at 21,048 miles. Oil was leaking through the hole into the bottom of the air cleaner canister.	Improve welding and inspection techniques.	Since only about 1/3 of the oil was lost, this problem is not classified as a deficiency. The loss, however, would definitely affect the air cleaner's effectiveness. It had been tested for 4391 miles.
Group 04: Exhaust System		
None.		
Group 05: Cooling System		
3. An excessive length hose from the radiator to the engine water manifold was being chaffed by the rubber fuel line coming out of the fuel pump. Occurred on U83 at 2001 miles.	Radiator hose should be shortened or quality control improved.	
4. A pin hole leak was found in the lower left corner of the radiator on vehicle U83 at 16,279 test miles.	None.	A repair was not successful and the radiator was replaced at 17,836 miles.
Group 06: Electrical System		
5. The radiator grille is insufficiently supported causing the headlamps on all three vehicles to be out of adjustment on receipt and again after 3300 test miles. U86 headlamps were also misaligned at 18,640 test miles.	Install upper supports for the grille.	Alignment problems are due to the lack of support of the radiator grille, into which the lamps are mounted.
6. A male connector had never been installed on the No 21 wire in the stoplight/taillight assembly.	Improve quality control during assembly.	Shortly after break-in operation had been initiated, the left taillight was observed to be inoperative.
7. The radio interference suppression wire mesh insulation, which is a part of the electrical lead and conduit assembly from the distributor to the spark plug, was found to be broken. The problem occurred on U86, No. 1 lead at 3550 test miles, U86, No. 3 lead at 5998 test miles; U81, No. 4 lead at 17170 test miles; and U83, No. 1 and No. 3 lead at 21048 test miles.	Provide better support for the leads, or design a more durable wire mesh insulation.	The failures appear to be due to fatigue of the wire mesh, caused by vibration.
8. The ignition coil assembly failed at 6012 miles on U83 causing the engine to surge and misfire. A similar problem occurred on U81 at 12,934 test miles.	More positive fastening device for the coil, and coil lead, retainer should be provided.	The ignition coil retaining tabs had broken off on U83, and one of the retaining screws was missing. This allowed the coil to bounce. The right side coil retaining screw was missing on U81 and the negative lead retainer and retainer screw had come unfastened. The negative lead retainer screw was bouncing on the breaker plate, periodically shorting out the ignition circuit.
9. The turn signal assembly is not reliable. The directional turn signal control was sticking in the left turn position, and would not easily return to neutral. Problem occurred on U86 at 12,084 miles and on U83 at 21,048 test miles.	None	None.
The brake lights would not operate on U86 at 14,936 test miles due to a faulty service brake circuit in the turn signal control assembly.	None	The assembly had been replaced previously. This one had operated for 2852 test miles when it failed.
At 17,836 test miles the turn signal lamps on U83 would not operate when the turn signal control was activated.	None	The control was found to have open circuits to the left and right turn signal lamps. The control assembly was replaced.
10. The ignition points broke on engine in U86 causing misfiring at speeds above 55 mph at 13,452 test miles.	None	The moveable arm side of the ignition points was found to be broken. A small mark was noted on that arm as if a screwdriver had been used to push the arm into alignment. Such action would account for breakage in a plane opposite that in which the points operate.
11. An ignition coil problem on U81 caused the engine to stop when idling. Problem occurred at 19,004 test miles.	None	The coil was extremely hot after a short period of operation. Replacement solved the problem.

*All test miles indicated are incorrect for odometer error. Actual mileages are 6 to 8 percent less then shown.

Shortcomings	Suggested Corrective Action	Remarks
12. The low beam on the right headlamp of U83 was burned out at 17, 836 test miles.	None	A new unit was installed.
13. At 17,836 test miles the center boss in the bakelite distributor cap on vehicle U83 was found to have a minute crack. The crack had not developed to the point of affecting performance.	None	It is possible that the crack resulted from stresses set up by the screws which hold the bakelite cap to the external metal cover.
Group 07: Transmission		
14. At 11,935 test miles a small ball bearing was found attached to the transmission drain plug of vehicle U83.	None	The transmission functioned perfectly both before and after discovery of the ball. It is conceivable that it might have been an extra ball left in the transmission during production.
Group 08: Transfer		
None		
Group 09: Propeller Shaft and Universal Joint		
None		
Group 10: Front Axle		
15. All three vehicles had excessive toe-in (19/32 inch to 3/4 inch) upon receipt.	Improve quality control during vehicle assembly.	All were adjusted to the 1/8-inch specification.
16. The front differential right output seal on vehicle U86 was leaking at 6518 test miles.	Improve quality control during vehicle assembly.	The seal was a press fit, evidently sealed with a Permatex type sealant. The sealant had been applied to only 50 percent of the contact surface, and leakage was occurring around this nonsealed portion of the casing, rather than past the seal.
17. The front differential right output seal was worn to the point of replacement on vehicle U83 at 11,935 test miles. The left front output seal was similarly replaced on vehicle U81 at 19,004 test miles.	Improve quality of the seal or redesign the differential to result in lower temperatures.	The 11,935 test miles is an abnormally short seal life. Minor leakage was also observed at most differential output seals throughout the durability testing.
Group 11: Rear Axle		
18. During final inspection on vehicle U81, the right output roller bearing in the rear differential was observed to have several spalled rollers. The bearing race was correspondingly worn from the spalled pieces.	None	Fatigue pattern on each roller was similar. Spalling began approximately two thirds of the distance toward the wide end of the bearing, and progressed toward that end. Both the bearing and the race were considered unserviceable and were replaced.
Group 12: Brakes		
19. During unscheduled maintenance on vehicle U81 at 5196 test miles, grease was found on both right front brake shoes.	Improve quality control during vehicle assembly.	No damage was noted to the hub seal, so problem was evidently caused by careless original installation. The shoes were cleaned and reinstalled.
Group 13: Wheels and Suspension		
20. Thirteen tire inner tubes failed during the test due to separation at the seam.	Improve quality control manufacture.	Tube reliability is 3149 miles between failures at 95 percent confidence limit.
21. During all durability operation, U86 seemed to give a rougher ride and bottom out more frequently than the other vehicles.	None	At 13,950 test miles the front springs were removed and the free length measured. Both were 1/4 inch below the 11.0-inch specification. They were replaced, and the ride seemed to be improved.
22. The bushings in the front upper and lower A-frame control arms were observed to be badly worn on all vehicles.	Improve bushing design or quality.	The problem was first noticed on U81 at 17,836 test miles. A check of the other vehicles at the time revealed the similar wear. New sets of arms were installed on U81 and U83, but the set on U83 had a repeated failure after only 200 miles, and were replaced. The arms on U86 were never replaced, but were shimmed instead to try to reach the camber specification. At the end of test each vehicle had 5/8 inch to 3/4 inch of shim for the front control arms. The reason for bushing failure has not been resolved.
Group 14 and 15: Controls, Frame and Brackets		
None		
Group 16: Springs and Shock Absorbers		
23. Leaking shock absorbers were replaced as follows:	Improve seals to prevent leakage.	Replacement was on the basis of observed leakage and not on performance.

Vehicle	Mileage	Location
U81	5,120	RF
U86	14,800	LF
U81	19,204	RR and LR
U83	19,679	RR
U86	20,097	RR

Group 17: Hoods, Fenders, Shields and Aprons

None

Shortcomings	Suggested Corrective Action	Remarks
Group 18: Hull, Body and Cab		
None		
Group 22: Miscellaneous Accessories		
24. The windshield washer pump fell apart on vehicle U81 at 7524 test miles.	None	The pump handle pivot pin evidently worked loose, allowing the handle and plunger to fall out. A new assembly was installed.
Group 31: On Equipment Material		
25. A torque specification for the wheel lifting eye and self-locking nut could not be located in the TM's.	Provide torque values in TM's.	The lifting eye torque is particularly critical since leakage into the hub during fording can occur if the torque is insufficient.
Group 47: Instruments		
26. The odometers of all vehicles were found to be reading higher mileage than actual by 6 to 8 percent.	Change odometer drive gear to correct ratio.	The specified durability mileage (20,000) was not completed by 1200 to 1600 miles. The QMR should be revised to indicate allowable error (suggest ±2 percent).

3. Corrected Shortcomings

Corrected Shortcomings		
27. A mismatch of air cleaner components allowed dust to leak past the air cleaner seals thereby bypassing the filtering systems (all three vehicles).	The contractor found that upper and lower sections were being matched by the vendor, but the match was not retained during vehicle assembly. Procedures were changed to the matched sections during the contractor's assembly.	Discovered during the 6000-mile maintenance, the junction between the upper and lower sections of the air cleaner was sealed with tape to prevent further dust ingestion until the manufacturer could remedy the problem. New air cleaners were installed between 16,500 and 18,500 miles, and no further leakage was observed.

APPENDIX IV. MAINTENANCE EVALUATION

Chart 1A

MAINTENANCE EVALUATION SUMMARY REPORT	PROJECT NO.	NOMENCLATURE	IDENTIFICATION
	1-VG-120-151-034	Truck, Utility, 1/4-Ton, 4x4, M151A2	USA Reg No. 02DU8170

1. Reporting period 2 Apr thru 30 Jun Interim No. ☐ Final ☒
2. Test miles required 20000 this report 21025 Total 21025
3. Operating hr required 1000 this report 857.2 Total 857.2
4. Op/Crew daily services this report 85.9 Total 85.9
5. Supply and admin delay time this report 305.7 Total 305.7
6. Vehicle mod hr this report 0.0 Total 0.0
7. Accident or error maint time this report 6.6 Total 6.6
8. Special engr test time this report 0.0 Total 0.0
9. Initial tech insp time 30.0 Final tech insp time 32.5
10.

Type of Maintenance	11. Inspection		12. Fault Location		13. Preparation		14. Adjust or Calibrate		15. Fault Correction		16. Part Replacement		17. Check Out		18. Active MMH		19. Clock Hr		20. System Failure		JCP-1, DPG
	This Period	Total Time	This Period	Total Time	This Period	Total Time	This Period	Total Time	This Period	Total Time	This Period	Total Time	This Period	Total Time	This Period	Total Maint Man-Hr	This Period	Total Time	This Period	Total Failures	
Op Crew Maint Scheduled		12.4														12.4		11.9			
Op Crew Maint Unscheduled						0.2				0.8						.5		.5			
Org Maint Scheduled		40.1										0.6		0.9		41.6		21.9			
Org Maint Unscheduled		11.1		1.1		3.2		7.0		11.4		18.4		1.7		54.4		44.7		1	
Direct Maint Scheduled																					
Direct Maint Unscheduled																					
General Maint Scheduled																					
General Maint Unscheduled																					
TOTALS		63.6		1.1		3.4		7.0		12.2		19.0		2.6		108.9		79.0		1	

Additional Test Information - Item No. 3, based on tachograph installed and on 20 mph

Item No. 5, administrative delay time is based on 16 hours per day, 5 days per week

STEYP-TE Form 14, 8 Apr 70. (STEYP-TAU SOP 02-06-70)

Chart 1A (Concluded)

MAINTENANCE EVALUATION SUMMARY REPORT	MAINTENANCE OR DELAY TIME (NON-CHARGEABLE)	NOMENCLATURE M151A2 IDENTIFICATION 02DU8170

Group No.	Incident, Component and or Related Operations	Authority	System Life (X) Miles Hours Rounds	Delay or Maintenance Time: Man-Hours	Delay or Maintenance Time: Clock Hours	Maintenance Level	Vehicle Modification	Supply Delay	Admin Delay	Accident or Error	Special Engineer Test	Initial or Final Inspection	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
--	Performed initial technical inspection		24.1	30.0	15.0	0						30.0	
12	Brake adjustment		15182.5		2.6	0			2.6				
16	Right front shock absorber bracket incorrectly installed		16267.4		3.8	0			2.8	1.0			
03	Repair fuel leak and		16694		1.0	0			1.0				
16	Tighten shock												
09	Repair U-joint		17156.7		51.3	0		1.0	50.3				
--	18,000-mile maintenance		18219		14.4	0			14.4				
--	Ignition, shocks and differential problem		19203.4		7.4	0			7.4				
--	Vehicle turned over on its side Relieved hydrostatic lock, change oil and thoroughly inspected vehicle for damage.		19986.6	5.6	2.8	0				5.6			22 June (0435 ti
03	Adjust carburetor and repaired fuel leak		20141		18.7	0			18.7				
--	Performed final technical inspection		21058	32.5	16.2	0			207.5			32.5	
				68.1	133.2	-	0	1.0	304.7	6.6	0	62.5	

STEYP-TE Form 70, 8 Apr 70 (Rev). Edition of 11 Dec 69 is obsolete. (STEYP-TAU SOP 2-06-07)

MAINTENANCE ANALYSIS CHART

STEYP-TE FORM 120

INSTRUCTION SHEET

COLUMN	
1	The sequence number of the Maintenance Operation.
2	Functional group number as indicated in the Maintenance Allocation Chart of the assembly or subassembly.
3	Component and related operation as indicated in the Maintenance Allocation Chart. Operation assigned to depot level maintenance are not normally shown.
4	Maintenance Level, Prescribed. By the Maintenance Allocation Chart is indicated by using the appropriate letter code.
5	Maintenance Level, Recommended. Use the appropriate letter code to indicate the level of maintenance recommended by the test agency.
6	TM Instructions, Adequate. Place an X in this column to indicate that TM instructions covering this maintenance task are adequate.
7	TM Instructions, Inadequate. When TM instructions are considered inadequate, insert test agency EPR number which transmitted the DA Form 2028.
8-9	Active Maintenance Time. Man-hours and Clock hours required for the maintenance operation to the nearest tenth of an hour. If the operation was not actually performed but was reviewed, the estimated active maintenance time is indicated by using the prefix E. (Unusual differences in the maintenance times for the same operation should be explained in the body of the test report.)
10	System Life. The number of operational hours, (essential) and miles, rounds, events, etc., as required in the test plan, accumulated during the test prior to the occurrence of the malfunction or scheduled service. (Under the life figure enter in parenthesis, the sequence number for which that particular operation was last performed.) "S" will be placed in this column if the operation was performed on a sampling basis and not because of an actual maintenance action.

COLUMN

11 Reason Performed, Scheduled. An X in this column indicates that the operation was performed and recorded as a required portion of a scheduled maintenance service.

12 Reason Performed, Unscheduled. An X in this column indicates that this operation was performed as a result of unscheduled maintenance. NOTE: If the operation was performed only to verify procedures or tool requirements, not to correct a malfunction, the symbol "SIM" will be used for simulated and record on separate Maintenance Analysis Chart.

13 EPR No. - Remarks. Enter EPR Number, if applicable. When operation is performed as result of a failure, as defined in USATECOM Reg 750-15, the notation (MCF) Mission Critical Failure will be inserted in this column. Enter other appropriate remarks to further explain operation.

Chart 1B

MAINTENANCE ANALYSIS CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE Truck, Utility, 1/4-Ton, 4x4, M151A2	IDENTIFICATION NO. 02DU8170

SEQ NO.	GROUP NO.	COMPONENT AND RELATED OPERATIONS	MAINTENANCE LEVEL C – OP CREW O – ORG F – DIRECT H – GENERAL		TECH MANUAL INSTRUCTIONS		ACTIVE MAINTENANCE TIME		SYSTEM LIFE M – MILES ~~H – HOURS R – ROUNDS~~	REASON PERFORMED		NOTE: MCF – MISSION CRITICAL FAILURE
			PRESB	RECM	ADQT	INADQT	MAN-HOURS	CLOCK HOURS		SCD	UNSCD	EPR No. – REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13
1	11	Adjusted axle shaft U-bolt torque	O	O	X		0.5	0.5	24.1		X	L5-1, Initial Technical Inspection
1A	06	Adjusted headlights aim	O	O	X		0.3	0.3	24.1		X	L5-1
1B	06	Adjusted spark plug gap	O	O	X		0.1	0.1	24.1		X	L5-1
1C	10 and 11	Corrected toe-in	O	O	X		0.8	0.4	24.1		X	L5-1
2	--	Performed 1000-mile lubrication	C	C	X		1.0	1.0	1001.0	X		
3	--	Performed 1000-mile lubrication	C	C	X		0.6	0.6	2024.0	X		
4	22	Adjusted windshield washer	O	O	X		0.2	0.2	2027.0		X	L5-18(11-2)
4A	06	Replaced stoplight bulbs	O	O	X		0.4	0.4	2027.0		X	
5	--	Performed 1000-mile lubrication	C	C	X		1.0	1.0	3000.0	X		
6	06	Adjusted headlight aim	O	O	X		0.6	0.6	3360.4		X	L5-15
7	07	Repaired transmission leak	O	O	X		0.8	0.8	3898.1		X	
8	13	Replaced wheel (bent)	O	O	X		0.5	0.5	4000		X	
9	--	Performed 1000-mile lubrication	C	C	X		0.5	0.5	4056.5	X		
10	--	Performed 1000-mile lubrication	C	C	X		0.8	0.8	5024.8	X		
11	16	Replaced shock absorber	O	O	X		1.0	1.0	5120.6		X	L5-20
12	12	Cleaned brake shoes (grease on shoe)	O	O	X		0.9	0.9	5196.3		X	L5-21
13		Performed 6000-mile maintenance	O	O	X		15.5	7.7	6000.1	X		
13A	01	Adjusted seal on air cleaner	O	O	X		0.1	0.1	6000.1		X	During 6000-mile maintenance
13B	01	Adjusted engine idle speed	O	O	X		0.3	0.3	6000.1		X	During 6000-mile maintenance

STEYP-TE Form 120, 11 Dec 69 (Rev). Previous edition is obsolete.

JCP-1, DPG

Chart 1B (Continued)

MAINTENANCE ANALYSIS CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE Truck, Utility, 1/4-Ton, 4x4, M151A2	IDENTIFICATION NO. 02DU8170

SEQ NO.	GROUP NO.	COMPONENT AND RELATED OPERATIONS	MAINTENANCE LEVEL C – OP CREW O – ORG F – DIRECT H – GENERAL		TECH MANUAL INSTRUCTIONS		ACTIVE MAINTENANCE TIME		SYSTEM LIFE M – MILES H – HOURS R – ROUNDS	REASON PERFORMED		NOTE: MCF – MISSION CRITICAL FAILURE EPR No. – REMARKS
			PRESB	RECM	ADQT	NADQT	MAN-HOURS	CLOCK HOURS		SCD	UNSCD	
1	2	3	4	5	6	7	8	9	10	11	12	13
13C	06	Tightened fuel gage mounting	O	O	X		0.3	0.3	6000.1		X	During 6000-mile maintenance
13D	06	Replaced spark plug lead	O	O	X		0.3	0.3	6000.1		X	During 6000-mile maintenance, L5-22
14	--	Performed 1000-mile lubrication	C	C	X		1.0	1.0	7018.6	X		
15	3	Air cleaner	O	C	X		0.4	0.4	7524.0		X	Serviced
							1 man					
15A	12	Service brakes	O	O	X		0.7	0.4	7524.0		X	Adjusted
							2 men					
15B	16	Shock absorber	O	O	X		0.9	0.5	7524.0		X	Replaced right front
							2 men					
16	--	Performed 1000-mile lubrication	C	C	X		1.0	1.0	8000.0	X		
							1 man					
17	13	Inner tube right rear	O	O	X		1.0	1.0	8073.9		X	Replaced EPR L5-27
							1 man					
18	13	Inner tube left rear	O	O	X		1.0	1.0	8163.0		X	Replaced EPR L5-27
							1 man					
19	13	Tire, pneumatic 700X16	O	O	X		0.5	0.5	8826.1		X	Repaired
							1 man					
20	--	Performed 1000-mile lubrication	C	C	X		0.9	0.9	9001.8	X		
							1 man					
21	06	Lamps, stoplight, and turn signal indicator	O	O	X		0.3	0.3	9562.7		X	Replaced EPR L5-30
							1 man					
22	12	Service brake, left front	O	O	X		1.5	1.5	9978.6		X	Cleaned and adjusted
							1 man					
22A	22	Windshield washer pump handle	O	O	X		0.5	0.5	9978.6		X	Replaced
							1 man					
23	--	Performed 1000-mile lubrication	C	C	X		1.0	1.0	11000.0	X		
							1 man					
24	13	Tire and inner tube left rear	O	O	X		1.3	1.3	11823.5		X	Replaced EPR L5-33
							1 man					

Chart 1B (Continued)

MAINTENANCE ANALYSIS CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE Truck, Utility, 1/4-Ton, 4x4, M151A2	IDENTIFICATION NO. 02DU8170

SEQ NO.	GROUP NO.	COMPONENT AND RELATED OPERATIONS	MAINTENANCE LEVEL C – OP CREW O – ORG F – DIRECT H – GENERAL		TECH MANUAL INSTRUCTIONS		ACTIVE MAINTENANCE TIME		SYSTEM LIFE M – MILES ~~H – HOURS~~ ~~R – ROUNDS~~	REASON PERFORMED		NOTE: MCF – MISSION CRITICAL FAILURE EPR No. – REMARKS
			PRESB	RECM	ADQT	NADQT	MAN-HOURS	CLOCK HOURS		SCD	UNSCD	
1	2	3	4	5	6	7	8	9	10	11	12	13
25	--	12,000-mile maintenance	O	O	X		15.9	8.0	12001.6	X		L5-39
25A		Left front wheel brake grabs, repaired	O	O	X		0.5	0.5	12001.6		X	L5-39
26	01	Intake manifold leaking	O	O	X		0.2	0.2	12875		X	Retorqued, L5-40
27	13	Inner tube, left rear wheel	O	O	X		0.5	0.5	12937		X	Replaced
28	06	Spark plugs	O	O	X		0.9	0.9	12949		X	Replaced, EPR L5-41
28A	06	Points and condenser	O	O	X		1.5	1.5	12949		X	Replaced, EPR L5-41
28B	03	Adjust carburetor	O	O	X		0.2	0.2	12949		X	Adjusted
28C	12	Hand brake	O	O	X		0.1	0.1	12949		X	Adjusted
29	13	Right rear tire, worn	O	O	X		0.6	0.6	12987	X		Replaced, L5-33
29A	--	1000-mile lubrication	C	C	X		0.8	0.8	12987	X		Performed
30	13	Right front tube, seam split	O	C	X		0.8	0.8	13919		X	Replaced L5-59
31	--	1000-mile lubrication	C	C	X		1.0	0.5	14074	X		Performed
32	12	Repaired, front brakes	O	O	X		3.0	1.8	14896		X	
32A	18	Repaired, front seat	O	O	X		1.5	1.5	14896		X	
33	--	Perform 1000-mile lubrication	C	C	X		0.6	0.6	15052	X		
34		Flat tire, replaced tube	O	O	X		0.8	0.8	15323		X	
35	13	Repair front brakes	O	O	X		2.4	2.4	15182		X	
36	--	Perform 1000-mile lubrication	C	C	X		0.6	0.6	16003	X		
37	03	Repaired fuel leak	O	O	X		1.9	0.9	16694		X	
37A	16	Tighten shock absorber mount	O	O	X		0.1	0.1	16694		X	
38	--	Perform 1000-mile lubrication	C	C	X		0.8	0.8	16942	X		
39	06	Light, tail, bulb	O	O	X		0.2	0.2	17025		X	Replaced
40	11	Retorqued A-frame bolts	O	O	X		0.4	0.4	17150		X	Bolts loose
41	09	Replaced U-joint on shaft	O	O	X		1.5	0.7	17156.7		X	L5-53 - Failure (1)

STEYP-TE Form 120, 11 Dec 69 (Rev). Previous edition is obsolete.

JCP-1, DPG

Chart 1B (Concluded)

MAINTENANCE ANALYSIS CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE Truck, Utility, 1/4-Ton, 4x4, M151A2	IDENTIFICATION NO. 02DU8170

SEQ NO.	GROUP NO.	COMPONENT AND RELATED OPERATIONS	MAINTENANCE LEVEL C – OP CREW O – ORG F – DIRECT H – GENERAL		TECH MANUAL INSTRUCTIONS		ACTIVE MAINTENANCE TIME		SYSTEM LIFE M – MILES ~~H – HOURS~~ ~~R – ROUNDS~~	REASON PERFORMED		NOTE: MCF – MISSION CRITICAL FAILURE EPR No. – REMARKS
			PRESB	RECM	ADQT	NADQT	MAN-HOURS	CLOCK HOURS		SCD	UNSCD	
1	2	3	4	5	6	7	8	9	10	11	12	13
41A	07	Replaced seal and flange	O	O	X		0.5	0.5	17156.7		X	Transmission
41B	03	Replaced fuel-filler gasket	O	O	X		0.2	0.2	17156.7		X	L5-62
41C	13	Replaced suspension arms	O	O	X		3.3	1.7	17156.7		X	L5-58, lower, 1-2 men
42	03	Replaced assembly air cleaner	O	O	X		0.5	0.5	17170		X	L5-57
43	13	Replaced left lower control arm	O	O	X		4.0	4.0	17446		X	Out of alignment
44	--	Performed 18,000-mile maintenance	O	O	X		9.6	5.6	18219	X		1-2 men
45	--	Performed 1000-mile lubrication	C	C	X		0.8	0.8	18989.8	X		
46	06	Replaced coil and points	O	O	X		2.5	2.5	19203.4		X	L5-72
46A	16	Replaced rear shocks	O	O	X		2.0	1.0	19203.4		X	L5-70
46B	10	Replaced seal output	O	O	X		2.4	1.4	19203.4		X	L5-71, front differential, 1-2 men
47	13	Replaced flat with spare	C	C	X		0.5	0.5	19420.3		X	
47A	13	Replaced spare with new tire and tube	O	O	X		0.6	0.6	19420.3		X	
48	13	Repair tube and replace tire	O	O	X		0.8	0.8	19520.4		X	
49	06	Replaced No. 4 spark plug lead	O	O	X		0.4	0.4	19990.0		X	L5-69, broken
50	06	Replaced lamp incandescent	O	O	X		0.2	0.2	20083.2		X	Instrument panel
51	13	Adjusted camber	O	O	X		4.0	2.0	20141		X	1-2 men, by installing shims
51A	03	Repair fuel leak	O	O	X		0.3	0.3	20141		X	
52	13	Flat tire, replaced tube	O	O	X		1.0	1.0	20407.0		X	
53	--	Performed final inspection	O	O								
		TOTAL					108.9	79.0				

STEYP-TE Form 120, 11 Dec 69 (Rev). Previous edition is obsolete.

PARTS ANALYSIS CHART

STEYP-TE FORM 121

INSTRUCTION SHEET

GENERAL: This chart is a list of parts which were used in maintaining the test item. Parts will be grouped in this chart by functional groups and in Federal Stock Number (FSN) numerical order within each group.

COLUMN

1-2 Sequence Number and Group Number. Parts usage by maintenance operation is indicated by a cross reference to the sequence and group number from column 1-2 of the Maintenance Analysis Chart.

3 Federal Stock Number. Record the Federal Stock Number, technical service part number, manufacturers part number, or drawing number in this order of preference.

4 Quantity. The number of identical parts used.

5 Noun Nomenclature. As listed in the parts manual.

6 Maintenance Level, Prescribed. The level prescribed by the parts list under review. Use letter code to indicate.

7 Maintenance Level, Recommended. Use appropriate letter code to indicate the maintenance level recommended by the test agency.

8 Part Life. The number of operating hours (essential) and miles, rounds, events, etc. As required by the test plan, accumulated on this part. This is actual part life and should agree with part life reported on the EPR. Each entry in this column is followed by the appropriate life unit letter code.

9 Reason Used, Scheduled. If the part was replaced as a required action of scheduled maintenance, an X will be placed in the sched column. NOTE: (1) If the part was used to satisfy a "Time Change Component" schedule the symbol "TCC" will be used in this column. (2) If the part was consumed to verify procedures or tools, not to correct a malfunction, the symbol "SIM" will be used.

10 Reason Used, Unscheduled. An X in this column indicates that this part was used as a result of unscheduled maintenance.

11 EPR No. - Remarks. Enter EPR Number if applicable. When part was replaced to correct a failure, as defined in USATECOM Reg 750-15, it will be indicated by inserting the word "Failure."

Chart 1C

PARTS ANALYSIS CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE M151A2, Truck, Utility	IDENTIFICATION 02DU8170

SEQ NO.	GROUP NO.	FEDERAL STOCK NO. OR PART NO.	QTY	NOMENCLATURE	MAINTENANCE LEVEL C – OP CREW O – ORG F – DIRECT H – GENERAL		PART LIFE M – MILES ~~H – HOURS~~ ~~R – ROUNDS~~	REASON USED		EPR No. – REMARKS
					PRESB	RECM		SCD	UNSCD	
1	2	3	4	5	6	7	8	9	10	11
4A	06	6240-044-6914	2	Bulb, incandescent	0	0	2027.0		X	Replaced
8	13		1	Wheel, right rear			4000.0		X	Replaced (bent)
11	16	2540-678-2996	1	Shock, absorber	0	0	5120.6		X	L5-20
13D	06	2920-843-1717	1	Lead, spark plug	0	0	6000.1		X	L5-22
15B	16	2540-678-2996	1	Shock absorber	0	0	7524.0		X	Replaced right front
17	13	2610-269-7332	1	Inner tube	0	0	8073.9		X	L5-27
18	13	2610-269-7532	1	Inner tube	0	0	8163.0		X	L5-27
21		6240-044-6914	1	Lamp, incandescent	0	0	9562.7		X	Replaced stoplight
21	13	6240-155-8714	1	Lamp, incandescent	0	0	9562.7		X	Replaced turn signal indicator
22A	22	Unknown	1	Windshield washer handle	0	0	9978.6		X	Replaced
24	13	2610-678-1362	1	Tire, pneumatic	0	0	11823.5	X		Replaced, L5-33
24	13	2610-269-7532	1	Inner tube, tire	0	0	11823.5		X	Replaced, L5-33
25	01	2940-832-6054	1	Element, engine oil	0	0	12001.	X		Replaced, 12,000-mile maintenance
27	13	2610-269-7532	1	Inner tube	0	0	12937		X	Replaced
28	06	2920-752-4258	4	Spark plug	0	0	12949			Replaced, AR-75, L5-41
28A	06	2920-066-4987	1	Ignition point kit	0	0	12949		X	Replaced, L5-41
29	13	2610-678-1363	1	Tire, pneumatic	0	0	12987	X		Replaced, L5-33
30	13	2610-269-7532	1	Inner tube	0	0	13919		X	Replaced, L5-59
34	13	2610-269-7532	1	Inner tube	0	0	15323		X	Replaced
39	06	1683	1	Lamp, incandescent, tail	0	0	17025		X	Replaced
41	09	2520-678-3115	1	U-joint	0	0	17156.7		X	L5-53, replaced
41A	07	2520-678-1764	1	Seal output, transmission	0	0	17156.7		X	Replaced
41A	07	2520-930-4113	1	Flange, transmission	0	0	17156.7		X	Replaced
41B	03	2910-930-2060	1	Gasket, fuel filler	0	0	17156.7		X	L5-62, replaced
41C	13	2530-678-3118	1	Arm, lower suspension	0	0	17156.7		X	L5-58, replaced
41C	13	2530-678-3070	1	Arm, lower suspension	0	0	17156.7		X	L5-58, replaced
42	03	2940-678-4253	1	Assembly, air cleaner	0	0	17170.0		X	L5-57, replaced

STEYP-TE Form 121, 11 Dec 69 (Rev). Previous editions are obsolete.

Chart 1C (Concluded)

PARTS ANALYSIS CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE M151A2, Truck, Utility	IDENTIFICATION 02DU8170

SEQ NO.	GROUP NO.	FEDERAL STOCK NO. OR PART NO.	QTY	NOMENCLATURE	MAINTENANCE LEVEL C – OP CREW O – ORG F – DIRECT H – GENERAL		PART LIFE M – MILES ~~H – HOURS~~ ~~R – ROUNDS~~	REASON USED		EPR No. – REMARKS
					PRESB	RECM		SCD	UNSCD	
1	2	3	4	5	6	7	8	9	10	11
43	13	2530-678-3122	1	Control arm, left lower	0	0	17446.0		X	Replaced
44	01	2940-832-6054	1	Filter, engine, oil	0	0	18219.0	X		18,000-mile maintenance
46	06	2920-076-8993	1	Coil, ignition	0	0	19203.4		X	L5-72, replaced
46	06	7059538	1	Point set contact	0	0	19203.4		X	L5-72, replaced
46A	16	2540-678-2978	2	Shock absorbers, rear	0	0	19203.4		X	L5-70, replaced
46B	10	2520-887-1347	1	Seal, output, front differential, left	0	0	19203.4		X	L5-71
47A	13	2610-678-1363	1	Tire	0	0	19420.3		X	Replaced
47A	13	2610-269-7332	1	Tube	0	0	19420.3			
48	13	2610-678-1363	1	Tire	0	0	19520.4		X	Replaced
49	06	2920-843-1717	1	Lead, spark plug, No. 4	0	0	19990.0		X	L5-69, replaced
50	06	6240-266-9940	1	Lamp, incandescent	0	0	20083.2		X	Replaced (instrument)
51	13	1095-0856-3	3	Shim, spacer	0	0	20141		X	For adjustment purposes only
51	13	875404	3	Shim, spacer	0	0	20141		X	For adjustment purposes only
52	13	2610-269-7332	1	Tube	0	0	20407.0		X	Replaced
53	01	2940-832-6054	1	Filter, engine, oil	0	0	21058	X		Final inspection

STEYP-TE Form 121, 11 Dec 69 (Rev). Previous editions are obsolete.

JCP-1, DPG

MAINTENANCE PACKAGE LITERATURE CHART

STEYP-TE FORM 122

INSTRUCTION SHEET

COLUMN

1	Enter Army or manufacturer's publication or draft manual number.
2	Number of copies received. Insert "0" if none were supplied. Use Chapter 9 of AR 310-3 as a guide to determine those publications that should accompany the test item. Publications contained in the maintenance package should cover operations and functions through general support maintenance and should specify the categories involved.
3	Complete title.
4	Fill in date publication was received.
5	Fill in date test item or materiel was received.
6 & 7	Insert "X" in appropriate block. Minor errors noted on DA 2028 forms are not in themselves sufficient reasons to term a publication inadequate.
8	Insert EPR number and date DA Form 2028 was forwarded.
9	In addition to appropriate remarks, explain if manuscript was <u>not</u> evaluated.

Chart 1D

MAINTENANCE PACKAGE LITERATURE CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE M151A2, Truck, Utility, 1/4-Ton, 4x4					IDENTIFICATION 02DU8170
MANUSCRIPT			DATE RECEIVED		EVALUATION		FORM 2028	
NUMBER	QTY	TITLE	LIT.	MATERIAL	ADQT	INADQT	DATE FORWARD	REMARKS
1	2	3	4	5	6	7	8	9
TM 9-2320 218-10	1	Truck, Utility, 1/4-Ton, 4x4, M151	Mar 68	Apr 70	X		None	Not evaluated
TM 9-2320 218-10 C/1	1	Truck, Utility, 1/4-Ton, 4x4, M151A2	Dec 69	Apr 70	X		None	Not evaluated
TM-9-2320 218-20	1	Truck, Utility, 1/4-Ton, 4x4, M151	Aug 68	Apr 70	X		None	Not evaluated
TM-9-2320 218-20 C/1	1	Truck, Utility, 1/4-Ton, 4x4, M151A2	Jan 70	Apr 70	X		None	Not evaluated
TM-9-2320 218-20P	1	Truck, Utility, 1/4-Ton, 4x4, M151	Apr 68	Apr 70	X		None	Not evaluated
TM-9-2320 218-20P C/2	1	Truck, Utility, 1/4-Ton, 4x4, M151A2	Jan 70	Apr 70	X		None	Not evaluated
TM-9-2320 218-34	1	Truck, Utility, 1/4-Ton, 4x4, M151	Jul 68	Apr 70	X		None	Not evaluated
TM-9-2320 218-34 C/2	1	Truck, Utility, 1/4-Ton, 4x4 M151A2	Jan 70	Apr 70	X		None	Not evaluated
TM-9-2320 218-34P	1	Truck, Utility, 1/4-Ton, 4x4 M151	Apr 68	Apr 70	X		None	Not evaluated
TM-9-2320 218-34P C/1	1	Truck, Utility, 1/4-Ton, 4x4, M151A2	Jan 70	Apr 70	X		None	Not evaluated

STEYP-TE Form 122, 11 Dec 69 (Rev). Previous editions are obsolete.

JCP-1, DPG

SPECIAL TOOL AND TEST EQUIPMENT CHART

STEYP-TE Form 123

INSTRUCTION SHEET

COLUMN

1 Nomenclature or Description. Enter the nomenclature as shown in the manual or if none, enter noun nomenclature and brief description of item. (Enter in parenthesis the number of like items received, such as "(2 ea)").

2 Federal Stock Number or Part Number. Record one of the following: Federal Stock Number, Part Number or Drawing Number, in this order of preference.

3 Maintenance Level, Prescribed. Maintenance Level authorized the tool as prescribed by the technical publication.

4 Maintenance Level, Recommended. Indicate the maintenance level to be authorized the tool as recommended by test agency. If the tool is not required, enter none.

5 Date Received. Enter the date the tool or test equipment was received (Example 6/69). Enter "not rec" if tool or test equipment was not received.

6 Evaluation, Adequate. Enter an X if the tool was found to be adequate for use by the mechanics and for its intended purpose at the maintenance level recommended in Column 4. Make no comment on tools marked None in Column 4.

7 Evaluation, Inadequate. Enter an X if the tool was found to be inadequate for its intended use. Make no comment on tools marked None in column 4.

8 Required (RQR) Yes or No. A yes in this column indicates the tool or test equipment is required at the maintenance level indicated in column 4. A No in this column indicates the tool or test equipment is not required. This column should be marked No when None is marked in Column 4.

9 Listed in Technical Manual. Enter the number of the technical publication for the test item in which the tool or test equipment is listed.

COLUMN	
10	Remarks. If an EPR is related to the tool, the EPR number will be entered. If the tool or test equipment was used only to verify the need for the item, this will be indicated. When it has been determined that a tool is not required, indicate the tool from the common tool set and the set number which will perform the required maintenance function.

SPECIAL TOOLS AND TEST EQUIPMENT CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE Truck, Utility, 1/4-Ton, 4x4, M151A2	IDENTIFICATION 02DU8170

NOMENCLATURE OR DESCRIPTION	FEDERAL STOCK NO. OR PART NO.	MAINTENANCE LEVEL C – OP CREW O – ORG F – DIRECT H – GENERAL		DATE RECEIVED	EVALUATION		REQ YES OR NO	TECHNICAL MANUAL REFERENCE	REMARKS
		PRESB	RECM		ADQT	INADQT			
1	2	3	4	5	6	7	8	9	10
Rag, cotton duck	5140-772-4142	C	C	Apr 70	X			9-2320-218-10	OEM
Jack	2120-729-5779	C	C	Apr 70	X				
Pliers, slip joint	5120-223-7397	C	C	Apr 70	X				
Screwdriver	5120-222-8852	C	C	Apr 70	X				
Wrench, adjustable	5120-240-5328	C	C	Apr 70	X				
Wrench, socket handle	5120-811-4114	C	C	Apr 70	X				
Handle, Jack	5120-708-3364	C	C	Apr 70	X			9-2320-218-10	OEM
Tool kit, Set A	4910-627-7048	O	O	Apr 70	X			9-2320-218-20P	Organizational tools available and utilized
Tool kit, Set B	4910-627-7049	O	O	Apr 70	X			9-2320-218-20P	
Tool kit, Set B	4910-627-7049	O	O	Apr 70	X			9-2320-218-34P	
Sling, engine and transmission	4910-627-7044	O	O	Apr 70	X			9-2320-218-34P	Organizational tools available and utilized

STEYP-TE Form 123, 11 Dec 69 (Rev). Previous edition is obsolete.

Chart 2A

MAINTENANCE EVALUATION SUMMARY REPORT	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE M151A2 Truck, Utility, 1/4-Ton, 4x4,	IDENTIFICATION 02DU8370

1. Reporting period 2 Apr thru 19 Jun Interim No. ☐ Final ☒
2. Test miles required 20,000 this report 21,048 Total 21,048
3. Operating hr required 1,000 this report 940.9 Total 940.9
4. Op/Crew daily services this report 76.5 Total 76.5
5. Supply and admin delay time this report 168.2 Total 168.2
6. Vehicle mod hr this report 0.0 Total 0.0
7. Accident or error maint time this report 4.5 Total 4.5
8. Special engr test time this report 0.0 Total 0.0
9. Initial tech insp time 13.3 Final tech insp time 29.7
10.

Type of Maintenance	11. Inspection		12. Fault Location		13. Preparation		14. Adjust or Calibrate		15. Fault Correction		16. Part Replacement		17. Check Out		18. Active MMH		19. Clock Hr		20. System Failure		JCP-1, DPG
	This Period	Total Time	This Period	Total Time	This Period	Total Time	This Period	Total Time	This Period	Total Time	This Period	Total Time	This Period	Total Time	This Period	Total Maint Man-Hr	This Period	Total Time	This Period	Total Failures	
Op Crew Maint Scheduled		12.9										0.3				13.2		13.2			
Op Crew Maint Unscheduled												0.8				0.8		0.8			
Org Maint Scheduled		40.5				0.4						1.5				42.0		27.1			
Org Maint Unscheduled		2.9		6.3		3.9		4.7		7.6		17.3		5.2		47.9		33.1			
Direct Maint Scheduled																					
Direct Maint Unscheduled						0.1				0.3						0.4		0.4			
General Maint Scheduled																					
General Maint Unscheduled																					
TOTALS		56.1		6.3		4.4		4.7		7.9		19.7		5.2		104.3		74.6			

Additional Test Information - Item No. 3, based on tachograph installed and on 20 mph

Item No. 5, administrative delay time is based on 16 hours per day, 5 days per week

STEYP-TE Form 14, 8 Apr 70. (STEYP-TAU SOP 02-06-70)

Chart 2A (Concluded)

MAINTENANCE EVALUATION SUMMARY REPORT	MAINTENANCE OR DELAY TIME (NON-CHARGEABLE)	NOMENCLATURE M151A2
		IDENTIFICATION 02DU8370

Group No.	Incident, Component and or Related Operations	Authority	System Life (X) Miles Hours Rounds	Delay or Maintenance Time: Man-Hours	Delay or Maintenance Time: Clock Hours	Maintenance Level	Vehicle Modification	Supply Delay	Admin Delay	Accident or Error	Special Engineer Test	Initial or Final Inspection	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
--	Initial Technical Inspection		13.3	13.3	7.2	0			3.7			13.3	
--	12,000-mile maintenance		11955		7.7	0			7.7				
12	Front brakes grab		13912		9.0	0		1.3	7.7				
05	Repaired radiator		16279.4		17.0	0			17.0				
12	Repair brakes and		16447		30.4	0			30.4				
03	Install cleaner assembly, air												
--	Perform 18,000-mile maintenance		17836		28.9	0			28.9				
12	Front brake grabs, oil on lining		17836	3.5	1.7	0				3.5			Error
	Replace outer seal (error)												
06	Engine stopped running during oper-		18119	1.0	0.8	0				1.0			Error
	ation, ignition resistor burned												
	out (shop error)												
--	A maintenance (partial final)		21084	14.0	8.3	0			8.3			14.0	
--	Final Technical Inspection		2116.0	15.7	7.8	0			63.2			15.7	
				47.5	118.8	0		1.3	166.9	4.5		43.0	

STEYP-TE Form 70, 8 Apr 70 (Rev). Edition of 11 Dec 69 is obsolete. (STEYP-TAU SOP 2-06-07)

JCP-1, DPG

Chart 2B

MAINTENANCE ANALYSIS CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE M151A2, Truck, Utility	IDENTIFICATION NO. 02DU8370

SEQ NO.	GROUP NO.	COMPONENT AND RELATED OPERATIONS	MAINTENANCE LEVEL C – OP CREW O – ORG F – DIRECT H – GENERAL		TECH MANUAL INSTRUCTIONS		ACTIVE MAINTENANCE TIME		SYSTEM LIFE M – MILES ~~H – HOURS~~ ~~R – ROUNDS~~	REASON PERFORMED		NOTE: MCF – MISSION CRITICAL FAILURE EPR No. – REMARKS
			PRESB	RECM	ADQT	NADQT	MAN-HOURS	CLOCK HOURS		SCD	UNSCD	
1	2	3	4	5	6	7	8	9	10	11	12	13
1	06	Rerouted starter switch cable	0	0	X		0.2	0.2	13.3		X	L5-2
1A	06	Adjusted headlights	0	0	X		0.5	0.5	13.3		X	L5-2
1B	13	Adjusted toe-in	0	0	X		0.3	0.3	13.3		X	L5-2
2		Performed 2000-mile lubrication	C	C	X		1.0	1.0	2000.0	X		
3	01	Cleaned and lubricated accelerator linkage	0	0	X		0.5	0.5	2000.9		X	L5-9
3A	05	Shortened radiator hose	0	0	X		1.0	0.5	2000.9		X	L5-10
4		Performed 3000-mile lubrication	C	C	X		1.0	1.0	3000.0	X		
5	06	Adjusted headlights	0	0	X		0.7	0.7	3346.5		X	L5-16
6		Performed 4000-mile lubrication	C	C	X		1.1	1.1	3983.8	X		
7	13	Replaced tire and tube (damaged)	0	0	X		0.7	0.7	3988.7		X	
8	06	Adjusted brake light switch	0	0	X		0.1	0.1	4351.6		X	
9	--	Performed 1000-mile lubrication	C	C	X		1.0	1.0	5000.0	X		
10	--	Performed 6000-mile maintenance	0	0	X		7.8	3.9	6031.1	X		
10A	01	Repaired engine, missing	0	0	X		2.6	1.3	6031.1		X	L5-23
11	--	Performed 1000-mile lubrication	C	C	X		1.0	1.0	7000.5	X		
12	--	Performed 1000-mile lubrication	C	C	X		0.8	0.8	8000.0	X		
13	13	Flat tire, right rear, repaired	0	0	X		0.8	0.8	8896.0		X	L5-27
14	--	Perform 1000-mile lubrication	C	C	X		1.5	1.5	9000.0	X		
15	--	Perform 1000-mile lubrication	C	C	X		0.7	0.7	10004.0	X		

STEYP-TE Form 120, 11 Dec 69 (Rev). Previous edition is obsolete.

JCP-1, DPG

Chart 2B (Continued)

MAINTENANCE ANALYSIS CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE M151A2, Truck, Utility	IDENTIFICATION NO. 02DU8370

NOTE:. MCF - MISSION CRITICAL FAILURE

SEQ NO.	GROUP NO.	COMPONENT AND RELATED OPERATIONS	MAINTENANCE LEVEL C - OP CREW O - ORG F - DIRECT H - GENERAL		TECH MANUAL INSTRUCTIONS		ACTIVE MAINTENANCE TIME		SYSTEM LIFE M - MILES ~~H - HOURS~~ ~~R - ROUNDS~~	REASON PERFORMED		EPR No. - REMARKS
			PRESB	RECM	ADQT	NADQT	MAN-HOURS	CLOCK HOURS		SCD	UNSCD	
1	2	3	4	5	6	7	8	9	10	11	12	13
16	13	Flat tire, replaced tube	O	O	X		1.0	1.0	10076		X	L5-31
17	13	Flat tire, replaced tube	O	O	X		1.2	1.2	11284		X	L5-31
18	--	Perform 1000-mile lubrication	C	C	X		0.9	0.9	11414	X		
19	--	Perform 12,000-mile maintenance	O	O	X		16.6	11.8	11955	X		L5-45, L5-43
20	10	Right output seal front differential, replaced	O	O	X		1.0	0.5	11955		X	L5-44
21	13	Flat tire, replaced worn tire and tube	O	O	X		0.4	0.4	12466	X		L5-33
22	06	Fuel gage transmitter wiring repaired	O	O	X		1.2	0.6	12907		X	L5-42
23	13	Tire, replaced with spare (worn)	C	C	X		0.3	0.3	13659	X		L5-33
24	13	Rear brakes grab, repaired	O	O	X		4.0	2.6	13912		X	L5-46
25	13	Flat, replaced tire	O	O	X		0.8	0.8	14555		X	
26	13	Flat tire, replaced with spare	C	C	X		0.5	0.5	15033		X	
27	--	Perform 1000-mile lubrication	C	C	X		0.5	0.5	15278	X		
27A	13	Flat tire, installed spare	C	C	X		0.3	0.3	15278		X	
27B	13	Flat tire, installed new tire	O	O	X		0.5	0.5	15278		X	
28	06	Replaced, instrument panel light	O	O	X		0.1	0.1	15850		X	
29	--	Perform 1000-mile lubrication	C	C	X		1.0	1.0	16075	X		
30	13	Flat tire, repaired tube	O	O	X		0.6	0.6	16279		X	
31	05	Repair radiator leak	O	O	X		2.0	2.0	16279		X	
32	10	Repair lower front suspension	O	O	X		8.0	4.2	16447		X	

STEYP-TE Form 120, 11 Dec 69 (Rev). Previous edition is obsolete.

MAINTENANCE ANALYSIS CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE M151A2, Truck, Utility	IDENTIFICATION NO. 02DU8370

SEQ NO.	GROUP NO.	COMPONENT AND RELATED OPERATIONS	MAINTENANCE LEVEL C – OP CREW O – ORG F – DIRECT H – GENERAL		TECH MANUAL INSTRUCTIONS		ACTIVE MAINTENANCE TIME		SYSTEM LIFE M – MILES ~~H – HOURS~~ ~~R – ROUNDS~~	REASON PERFORMED		NOTE: MCF – MISSION CRITICAL FAILURE EPR No. – REMARKS
			PRESB	RECM	ADQT	NADQT	MAN-HOURS	CLOCK HOURS		SCD	UNSCD	
1	2	3	4	5	6	7	8	9	10	11	12	13
32A	03	Replaced air cleaner assembly	O	O	X		0.5	0.5	16447		X	L5-57
32B	12	Brakes grab, repaired	O	O	X		2.4	1.5	16447		X	
33	13	Flat tire, repaired	O	O	X		1.0	1.0	16575		X	
34	13	Flat tire, replaced tube	O	O	X		0.8	0.4	16745		X	
35	--	Perform 1000-mile lubrication	C	C	X		1.0	1.0	17000	X		
36	--	Perform 18,000-mile maintenance	O	O	X		16.1	9.9	17836	X		
36A	05	Radiator leaking, replaced	O	O	X		2.6	1.3	17836		X	L5-77
36B	06	Replaced turn signal	O	O	X		0.8	0.4	17836		X	L5-67
36C	06	Low beam headlight replaced	O	O	X		0.2	0.2	17836		X	L5-73
36D	13	Left and right lower suspension arm replaced	O	O	X		5.8	2.9	17836		X	L5-58
36E	06	Replaced distributor cap and O-ring seal	O	O	X		2.0	2.0	17836		X	L5-66, L5-75, L5-74
37	--	Perform 1000-mile lubrication	C	C	X		0.4	0.4	18027	X		
38	12	Cannot adjust hand brake replace brake band	O	O	X		1.6	0.8	18639		X	L5-55
39	--	Perform 1000-mile lubrication	C	C	X		0.5	0.5	19003	X		
40	13	Replaced right and left rear tires	O	O	X		1.1	1.1	19089	X		Worn out
41	16	Right rear shock leaks, replaced	O	O	X		0.5	0.5	19699		X	L5-64
41A	12	Replace, right front brake shoe	O	O	X		1.1	1.1	19699		X	
41B	06	Replace turn signal indicators	O	O	X		0.6	0.6	19699		X	

Chart 2B (Concluded)

MAINTENANCE ANALYSIS CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE M151A2, Truck, Utility	IDENTIFICATION NO. 02DU8370

SEQ NO.	GROUP NO.	COMPONENT AND RELATED OPERATIONS	MAINTENANCE LEVEL C – OP CREW O – ORG F – DIRECT H – GENERAL		TECH MANUAL INSTRUCTIONS		ACTIVE MAINTENANCE TIME		SYSTEM LIFE M – MILES ~~H – HOURS~~ ~~R – ROUNDS~~	REASON PERFORMED		NOTE: MCF – MISSION CRITICAL FAILURE EPR No. – REMARKS
			PRESB	RECM	ADQT	NADQT	MAN-HOURS	CLOCK HOURS		SCD	UNSCD	
1	2	3	4	5	6	7	8	9	10	11	12	13
42	--	Perform 1000-mile lubrication	C	C	X		0.5	0.5	20003	X		
43A	06	Lead spark plug	O	O	X		0.2	0.2	21084		X	L5-78, replaced
44	03	Air cleaner canister	F	F	X		0.4	0.4	21085		X	(partial final) Repaired
45		Completed final inspection	O	O	X							
		TOTAL					104.3	74.6				

STEYP-TE Form 120, 11 Dec 69 (Rev). Previous edition is obsolete.

Chart 2C

SPECIAL TOOLS AND TEST EQUIPMENT CHART	PROJECT NO. 1-VG-120-151-034			NOMENCLATURE M151A2, Truck, Utility					IDENTIFICATION 02DU8370
NOMENCLATURE OR DESCRIPTION	FEDERAL STOCK NO. OR PART NO.	MAINTENANCE LEVEL C – OP CREW O – ORG F – DIRECT H – GENERAL		DATE RECEIVED	EVALUATION		REQ YES OR NO	TECHNICAL MANUAL REFERENCE	REMARKS
		PRESB	RECM		ADQT	INADQT			
1	2	3	4	5	6	7	8	9	10
Bag, cotton duck	5140-772-4142	C	C	Apr 70	X			9-2320-218-10	OEM
Jack	2120-729-5779	C	C	Apr 70	X				
Pliers, slip joint	5120-223-7397	C	C	Apr 70	X				
Screwdriver	5120-222-8852	C	C	Apr 70	X				
Wrench, adjustable	5120-240-5328	C	C	Apr 70	X				
Wrench, socket handle	5120-811-4114	C	C	Apr 70	X				
Handle, jack	5120-708-3364	C	C	Apr 70	X			9-2320-218-10	OEM
Tool kit, Set A	4910-627-7048	O	O	Apr 70	X			9-2320-218-20P	Organizational tools available and utilized
Tool kit, Set B	4910-627-7049	O	O	Apr 70	X			9-2320-218-20P	Organizational tools available and utilized
Tool kit, Set B	4910-627-7049	O	O	Apr 70	X			9-2320-218-34P	Organizational tools available and utilized
Sling, engine and transmission	4910-627-7044	O	O	Apr 70	X			9-2320-218-34P	Organizational tools available and utilized

STEYP-TE Form 123, 11 Dec 69 (Rev). Previous edition is obsolete.

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Chart 2D

PARTS ANALYSIS CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE M151A2, Truck, Utility	IDENTIFICATION 02DU8370

SEQ NO.	GROUP NO.	FEDERAL STOCK NO. OR PART NO.	QTY	NOMENCLATURE	MAINTENANCE LEVEL C – OP CREW O – ORG F – DIRECT H – GENERAL		PART LIFE M – MILES ~~H – HOURS~~ ~~R – ROUNDS~~	REASON USED		EPR No. – REMARKS
					PRESB	RECM		SCD	UNSCD	
1	2	3	4	5	6	7	8	9	10	11
7	13	2610-678-1363	1	Tire	O	O	3988.7		X	
7	13	2610-269-7332	1	Tube, pneumatic	O	O	3988.7		X	
10	06	2920-089-3607	1	Kit, ignition repair	O	O	6031.1		X	L5-23
10	06	7059538	1	Points, ignition	O	O	6031.1		X	L5-23
10	06	2920-287-9135	4	Spark plugs	O	O	6031.1		X	L5-23
16	13	2610-269-7332	1	Tube, pneumatic	O	O	10076		X	L5-31
17	13	2610-269-7332	1	Tube, pneumatic	O	O	11284		X	L5-31
19	01	2940-832-6054	1	Filter, oil	O	O	11955	X		
19	01	2920-287-9135	4	Spark plug	O	O	11955	X		L5-45
20	10	2520-887-1347	1	Seal	O	O	11955		X	L5-44
21	13	2610-269-7332	1	Tube	O	O	12466	X		L5-33
21	13	2610-678-1363	1	Tire	O	O	12466	X		L5-33
23	13	2610-678-1363	1	Tire	O	O	13659	X		L5-33
24	13	702-5883	2	Spring retainer	O	O	13912		X	L5-46
	13	2530-887-1348	2	Seal, wheel	O	O	13912		X	L5-46
25	13	2610-678-1363	1	Tire	O	O	14555		X	
27B	13	2610-678-1363	1	Tire	O	O	15278		X	
28	06	6240-019-0877	1	Lamp, instrument panel	O	O	15850		X	
32A	03	2940-678-4253	1	Air cleaner assembly	O	O	16447		X	
34	13	2610-269-7332	1	Tube, pneumatic	O	O	16745		X	
36	01	2940-832-6054	1	Oil filter	O	O	17836	X		18,000-mile maintenance
36A	05	2930-064-5979	1	Radiator assembly	O	O	17836		X	L5-77
36B	06	11613632	1	Turn signal control	O	O	17836		X	L5-67
36C	06	6240-686-4168	1	Light, low beam	O	O	17836		X	L5-73
36D	13	2530-678-3118	1	Arm assembly	O	O	17836		X	L5-58
	13	2530-678-3070	1	Arm assembly	O	O	17836		X	L5-58
36E	06	2920-353-2216	1	Distributor cap	O	O	17836		X	L5-75
	06	5330-054-6880	1	Seal, O-ring	O	O	17836		X	L5-74
38	12	2530-678-1284	1	Brake band	O	O	18639		X	L5-55
40	13	2610-678-1363	2	Tire	O	O	19089	X		Worn out
41	16	2540-678-2978	1	Shock absorber	O	O	19699		X	L5-64
41A	12	2530-678-3111	2	Brake shoe	O	O	19699		X	

STEYP-TE Form 121, 11 Dec 69 (Rev). Previous editions are obsolete.

Chart 2D (Concluded)

PARTS ANALYSIS CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE M151A2, Truck, Utility	IDENTIFICATION 02DU8370

SEQ NO.	GROUP NO.	FEDERAL STOCK NO. OR PART NO.	QTY	NOMENCLATURE	MAINTENANCE LEVEL (C – OP CREW, O – ORG, F – DIRECT, H – GENERAL) PRESB	MAINTENANCE LEVEL RECM	PART LIFE (M – MILES, ~~H – HOURS~~, ~~R – ROUNDS~~)	REASON USED SCD	REASON USED UNSCD	EPR No. – REMARKS
1	2	3	4	5	6	7	8	9	10	11
41B	06	1161362-1	1	Turn signal indicators	0	0	19699		X	
43	01	2940-832-6045	1	Filter, engine oil	0	0	21084	X		Final and A maintenance
43A	06	2920-843-1717	1	Lead spark plug No. 2	0	0	21084		X	Final inspection
45	01	2940-832-6045	1	Filter engine oil	0	0	21166.0	X		Final

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STEYP-TE Form 121, 11 Dec 69 (Rev). Previous editions are obsolete.

Chart 2E

MAINTENANCE PACKAGE LITERATURE CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE M151A2, Truck, Utility, 1/4-Ton, 4x4					IDENTIFICATION 02DU8370
MANUSCRIPT			DATE RECEIVED		EVALUATION		FORM 1598	
NUMBER	QTY	TITLE	LIT.	MATERIAL	ADQT	INADQT	DATE FORWARD	REMARKS
1	2	3	4	5	6	7	8	9
TM-9-2320 218-10	1	Truck, Utility, 1/4-Ton, 4x4, M151	Mar 68	Apr 70	X		None	Not evaluated
TM-9-2320 218-10 C/1	1	Truck, Utility, 1/4-Ton, 4x4, M151A2	Dec 69	Apr 70	X		None	Not evaluated
TM-9-2320 218-20	1	Truck, Utility, 1/4-Ton, 4x4 M151	Aug 68	Apr 70	X		None	Not evaluated
TM-9-2320 218-20 C/1	1	Truck, Utility, 1/4-Ton, 4x4, M151A2	Jan 70	Apr 70	X		None	Not evaluated
TM-9-2320 218-20P	1	Truck, Utility, 1/4-Ton, 4x4 M151	Apr 68	Apr 70	X		None	Not evaluated
TM-9-2320 218-20P C/2	1	Truck, Utility, 1/4-Ton, 4x4, M151A2	Jan 70	Apr 70	X		None	Not evaluated
TM-9-2320 218-34	1	Truck, Utility, 1/4-Ton, 4x4, M151	Jul 68	Apr 70	X		None	Not evaluated
TM-9-2320 218-34 C/2	1	Truck, Utility, 1/4-Ton, 4x4, M151A2	Jan 70	Apr 70	X		None	Not evaluated
TM-9-2320 218-34P	1	Truck, Utility, 1/4-Ton, 4x4, M151	Apr 70	Apr 70	X		None	Not evaluated
TM-9-2320 218-34P C/1	1	Truck, Utility, 1/4-Ton, 4x4, M151A2	Jan 70	Apr 70	X		None	Not evaluated

STEYP-TE Form 122, 11 Dec 69 (Rev). Previous editions are obsolete.

Chart 3A

MAINTENANCE EVALUATION SUMMARY REPORT	PROJECT NO.	NOMENCLATURE	IDENTIFICATION
	1-VG-120-151-034	Truck, Utility, 1/4-Ton, 4x4, M151A2	02DU8670

1. Reporting period 1 Apr thru 17 Jun Interim No. ☐ Final ☒
2. Test miles required 20000 this report 21091 Total 21091
3. Operating hr required 1000 this report 872.0 Total 872.0
4. Op/Crew daily services this report 91.7 Total 91.7
5. Supply and admin delay time this report 70.7 Total 70.7
6. Vehicle mod hr this report 0 Total 0
7. Accident or error maint time this report 0 Total 0
8. Special engr test time this report 0 Total 0
9. Initial tech insp time 12.5 Final tech insp time 27.6
10.

Type of Maintenance	11. Inspection		12. Fault Location		13. Preparation		14. Adjust or Calibrate		15. Fault Correction		16. Part Replacement		17. Check Out		18. Active MMH		19. Clock Hr		20. System Failure		JCP-1, DPG
	This Period	Total Time	This Period	Total Time	This Period	Total Time	This Period	Total Time	This Period	Total Time	This Period	Total Time	This Period	Total Time	This Period	Total Maint Man-Hr	This Period	Total Time	This Period	Total Failures	
Op Crew Maint Scheduled		14.8										0.5				15.3		14.7			
Op Crew Maint Unscheduled										0.5		0.6				0.6		0.6			
Org Maint Scheduled		52.9										0.8				53.7		24.6			
Org Maint Unscheduled		5.0		1.1		3.2		7.9		10.2		14.4		1.5		43.8		35.1			
Direct Maint Scheduled																					
Direct Maint Unscheduled		0.5				1.5								1.0		3.0		3.0			
General Maint Scheduled																					
General Maint Unscheduled																					
TOTALS		73.2		1.1		4.7		7.9		10.7		16.3		2.5		116.4		78.0			

Additional Test Information - Item No. 3 is based on tachograph installed

Item No. 5 administrative delay time is based on 16 hours per day, 5 days per week

STEYP-TE Form 14, 8 Apr 70. (STEYP-TAU SOP 02-06-70)

Chart 3A (Concluded)

MAINTENANCE EVALUATION SUMMARY REPORT	MAINTENANCE OR DELAY TIME (NON-CHARGEABLE)	NOMENCLATURE M151A2
		IDENTIFICATION 02DU8670

Group No.	Incident, Component and or Related Operations	Authority	System Life (X Miles / Hours / Rounds)	Delay or Maintenance Time: Man-Hours	Delay or Maintenance Time: Clock Hours	Maintenance Level	Vehicle Modification	Supply Delay	Admin Delay	Accident or Error	Special Engineer Test	Initial or Final Inspection	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Initial Technical Inspection		13.6	12.5	7.0	0						12.5	
	Check front end and adjust headlights		14840.		4.4	0			4.4				
16	Replace left rear shock and brake, adjust dust covers		14999		7.4	0			7.4				
12	Replace brake linings		15263		2.5	0			2.5				
	18,000-mile maintenance		18639		14.8	0			14.8				
16	Replace shock absorber		20097		0.5	0		0.2	0.3				
	Perform A maintenance (partial final)		21123	8.5	4.8	0			16.2			8.5	
	Complete final technical inspection		22420	19.1	10.1				24.9			19.1	
	TOTALS			40.1	51.5	-	0	0.2	70.5	0	0	40.1	

STEYP-TE Form 70, 8 Apr 70 (Rev). Edition of 11 Dec 69 is obsolete. (STEYP-TAU SOP 2-06-07)

Chart 3B

MAINTENANCE ANALYSIS CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE Truck, Utility, 1/4-Ton, 4x4, M151A2	IDENTIFICATION NO. 02DU8670

SEQ NO.	GROUP NO.	COMPONENT AND RELATED OPERATIONS	MAINTENANCE LEVEL C – OP CREW O – ORG F – DIRECT H – GENERAL		TECH MANUAL INSTRUCTIONS		ACTIVE MAINTENANCE TIME		SYSTEM LIFE M – MILES ~~H – HOURS~~ ~~R – ROUNDS~~	REASON PERFORMED		NOTE: MCF – MISSION CRITICAL FAILURE
			PRESB	RECM	ADQT	NADQT	MAN-HOURS	CLOCK HOURS		SCD	UNSCD	EPR No. – REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13
1	06	Corrected spark plug gap	0	0	X		0.3	0.3	13.6		X	L5-3
1A	01	Corrected torque on intake manifold bolts	0	0	X		0.2	0.2	13.6		X	L5-3
1B	12	Corrected hand brake adjustment	0	0	X		0.3	0.3	13.6		X	L5-3
1C	11	Corrected torque on differential mount bolts	0	0	X		0.2	0.2	13.6		X	L5-3
1D	06	Replaced lamp in turn signal handle	0	0	X		0.1	0.1	13.6		X	L5-3
2	06	Replaced electrical ferrule on left taillight	0	0	X		0.9	0.9	91.8		X	L5-4
3	06	Replaced lamp, left taillight and adjusted switch	0	0	X		0.4	0.4	1306.6		X	
4	06	Adjusted brake light switch	0	0	X		0.1	0.1	1754.9		X	
5	06	Cleaned starter switch (sticking)	0	0	X		0.3	0.3	2011.0		X	L5-7
6		Performed 1000-mile lubrication	C	C	X		0.5	0.5	2041.8	X		
7	05	Adjusted fan belts	0	0	X		0.4	0.4	2650.0		X	L5-8
8		Performed 1000-mile lubrication	C	C	X		1.1	1.1	3000.0	X		
9	06	Adjusted headlight aim	0	0	X		0.6	0.6	3280.0		X	L5-17
10	13	Replaced right rear tire (damaged)	0	0	X		0.7	0.7	3840.0		X	L5-14
11	--	Performed 1000-mile lubrication	C	C	X		1.0 1 man	1.0	4000.0	X		
12	--	Performed 1000-mile lubrication	C	C	X		0.8 1 man	0.8	5000.0	X		
13	--	Performed 6000-mile maintenance	0	0	X		10.7 2 men	5.4	5997.7	X		

STEYP-TE Form 120, 11 Dec 69 (Rev). Previous edition is obsolete.

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Chart 3B (Continued)

MAINTENANCE ANALYSIS CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE M151A2	IDENTIFICATION NO. 02DU8670

SEQ NO.	GROUP NO.	COMPONENT AND RELATED OPERATIONS	MAINTENANCE LEVEL C – OP CREW O – ORG F – DIRECT H – GENERAL		TECH MANUAL INSTRUCTIONS		ACTIVE MAINTENANCE TIME		SYSTEM LIFE M – MILES ~~H – HOURS~~ ~~R – ROUNDS~~	REASON PERFORMED		NOTE: MCF – MISSION CRITICAL FAILURE EPR No. – REMARKS
			PRESB	RECM	ADQT	NADQT	MAN-HOURS	CLOCK HOURS		SCD	UNSCD	
1	2	3	4	5	6	7	8	9	10	11	12	13
14	12	Cleaned front brake shoes	0	0	X		2.0 1 man	2.0	5997.7		X	
15	06	Spark plugs leads	0	0	X		0.2 1 man	0.2	5997.7		X	L5-24, replaced
16	10	Differential output seal, right front	0	0	X		1.1 1 man	0.6	6518.0		X	Replaced, L5-26
17	--	Performed 1000-mile lubrication	C	C	X		1.0 1 man	1.0	7000.0	X		
18	12	Adjusted hand parking brake	0	0	X		0.2 1 man	0.2	7382.7		X	
19	16	Front springs and suspension	0	0	X		0.3 1 man	0.3	7382.7		X	Inspected
20	16	Rear springs and suspension	0	0	X		0.2 1 man	0.2	7382.7		X	Inspected
21	10	Front differential output shaft seal	0	0	X		0.2 1 man	0.2	7382.7		X	Inspected
22	13	Inner tube, tire	0	0	X		0.8 1 man	0.8	7806.4		X	Replaced
23	--	Performed 1000-mile lubrication	C	C	X		1.0 1 man	1.0	8001.6	X		
24	13	Replace tube	0	0	X		1.0	1.0	8074		X	L5-27
25	13	Replaced tube	0	0	X		1.0	1.0	8163		X	L5-27
26	13	Replace flat tire with spare	0	0	X		0.5	0.5	8298.9		X	
27	13	Repair left rear tire, new tube installed	0	0	X		1.0	1.0	8896		X	L5-27
28	03	Replace fuel cap gasket	0	0	X		0.3	0.3	8975		X	L5-29
29	--	Perform 1000-mile lubrication	C	C	X		1.0	1.0	9000.0	X		
30	13	Flat tire, replace tube	0	0	X		0.8	0.8	9212		X	
31	--	Perform 1000-mile lubrication	C	C	X		1.0	1.0	10003	X		

STEYP-TE Form 120, 11 Dec 69 (Rev). Previous edition is obsolete.

Chart 3B (Continued)

MAINTENANCE ANALYSIS CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE M151A2	IDENTIFICATION NO. 02DU8670

SEQ NO.	GROUP NO.	COMPONENT AND RELATED OPERATIONS	MAINTENANCE LEVEL C – OP CREW O – ORG F – DIRECT H – GENERAL		TECH MANUAL INSTRUCTIONS		ACTIVE MAINTENANCE TIME		SYSTEM LIFE M – MILES ~~H – HOURS~~ ~~R – ROUNDS~~	REASON PERFORMED		NOTE: MCF – MISSION CRITICAL FAILURE
			PRESB	RECM	ADQT	NADQT	MAN-HOURS	CLOCK HOURS		SCD	UNSCD	EPR No. – REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13
32	--	Performed 1000-mile lubrication	C	C	X		1.0	1.0	11000	X		
33	16	Rear shocks, lower mount bolts	O	O	X		0.1	0.1	11505		X	Tightened, L5-34
34	--	Performed 12,000-mile lubrication	O	O	X		14.4	7.2	12084	X		L5-36, L5-37
34A	06	Directional control assembly	O	O	X		0.4	0.2	12084		X	L5-38, during 12,000-mile lubrication
35	01	Exhaust manifold bolts	O	O	X		0.3	0.3	12250		X	Tightened
36	13	Blowout, right rear tire	O	O	X		1.3	1.3	12276		X	Replaced, L5-33
37	13	Flat tire, right rear	O	O	X		0.5	0.5	12431		X	Replaced valve core
38	13	Flat tire, left front	O	O	X		0.8	0.8	12708		X	Replaced tube
39	--	Performed 1000-mile lubrication	C	C	X		0.7	0.7	13000	X		
40		Torsion bar rear bolt of A-frame	O	O	X		0.2	0.2	13059		X	Retightened
40A	13	Tire, worn out, left front	O	O	X		0.8	0.8	13059	X		L5-33, replaced
41	06	Engine misfires, repaired	O	O	X		3.1	2.1	13452		X	L5-47
42	16	Both front springs, replaced	O	O	X		1.5	1.0	13950		X	L5-49
42A	12	Left front brake grabs, repaired	O	O	X		4.5	2.3	13950		X	
42B	07	Front differential oil seals leak, repaired	O	O	X		4.5	2.3	13950		X	
42C	18	Windshield washer pump leaks, repaired	O	O	X		1.5	1.5	13950		X	
43	--	Perform 1000-mile lubrication	C	C	X		0.5	0.5	14029	X		
44	13	Flat tire, replaced with spare	C	C	X		0.3	0.3	14089		X	
45	06	Replaced turn signal control	O	O	X		1.0	1.0	14840		X	L5-48

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STEYP-TE Form 120, 11 Dec 69 (Rev). Previous edition is obsolete.

Chart 3B (Concluded)

MAINTENANCE ANALYSIS CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE M151A2	IDENTIFICATION NO. 02DU8670

SEQ NO.	GROUP NO.	COMPONENT AND RELATED OPERATIONS	MAINTENANCE LEVEL (C – OP CREW, O – ORG, F – DIRECT, H – GENERAL) PRESB	RECM	TECH MANUAL INSTRUCTIONS ADQT	NADQT	ACTIVE MAINTENANCE TIME MAN-HOURS	CLOCK HOURS	SYSTEM LIFE (M – MILES, ~~H – HOURS~~, ~~R – ROUNDS~~)	REASON PERFORMED SCD	UNSCD	NOTE: MCF – MISSION CRITICAL FAILURE EPR No. – REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13
45A	15	Checked front end alignment	F	F	X		3.0	3.0	14840		X	
46	--	Perform 1000-mile lubrication	C	C	X		0.5	0.5	14994	X		
47	16	Left front shock, replaced	O	O	X		2.4	2.4	14999		X	L5-50
48	13	Flat tire, install spare	C	C	X		0.3	0.3	15060		X	
49	13	Left rear tube, replace	O	O	X		1.0	1.0	15240		X	
50	12	Replace brake linings	O	O	X		2.5	1.5	15263		X	
51	--	Perform 1000-mile lubrication	C	C	X		1.2	0.6	16008	X		
52	--	Perform 1000-mile lubrication	C	C	X		0.8	0.8	17047	X		
53	--	Perform 1000-mile lubrication	C	C	X		0.8	0.8	18020	X		
54	--	Perform 18,000-mile maintenance	O	O	X		27.8	11.2	18639	X		
54A	06	Replace spark plug lead	O	O	X		0.6	0.6	18639		X	
54B	12	Replace parking brake band	O	O	X		2.8	1.7	18639		X	
55	--	Perform 1000-mile lubrication	C	C	X		0.8	0.8	19022	X		
56	--	Perform 1000-mile lubrication	C	C	X		0.7	0.7	20097	X		
57	16	Replace, right rear shock	O	O	X		0.5	0.5	20097		X	Leaking (L5-65)
58	06	Replace panel bulb	O	O	X		0.2	0.2	20173		X	Burned out
59	13	Replace left front tire with spare	C	C	X		0.5	0.5	20573	X		Worn
60	--	Perform 1000-mile lubrication	C	C	X		0.4	0.4	21002	X		
61	01	Performed A maintenance and final in part	O	O	X				21123	X		
		TOTALS					116.4	78.0				

STEYP-TE Form 120, 11 Dec 69 (Rev). Previous edition is obsolete.

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PARTS ANALYSIS CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE Truck, Utility, 1/4-Ton, 4x4, M151A2	IDENTIFICATION 02DU8670

SEQ NO.	GROUP NO.	FEDERAL STOCK NO. OR PART NO.	QTY	NOMENCLATURE	MAINTENANCE LEVEL C - OP CREW O - ORG F - DIRECT H - GENERAL		PART LIFE M - MILES ~~H - HOURS~~ ~~R - ROUNDS~~	REASON USED		EPR No. - REMARKS
					PRESB	RECM		SCD	UNSCD	
1	2	3	4	5	6	7	8	9	10	11
1	06	GE-1829	1	Lamp, incandescent	0	0	13.6		X	L5-3
2	06	6220-669-5623	1	Fitting, electrical	0	0	91.8		X	L5-4
10	13	2610-678-1363	1	Tire, pneumatic	0	0	3840.0		X	L5-14
10	13	2610-269-7332	1	Inner tube, pneumatic tire	0	0	3840.0		X	L5-14
15	06	2920-843-1717	2	Leads, spark plug	0	0	5997.7		X	L5-24
16	10	2520-887-1347	1	Seal, rear output	0	0	6518.0		X	L5-26
22	13	2610-269-7332	1	Inner tube, pneumatic tire	0	0	7806.4		X	L5-27
24	13	2610-269-7332	1	Tube, pneumatic	0	0	8074		X	L5-27
25	13	2610-269-7332	1	Tube, pneumatic	0	0	8163		X	L5-27
27	13	2610-269-7332	1	Tube, pneumatic	0	0	8896		X	L5-27
28	03	2910-930-2060	1	Gasket	0	0	8975		X	L5-29
30	13	2610-269-7332	1	Tube, pneumatic	0	0	9212		X	
34	01	2940-832-6054	1	Filter, oil	0	0	12084	X		L5-36, L5-37
34A	06	2540-953-2180	1	Control, directional	0	0	12084		X	L5-38
36	13	2610-678-1363	1	Tire, pneumatic	0	0	12276		X	L5-33
	13	2610-269-7332	1	Tube, pneumatic	0	0	12276		X	L5-33
37	13	Unknown	1	Valve core	0	0	12431		X	
38	13	2610-269-7332	1	Tube, pneumatic	0	0	12708		X	
40A	13	2610-678-1363	1	Tire, pneumatic	0	0	13059	X		L5-33
41	01	AR 75	4	Spark plug	0	0	13452		X	L5-47
41	01	P1-ZZ TGW3028DS	1	Contact, point set	0	0	13452		X	L5-47
42	16	2510-678-2963	2	Spring	0	0	13950		X	L5-49
45	06	2540-953-2180	1	Control, turn signal	0	0	14840		X	L5-48
47	16	2540-176-9466	1	Shock absorber	0	0	14999		X	L5-50
		2530-700-1423	2	Dust covers, brake						
49	13	2610-269-7332	1	Tube, pneumatic	0	0	15240		X	
50	12	2530-678-3111	8	Brake, lining shoe	0	0	15263		X	
54	03	2940-678-4253	1	Air cleaner assembly	0	0	18639	X		18,000-mile maintenance L5-57
	01	11630417	1	Filter oil	0	0	18639	X		
54A	06	2920-843-1718	1	Lead spark plug	0	0	18639		X	

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STEYP-TE Form 121, 11 Dec 69 (Rev). Previous editions are obsolete.

Chart 3C (Concluded)

PARTS ANALYSIS CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE M151A2	IDENTIFICATION 02DU8670

SEQ NO.	GROUP NO.	FEDERAL STOCK NO. OR PART NO.	QTY	NOMENCLATURE	MAINTENANCE LEVEL C – OP CREW O – ORG F – DIRECT H – GENERAL		PART LIFE M – MILES ~~H – HOURS~~ ~~R – ROUNDS~~	REASON USED		EPR No. -- REMARKS
					PRESB	RECM		SCD	UNSCD	
1	2	3	4	5	6	7	8	9	10	11
54B	12	2530-678-1284	1	Parking brake band	0	0	18639		X	
57	16	2540-678-2978	1	Shock absorber	0	0	20097		X	Leaking, L5-65
58	06	GE 1829	1	Lamp, instrument panel	0	0	20173		X	Burned out
59	13	2610-678-1363	1	Tire	0	0	20573	X		Worn out

STEYP-TE Form 121, 11 Dec 69 (Rev). Previous editions are obsolete.

Chart 3D

MAINTENANCE PACKAGE LITERATURE CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE M151A2, Truck, Utility, 1/4-Ton, 4x4					IDENTIFICATION 02DU8670
MANUSCRIPT			DATE RECEIVED		EVALUATION		FORM 1598	
NUMBER	QTY	TITLE	LIT.	MATERIAL	ADQT	INADQT	DATE FORWARD	REMARKS
1	2	3	4	5	6	7	8	9
TM-9-2320-218-10	1	Truck, Utility, 1/4-Ton, 4x4, M151	Mar 68	Apr 70	X		None	Not evaluated
TM-9-2320-218-10 C/1	1	Truck, Utility, 1/4-Ton, 4x4, M151A2	Dec 69	Apr 70	X		None	Not evaluated
TM-9-2320-218-20	1	Truck, Utility, 1/4-Ton, 4x4, M151	Aug 68	Apr 70	X		None	Not evaluated
TM-9-2320-218-20 C/1	1	Truck, Utility, 1/4-Ton, 4x4, M151A2	Jan 70	Apr 70	X		None	Not evaluated
TM-9-2320-218-20P	1	Truck, Utility, 1/4-Ton, 4x4, M151	Apr 68	Apr 70	X		None	Not evaluated
TM-9-2320-218-20P C/2	1	Truck, Utility, 1/4-Ton, 4x4, M151A2	Jan 70	Apr 70	X		None	Not evaluated
TM-9-2320-218-34	1	Truck, Utility, 1/4-Ton, 4x4, M151	Jul 68	Apr 70	X		None	Not evaluated
TM-9-2320-218-34 C/2	1	Truck, Utility, 1/4-Ton, 4x4, M151A2	Jan 70	Apr 70	X		None	Not evaluated
TM-9-2320-218-34P	1	Truck, Utility, 1/4-Ton, 4x4 M151	Apr 68	Apr 70	X		None	Not evaluated
TM-9-2320-218-34P C/1	1	Truck, Utility, 1/4-Ton, 4x4, M151A2	Jan 70	Apr 70	X		None	Not evaluated

STEYP-TE Form 122, 11 Dec 69 (Rev). Previous editions are obsolete.

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Chart 3E

SPECIAL TOOLS AND TEST EQUIPMENT CHART	PROJECT NO. 1-VG-120-151-034	NOMENCLATURE Truck, Utility, 1/4-Ton, 4x4, M151A2	IDENTIFICATION 02DU8670

NOMENCLATURE OR DESCRIPTION	FEDERAL STOCK NO. OR PART NO.	MAINTENANCE LEVEL C – OP CREW O – ORG F – DIRECT H – GENERAL		DATE RECEIVED	EVALUATION		REQ YES OR NO	TECHNICAL MANUAL REFERENCE	REMARKS
		PRESB	RECM		ADQT	INADQT			
1	2	3	4	5	6	7	8	9	10
Bag, cotton duck	5140-772-4142	C	C	Apr 70	X			9-2320-218-10	OEM
Jack	2120-729-5779	C	C	Apr 70	X				
Pliers, slip joint	5120-223-7397	C	C	Apr 70	X				
Screwdriver	5120-222-8852	C	C	Apr 70	X				
Wrench, adjustable	5120-240-5328	C	C	Apr 70	X				
Wrench, socket handle	5120-811-4114	C	C	Apr 70	X				
Handle, jack	5120-708-3364	C	C	Apr 70	X			9-2320-218-10	OEM
Tool kit, Set A	4910-627-7048	O	O	Apr 70	X			9-2320-218-20P	Organizational tools available and utilized
Tool kit, Set B	4910-627-7049	O	O	Apr 70	X			9-2320-218-20P	
Tool kit, Set B	4910-627-7049	O	O	Apr 70	X			9-2320-218-34P	
Sling, engine and transmission	4910-627-7044	O	O	Apr 70	X			9-2320-218-34P	Organizational tools available and utilized

STEYP-TE Form 123, 11 Dec 69 (Rev). Previous edition is obsolete.

APPENDIX V. REFERENCES

1. Directive for Initial Production Test of Trucks, Utility: 1/4-Ton, 4x4, M151A2, USATECOM Project No. 1-VG-120-151-034, 15 January 1970.

2. Letter, U.S. Army Aberdeen Research and Development Center, AMXCC-FL, subject "Temperature Limits for Lubricating Oils and Hydraulic Fluids," 24 October 1967.

3. MIL-A-13488A(Ord), Military Specification for Air Cleaner, Engine: Heavy-Duty, Oil Bath Type (for Internal Combustion Engines), 22 December 1955.

4. MIL-STD-130C, Military Standard for Identification Marking of U.S. Military Property, 29 September 1967.

5. MIL-STD-642H, Identification Marking of Combat and Tactical Transport Vehicles, 1 November 1968.

6. MIL-T-45331C(MO), Military Specification for Truck, Utility: 1/4-Ton, 4x4, M151A1, 4 February 1966.

7. MTP 2-2-614, Aberdeen Proving Ground, subject "Toxic Hazard Test for Vehicles," 18 June 1968.

8. MTP 2-2-503, Aberdeen Proving Ground, subject "Maintenance, Vehicle," 15 January 1966.

9. MTP 2-4-001, Yuma Proving Ground, subject "Desert Environmental Testing of Wheeled and Tracked Vehicles," 1 March 1968

10. Test Plan for Initial Production Test of Truck, Utility, 1/4-Ton, 4x4, M151A2, Yuma Proving Ground, January 1970.

11. USATECOM Regulation 750-15, subject "Maintenance of Supplies and Equipment," 1 December 1969.

12. Slater, F. G., Inspection Comparison Test of Truck, Utility, 1/4-Ton, M151A1, USATECOM Project No. 1-7-4030-87, YPG Report 9012, January 1969.

13. Holman, John C., Inspection Comparison Test of Truck, Utility, 1/4-Ton, M151A1, USATECOM Project No. 1-VG-120-151-016, YPG Report 9089, December 1969.

14. Foster, J. W., Product Improvement Test of Components for Truck, Utility, 1/4-Ton, 4x4, M151A1, YPG Report 9024, March 1969.

APPENDIX VI. ABBREVIATIONS

gm - Gram(s)

GVW - Gross vehicle weight

MTP - Materiel Test Procedure

Para. - Paragraph

PN - Part number

USATECOM - U.S. Army Test and Evaluation Command

MMBM - Mean miles between maintenance

MMH - Maintenance man-hours

MTBM - Mean time between maintenance

MTBF - Mean time between failures

APPENDIX VII. DESCRIPTION OF YPG TEST COURSES

Dynamometer Course (Also Paved Durability Test Course)

A 2-mile smooth near-level (0.8 percent upgrade from south to north) 30-foot wide roadway with 500-foot radius turn-arounds at each end, surfaced with a high strength asphalt. The course is located at an elevation of approximately 470 feet above sea level and is staked at 0.1-mile intervals.

Truck Gravel Course (Straight Secondary)

An elongated loop, 3.1 miles in length and 40 feet wide with a graded gravel surface; this course is used to simulate vehicle operation at convoy speeds on secondary roads.

Tank Gravel Course (Winding Secondary)

A 3.6-mile compacted and graded gravel course with short, straight sections and curves of varying radii. This course provides a test of steering mechanisms at medium vehicle speeds.

Truck Level Cross-Country

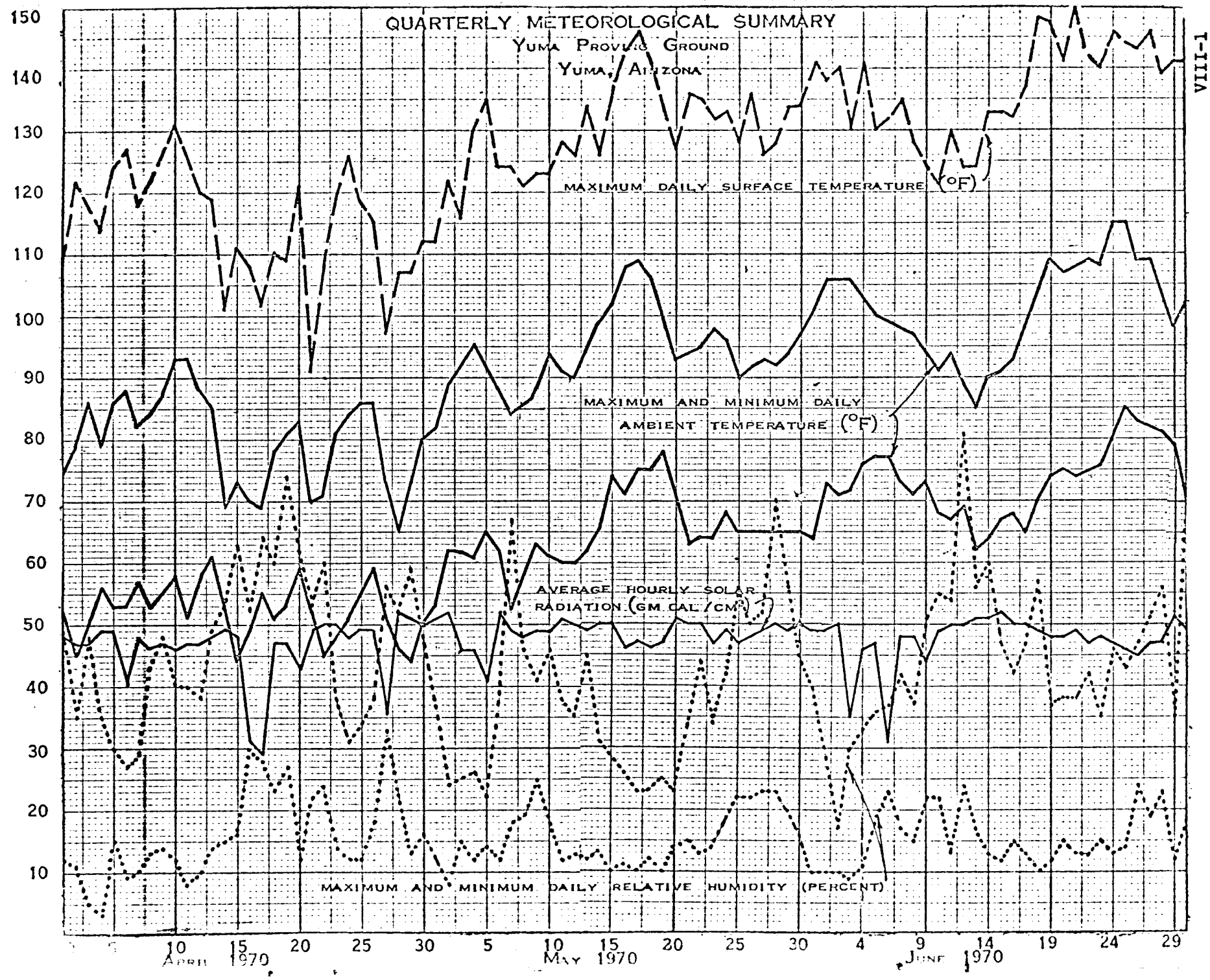
A 6.4-mile cross-country course over typical terrain consisting of desert pavement, sand and gravel washes, and loose sandy areas. This test course is used for durability tests of wheeled vehicles. The course is relatively level except for sharp embankments encountered where washes are crossed.

Truck Hilly Cross-Country Course

The course is a 2.7-mile test course with grades to 20 percent, several hundred feet in length. The surface varies from a rough, stony surface to loose rock, gravel and sand. Operation on this course requires frequent braking and shifting of transmission gears under load.

Belgian Block Equivalent Course

The course has a rough, stony surface with short straight sections and curves of varying radii. The course subjects the vehicle to severe, high frequency vibration.


QUARTERLY METEOROLOGICAL SUMMARY
YUMA PROVING GROUND
YUMA, ARIZONA
MAXIMUM DAILY SURFACE TEMPERATURE (°F)
MAXIMUM AND MINIMUM DAILY AMBIENT TEMPERATURE (°F)
AVERAGE HOURLY SOLAR RADIATION (GM CAL/CM²)
MAXIMUM AND MINIMUM DAILY RELATIVE HUMIDITY (PERCENT)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
10 15 20 25 30
APRIL 1970
5 10 15 20 25 30
MAY 1970
4 9 14 19 24 29
JUNE 1970

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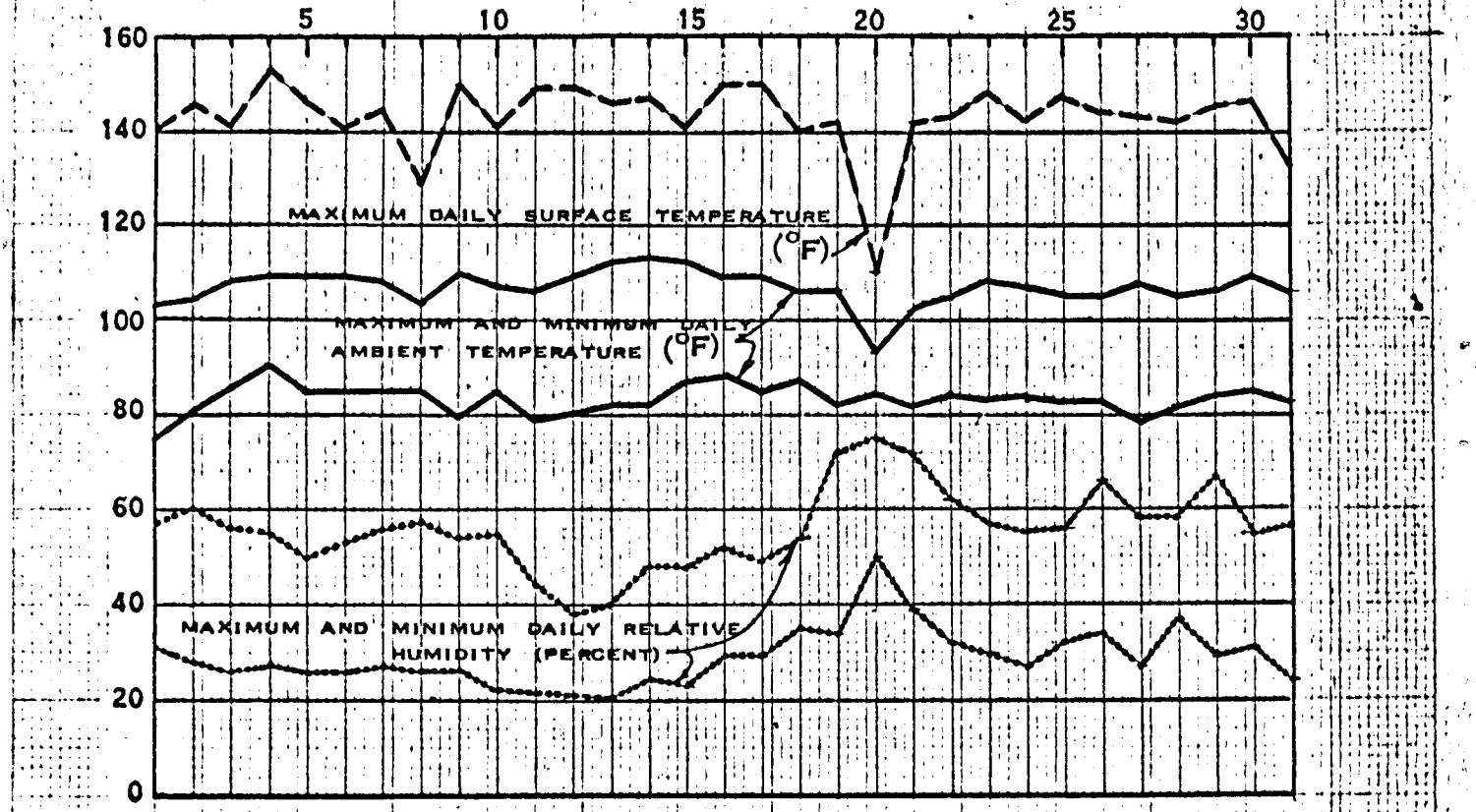
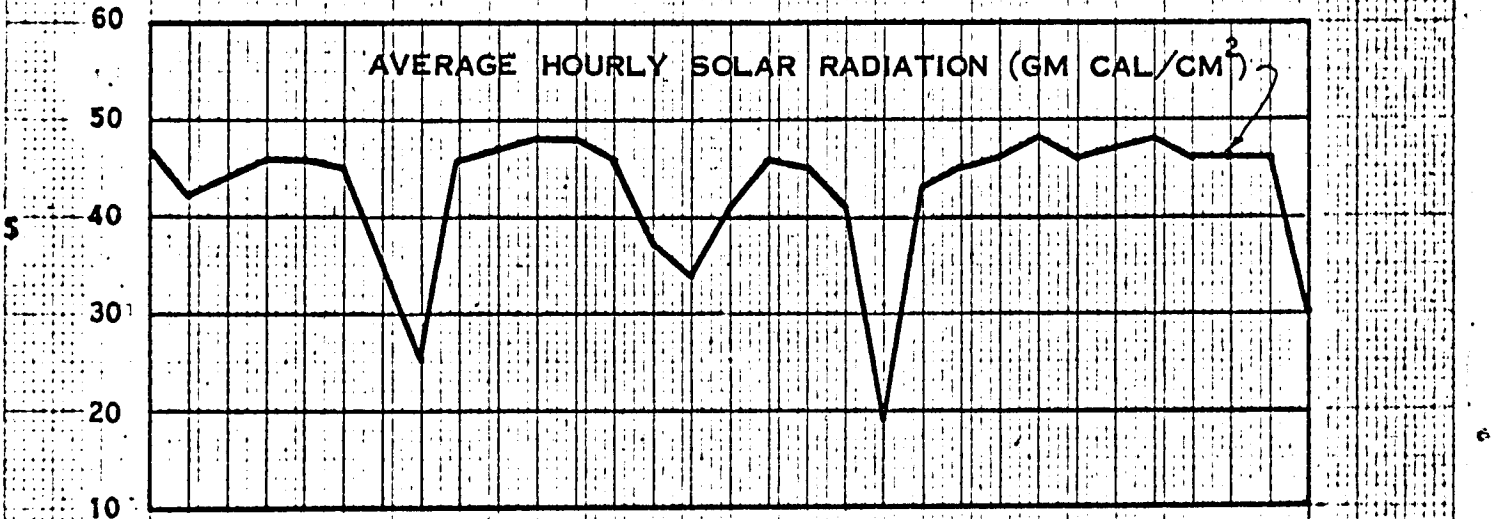
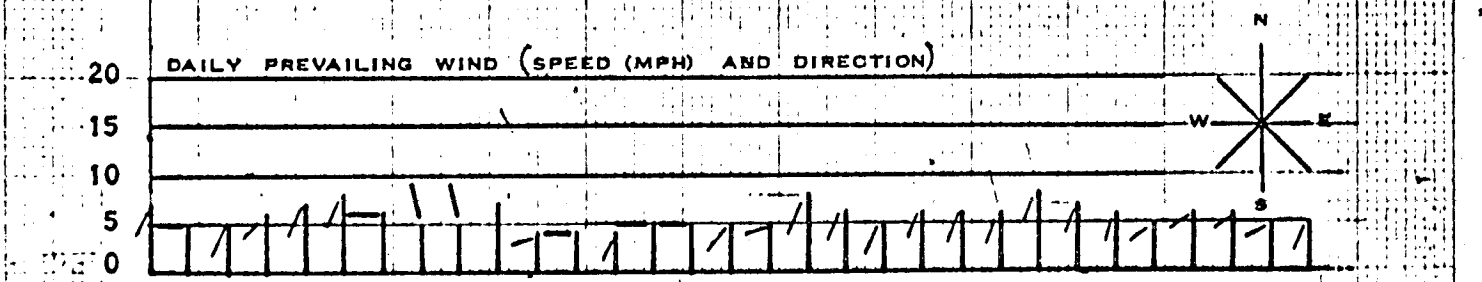
YUMA PROVING GROUND, YUMA, ARIZONA
METEOROLOGICAL SUMMARY FOR JULY 1970







AVERAGE DAILY SKY CONDITION CLEAR - CLEAR P - PARTLY CLOUDY & CLOUDY

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Yuma, Arizona 85364

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Unclassified

2b. GROUP

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4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*

Final Report, 6 April to 3 August 1970

5. AUTHOR(S) *(First name, middle initial, last name)*

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13. ABSTRACT

An initial production test of three Trucks, Utility, 1/4-Ton, 4x4, M151A2 was conducted by Yuma Proving Ground during the period 6 April to 3 August 1970.

The purpose of the test was to determine contractor conformance to contractual requirements, investigate adequacy of quality assurance procedures and provide verification of safety of the vehicles with particular emphasis on vehicle stability.

After 1000 miles of break-in, each truck completed approximately 20,000 miles of durability operation. Cooling, dust, toxic hazard and various performance tests were run, and safety and maintenance evaluations were made. Tests were also undertaken to determine the effect of the new semi-trailing arm rear suspension on vehicle stability and handling.

It was concluded that:

a. Vehicle was not adequately suppressed for radio interference radiation.

b. The design and/or quality of the A-frame control arms and propeller shaft yokes are inadequate.

c. Uneven application and brake pulling observed throughout test constitutes a safety hazard.

d. The rear suspension redesign has substantially improved vehicle stability and handling.

It was recommended that the brake and A-frame problems be corrected and that all deficiencies and as many shortcomings as possible be corrected.

DD FORM 1 NOV 68 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

Unclassified

Security Classification

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Truck, Utility, 1/4-Ton, 4x4, M151A2						
Durability						
Performance						

UNCLASSIFIED

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