

MIL-H-45374D (AR)  
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 SUPERSEDING  
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## MILITARY SPECIFICATION

HOWITZER, MEDIUM, SELF-PROPELLED: 155MM, M109  
 HOWITZER, MEDIUM, SELF-PROPELLED: 155MM, M109A1  
 HOWITZER, MEDIUM, SELF-PROPELLED: 155MM, M109A1B  
 HOWITZER, MEDIUM, SELF-PROPELLED: 155MM, M109A2  
 HOWITZER, MEDIUM, SELF-PROPELLED: 155MM, M109A3

This specification is approved for use by the U.S. Army Armament Munitions and Chemical Command, and is available for use within all Departments and Agencies of the Department of Defense.

### 1. SCOPE

1.1 Scope. This specification covers one type of full-tracked self-propelled vehicle, mounting a 155MM Howitzer.

### 2. APPLICABLE DOCUMENTS

#### 2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

## SPECIFICATIONS

### MILITARY

MIL-P-514 - Plates; Identification, Instruction and Marking; Blank  
 MIL-R-3065 - Rubber, Fabricated Product

### FEDERAL

WV-F-800 - Fuel Oil, Diesel

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, U.S. Army Armament, Munitions and Chemical Command, Attn. AMSMC-QA, Picatinny Arsenal, New Jersey 07806-5000 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

FSC 2350

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MIL-M-45212	-	Mount, Gun: Mount, Howitzer
MIL-C-45525	-	Cannon, 155MM Howitzer: M126A1
MIL-C-45964	-	Cannon, 155MM Howitzer: M185
MIL-C-46168	-	Coating, Aliphatic Polyurethane, Chemical Agent Resistant
MIL-M-46312	-	Mount Telescope: M146
MIL-T-46313	-	Telescope, Panoramic: M117
MIL-M-46314	-	Mount, Telescope: M145
MIL-Q-46315	-	Quadrant, Fire Control: M15
MIL-T-46316	-	Telescope, Elbow, M118: M118 Series and T176E4
MIL-H-46709	-	Howitzer, Light, Self-Propelled: 105MM, M108; and Howitzer, Medium Self-Propelled: 155MM, M109, M109A1, M109A1B, M109A2; Processing for Storage and Shipment of
MIL-A-48449	-	Alignment Device, Optical, Gun Bore
MIL-T-50782	-	Telescope, Panoramic: M117A2
MIL-C-53072	-	Chemical Agent Resistant (CARC) System Application Procedures and Quality Control Inspection
MIL-T-63359	-	Telescope, Elbow: M118A2
MIL-T-60895	-	Telescope, Panoramic: M117A1
MIL-M-63988	-	Mount, Howitzer, M178

## STANDARDS

## MILITARY

MIL-STD-130	-	Identification Marking of U.S. Military Property
MIL-STD-171	-	Finishing of Metal and Wood Surfaces
MIL-STD-210	-	Climatic Information To Determine Design and Test Measurements for Military Systems and Equipment
MIL-STD-248	-	Welding and Brazing Procedure and Performance Qualification
MIL-STD-417	-	Classification System and Tests for Solid Elastomeric Materials
MIL-STD-461	-	Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference
MIL-STD-642	-	Identification and Marking of Combat and Tactical Transport Vehicles
MIL-STD-882	-	System Safety Program Requirements
MIL-STD-1246	-	Product Cleanliness Levels and Contamination Control Program

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2.1.2 Other Government documents, drawings and publications.  
The following other Government documents, drawings and publications forms a part of this specification to the extent specified herein.

## DRAWINGS

8736372	-	Howitzer, Medium, Self-Propelled: 155MM, M109
8449200	-	Howitzer, Medium, Self-Propelled: 155MM, M109A1
8736916	-	Howitzer, Medium, Self-Propelled: 155MM, M109A1B
11747268	-	Installation Instructions for Mounting M140 Alignment Device, Direct Fire Telescope
11747269	-	Installation Instructions for Mounting M140 Alignment Device, Indirect Fire Telescope
12012100	-	Howitzer, Medium, Self-Propelled: 155MM, M109A2
12012200	-	Howitzer, Medium, Self-Propelled: 155MM, M109A3

(Copies of specifications, standards, and other Government documents required by contractors with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following document forms a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DoDISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS shall be issue of the nongovernment documents which is current on the date of solicitation.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM B117	-	Standard Method of Salt Spray (fog) Testing
ASTM D2000	-	Classification System for Rubber Products in Automotive Applications

(Application for copies shall be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103).

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

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## 3. REQUIREMENTS

3.1 Preproduction model. When specified (see 6.2), a pre-production model(s) of the complete vehicle to be furnished under this specification shall be produced prior to the manufacture or fabrication of vehicles in quantity. The vehicle(s), when complete, shall be submitted to the Government for examination and tests to determine conformance to the requirements of this specification. Vehicle(s) submitted by the contractor shall be fully representative of vehicles proposed to be supplied by the vehicle manufacturer from production facilities and tooling under the supply contract.

3.2 First production vehicles. The vehicles selected shall be fully representative of vehicles proposed to be furnished under the contract, and shall be submitted to the Government for inspection to determine conformance to the requirements of this specification.

3.2.1 Reliability. (See 6.4.2)

3.2.1.1 Automotive. The vehicle(s) mean miles between mission failure (MMBF) shall not be less than 375 miles during the first 4,000 miles of operation consisting of 25 percent hard surface roads (HSR), 50 percent secondary roads (SR), and 25 percent cross country (CC) operation.

3.2.1.2 Armament. The armament system shall exhibit a mean round between failure (MRBF) of not less than 625 rounds.

3.2.2 Durability.

3.2.2.1 Automotive. The vehicle, with rated payload, shall have a .50 probability of completing the first 400 operation hours without replacement, rebuild, or overhaul of powertrain components (engine, transmission, and final drive) for failures chargeable to hardware.

3.2.3 Maintainability.

3.2.3.1 Automotive. The total scheduled and unscheduled maintenance excluding driver/crew checks and services shall not exceed 200 man hours during 4,000 miles of operation. At an average speed of 10 mph of operation, this specification yields a maintenance ratio of 0.5. The scheduled maintenance intervals shall not be less than 750 miles or semi-annual, whichever comes first. The mean time repair (MTTR) shall not exceed the hours listed below for each level of maintenance 95 percent of the time.

Crew	-	3.52 hours
Organizational	-	2.93 hours
Direct support	-	5.25 hours
General support	-	6.24 hours
Overall	-	3.64 hours

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3.2.3.2 Armament. The mean time to repair (MTTR) of the armament system shall not exceed the hours listed below for each organizational level.

Crew	-	2.76 hours
Organizational	-	2.76 hours
Direct support	-	10.81 hours
General support	-	6.00 hours
Overall	-	6.65 hours

3.3 Materials.

3.3.1 Qualified products. Vehicle manufacturer shall be responsible for ascertaining that all assemblies and components parts which require product qualification in accordance with a specification are listed or qualified for inclusion on the applicable Qualified Products Lists (QPL). In the instance that a qualified vendor no longer exists on the QPL, the contractor is responsible for selecting a vendor whose product meets the minimum requirements of the specification. The contractor must also submit to the government for approval, documentation which confirms the vendor's ability to meet the specification in question. Manufacturer's inspection records shall specifically list such components, name of supplier(s), and number and date of applicable QPL or government approved vendors not on a QPL.

3.3.2 Ozone resistant. Rubber products procured under requirements of MIL-R-3065 are to be ozone resistant to the degree specified by the C<sub>1</sub> requirements of ASTM D2000, unless the component drawing specifically states that ozone resistance is not required.

3.4 Construction. Vehicles, components, subassemblies, assemblies shall be fabricated and assembled into a complete vehicle in accordance with drawings listed or referenced to in 2.1.2, (8736372 for M109, 8449200 for M109A1, 8736916 for M109A1B, 12012100 for M109A2, 12012200 for M109A3). All parts requiring identification shall be identified in accordance with MIL-STD-130.

3.4.1 Sealing.

3.4.1.1 Sealer. The sealer used to seal a vehicle shall prevent the accumulation of water greater than 1 inch in the bottom of the hull when operating in water up to 42 inches in depth for 15 minutes.

3.4.1.2 Hatch, doors and periscope seals. With hatches and doors closed, the seals shall prevent the entrance of water into the interior of the vehicle.

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3.4.1.3 Turret ring seal. The seal shall prevent the entrance of water into the interior of the vehicle. The turret ring seal installed in the M109A1 vehicle requires inflation to seal.

3.4.2 Special kits. When specified (see 6.2), special kits shall be furnished as follows:

3.4.2.1 Winterization kit. With the winterization kit installed in the vehicle, the engine shall start and perform satisfactorily when vehicle is operating in ambient air temperatures of 0°F to minus 65°F.

3.4.2.2 Flotation kit. With the flotation kit installed, the vehicle shall perform satisfactorily when vehicle is operating in water of a depth requiring a flotation kit. The flotation kit is not applicable to the M109A2 or M109A3 vehicles.

3.4.3 Carbon monoxide concentration. The exhaust system of the engine, personnel heater, or engine heater, when used individually or collectively, shall prevent carbon monoxide concentration in the occupied portions of the vehicle in excess of 50 parts per million under normal operation.

3.4.4 Controls. Controls for the engine, transmission, electrical equipment, permanently mounted fire extinguisher system, armament and other operating mechanisms shall operate without any interference.

3.4.5 Throttle linkage. With throttle linkage attached to engine, and pedal fully depressed, the throttle shall be at full rack position. With the throttle at full rack position, the pedal shall be in contact with the stop.

3.4.6 Adjustment. All adjusting mechanisms shall operate without any interference, and shall maintain adjustment settings under all operating conditions.

3.4.7 Fasteners and locks. All fastening and locking devices shall be positive locking. Means for locking vehicle from outside shall be provided.

3.4.8 Fuel system. During engine operation, the fuel system shall maintain fuel supply to the engine when ascending and descending 60 percent grades in forward and reverse gear, and when vehicle is being operated on 40 percent side slopes, with each side of vehicle up slope.

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3.4.8.1 Fuel tanks. Provisions shall be made to assure the internal cleanliness of the fuel tanks prior to initial fueling of vehicle. The fuel tanks shall be capable of receiving fuel at a rate of 50 gallons per minute (gpm), and shall be free from leakage after installation and when tanks are filled to capacity.

3.4.8.2 Fuel lines. Provisions shall be made to assure internal cleanliness of fuel lines and connections prior to final assembly or initial fueling of vehicle. All fuel lines and connections shall be free from leakage.

3.4.9 Hydraulic reservoir and lines. Provisions shall be made to assure the internal cleanliness of the hydraulic reservoir, lines, and connections prior to initial filling of the reservoir. The system shall be free from leakage, under all conditions of vehicle operation. The hydraulic fluid in the reservoir shall meet the cleanliness requirements of MIL-STD-1246 (Level 200) (see 6.4.3).

3.4.10 Electrical system.

3.4.10.1 Generating system voltage (alternator). The generating system output voltage shall remain within  $28 \pm .7$  volts under all conditions of vehicle electrical loading as long as the total system current demand does not exceed 100 amperes and the engine speed does not drop below 1025 RPM: (i.e., Hydraulic Power Pack Pump Motor and bilge pump motor must be off for this criteria and the systems' batteries must be fully charged).

3.4.10.2 Lights. The internal and external lights as specified on applicable drawings shall operate throughout all vehicle-operating conditions.

3.4.10.3 Bilge pump. The electrical system shall supply nominal 24 volts DC to the bilge pump motor.

3.4.10.4 Air cleaner blower. The air cleaner motors shall be capable of providing an unrestricted flow of air through each blower outlet. The blower motors shall operate only when the engine is operating.

3.4.10.5 Personnel heater. The system shall provide sufficient voltage to operate the igniter and heater blower motor.

3.4.10.6 Communication equipment electrical service. The communication equipment electrical service shall be capable of delivering 24 volts DC nominal to provide operational capability to the communication equipment at all times.



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3.4.10.7 Slip ring. The slip ring and external communication circuits shall maintain continuity without evidence of shorts under continuous 360 degrees of cab rotation.

3.4.11 Welding and weld repairs. All welding and weld repairs shall be in accordance with the vehicle prime contractor's approved joint welding procedure or the current DMWR.

3.4.11.1 Qualification of welders. The contractor is responsible to insure that all welders are qualified per MIL-STD-248. Records shall be kept as a permanent record by the contractor and the results of the qualification test shall be made available to the government upon request.

3.4.12 Stowed equipment. All on vehicle equipment items shall be stowed (combat loaded) on the vehicle in spaces provided without interfering with vehicle operation in any manner.

### 3.5 Break-in run.

3.5.1 Preparation. Prior to break-in run, except for equipment and component installation and servicing performed by the contractor as a final processing of the vehicle for acceptance, the vehicle shall be completely assembled and all adjustments completed. The vehicle, including all components requiring lubrication, shall be lubricated as specified in production lubrication chart shown on applicable Engineering Parts List. The vehicle shall be supplied with fuel conforming to Grade DF-2 of VV-F-800.

3.5.2 Oil pressure and temperature. Prior to the start of the break-in run, the engine shall be operated at idle speed until lubricating oil is at operating pressure and temperature. If at any time during the break-in run the engine has been stopped for at least 30 minutes, the engine shall again be operated, as above, before continuing break-in runs. Proper oil pressure and temperature shall be maintained during operating on level ground, 60 percent grades (front and rear) and 40 percent side slope (both sides).

3.5.3 Distance operated. Prior to tests, each vehicle shall be given a break-in run on smooth, level, hard-surface roads, except a section of the road shall be as shown in Figure 1. The vehicle shall be operated as specified in Table I, and over the section of road shown in Figure 1, in "a" and "b" division of the break-in run in both directions for the purpose of observing the function and performance of various parts, assemblies, controls, and suspension system.

TABLE I. Speeds and distance for break-in run.

<u>Division of Run</u>	<u>Speed M.P.H.</u>	<u>Distance Miles</u>
a	0 to 10	10
b	11 to 20	25
c	21 to 30	5



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3.5.4 Reverse operation. After each division of the break-in run, vehicle shall be stopped, the engine allowed to idle for not less than 2 minutes, and the vehicle driven in reverse for a distance of not less than 50 feet.

3.5.5 Condition after run. After completion of the break-in run, the engine shall idle smoothly at  $600 \pm 25$  rpm with accessories operating. There shall be no defects indicative of damaged components, or maladjustments that may cause faulty vehicle operation.

3.6 Performance. A complete vehicle, combat loaded or loaded with a simulated load of equal weight (see 3.4.12) and serviced, shall perform as specified herein. Ammunition may be simulated in size and weight. Vehicle, serviced (see 3.5.1) and equipped for existing climatic conditions, shall operate as specified without special equipment. Unless otherwise specified, performance shall be demonstrated on smooth, level, hard-surfaced roads free of loose material, except a section of road shall be as shown in Figure 1.

3.6.1 Environmental. The vehicle shall operate in ambient air temperature of plus  $115^{\circ}\text{F}$  to  $0^{\circ}\text{F}$ , and with special equipment installed, at temperature ranges of  $0^{\circ}\text{F}$  to minus  $65^{\circ}\text{F}$ . The complete vehicle when in storage shall withstand climatic extremes as specified in MIL-STD-210, without deterioration that may cause failure of any component part of the vehicle.

3.6.2 Power package and drive train. When power package and drive train are installed in accordance with applicable drawings, they shall function throughout all gear and speed ranges without loss of lubricants, and damage that may cause failure of vehicle. The power package and drive train and associated controls shall be capable of operation throughout all speed and steering ranges without binding of linkages, loss of lubricants, grabbing, and chattering or slippage when controls are applied to control, stop and hold vehicle.

3.6.2.1 Cooling system. The engine water temperature, engine lubricant and transmission lubricant temperatures, shall not exceed those shown in Table II when the vehicle is operated under any one or a combination of the following conditions:

- a. Ambient air temperature up to  $115^{\circ}\text{F}$ .
- b. Under full load.
- c. At all speeds down to the track slippage point of the vehicle when operating on smooth, level, hard-surfaced roads, but not less than 3 miles per hour (mph) in first gear or below a transmission speed ratio of 0.56 in other gears.

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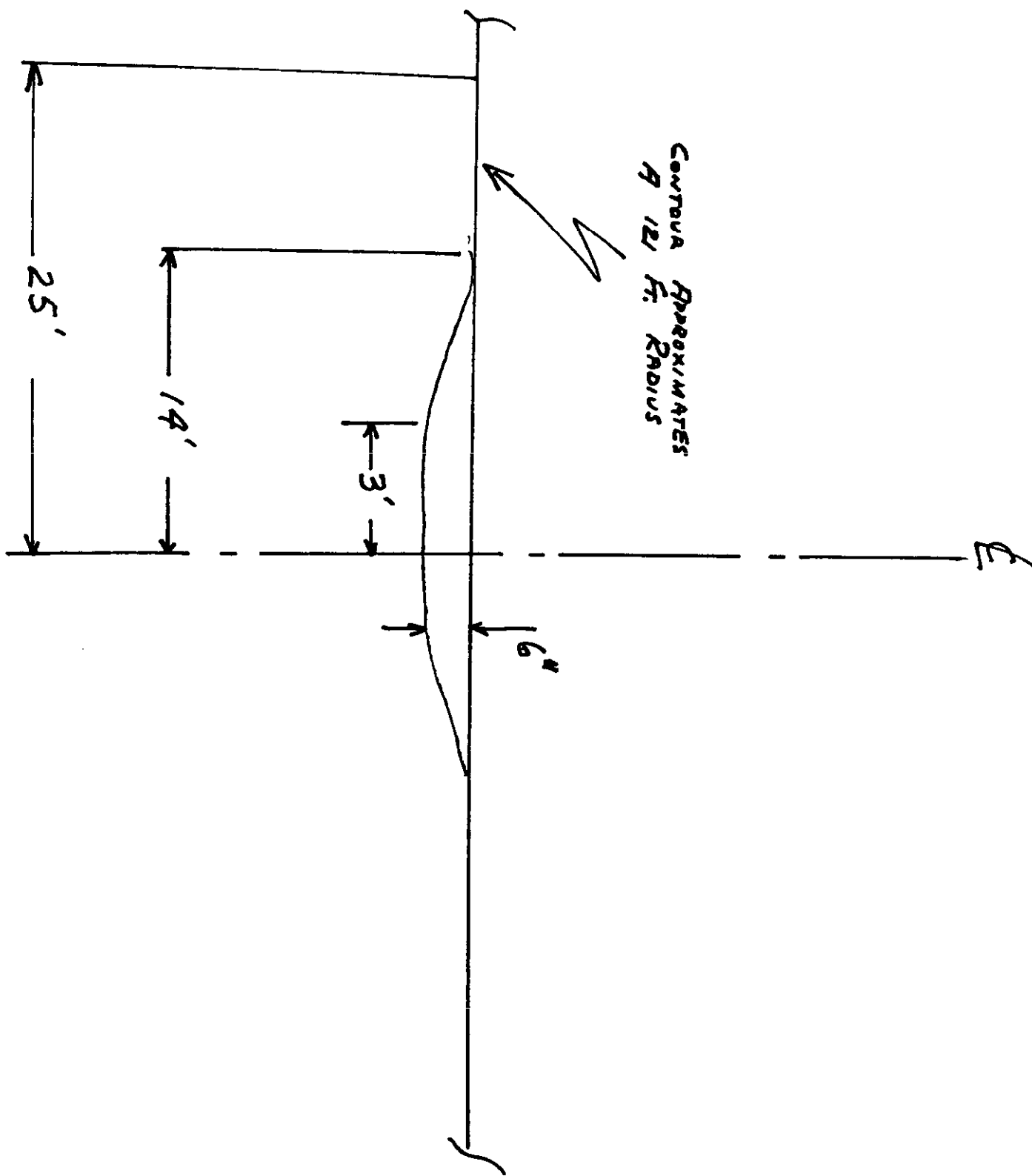


FIGURE 1. Profile of test track.

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TABLE II. Operating temperatures.

<u>Water Temperature from Engine</u>	<u>Maximum Engine Oil Temperature in Sump</u>	<u>Maximum Transmission Oil Temperature Into Cooler</u>
230°F	275°F	300°F

3.6.3 Air cleaners. With a maximum air flow of 600 cubic feet per minute, the air cleaner shall be capable of removing not less than 99.8 percent of dust and other foreign material from the engine intake air.

3.6.4 Water removal (bilge pump). The bilge pump installed in accordance with applicable drawings shall remove water from the vehicle at a minimum rate of 40 gallons per minute (gpm), with a discharge head of 4 1/2 feet and with pump motor operating on 27.5 volts DC.

### 3.6.5 Speeds.

3.6.5.1 Speeds without towed load. Vehicles shall be capable of operating at a sustained speed of 30 mph and shall be capable of maintaining a minimum of 2.5 mph in lowest gear without towed load. The vehicle shall be capable of obtaining a maximum speed of 35 mph. With vehicle traveling between 25 mph and maximum speed, the drift from a straight line shall be not more than 2 feet in 100 feet.

3.6.5.2 Speeds with towed load. The vehicle shall be capable of towing a track laying free rolling vehicle of equal weight at a sustained speed of 15 mph.

3.6.6 Acceleration. The vehicle on dry, smooth, level, hard-surfaced roads free of loose material shall, from a standing start, be capable of accelerating through a distance of 300 feet in not more than 15 seconds.

3.6.7 Slope operation. Vehicle shall be capable of sustained automotive operation on 40 percent side slope with each side of vehicle up slope.

3.6.7.1 Engine starting on grades and side slopes. When standing on a 60 percent longitudinal grade, for not less than 2 minutes, with engine operating at idle, the engine shall be stopped for not less than two minutes. The engine shall restart in not more than 1 minute when headed up and headed down grade. The same engine starting test shall be conducted on 40 percent side slope with each side of vehicle up slope.

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3.6.8 Braking.

3.6.8.1 Stopping. Vehicle traveling at 20 mph, on dry, smooth, level, hard-surfaced roads free of loose material shall be capable of being stopped by service brake application within a distance of 35 feet from point of brake application. Vehicle drift during stopping shall not exceed three feet.

3.6.8.2 Holding. Vehicle, standing on a 60 percent longitudinal grade with brakes applied and locked for parking, transmission in neutral, shall remain stationary when headed up and down grade. For this operation, vehicle shall be combat loaded or with a simulated load of equal weight.

3.6.9 Turning. The vehicle shall be capable of making continuous 360 degree turns to the right and to the left. With the vehicle in geared steer, the rear point or outer edge of vehicle shall be within a 100 foot diameter circle at all times. When clutch brake steer is employed, the vehicle's track pattern shall be within a 35 foot diameter circle at all times.

3.6.10 Fording shallow water and flotation operation.

3.6.10.1 Fording shallow water. Vehicle shall ford hard-bottom salt or fresh water crossings of 42 inches in depth without special equipment. After 4000 miles of system operation, with vehicle operating in water up to 42 inches in depth for 15 minutes, without the aid of bilge pumps, the accumulation of water shall be not more than 1 inch in the bottom of the hull.

3.6.10.2 Flotation operation. With flotation kit (see 3.4.2.2) installed, the vehicles shall be capable of floating and operating in calm water of unlimited depth for 15 minutes without the aid of bilge pumps. The accumulation of water shall not exceed a one-inch depth in the bottom of the hull. The M109A1 and M109A1B vehicles must be capable of operating on calm, unlimited depth water at an average speed of 3.2 mph. The M109 vehicle average water speed requirement is 4.0 mph. The flotation operation is not applicable to the M109A2 and M109A3 vehicles.

3.6.10.3 Lubricant contamination. After fording or flotation for 15 minutes, the water contamination content of the transmission, engine, final drives, and suspension system shall not be more than 2 percent (by volume).

3.6.11 Climbing. Vehicle shall climb a prepared 60 percent longitudinal grade in forward and reverse gear from a standing start on the grade.

3.6.12 Trench crossing. Vehicle shall cross trenches 36 inches in depth and 72 inches in width at low speeds without stalling or damage to vehicle.

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3.6.13 Vertical obstacle. Vehicle shall cross vertical obstacles up to 21 inches in height at low speeds without stalling or damage to vehicle.

3.6.14 Cab control system.

3.6.14.1 Cab ring friction. With the vehicle level within 2 degrees, the cab assembly mounted to the hull, and the cab complete with slip rings, but without traverse gear box output pinions installed, the torque required to rotate the cab shall not exceed 750 foot pounds, after breakaway.

3.6.14.2 Cab traversing speeds. The cab shall be controllable in traverse at all speeds between 0.5 mils per second and 320 mil/second. Tracking speed shall range from not less than 1.0 mil/second to not more than 65.2 mil/second. The cab speed at maximum velocity shall not be less than 266.7 mil/second. These requirements are applicable to gunner's power controller only.

3.6.14.3 Cab manual traverse effort. With the vehicle level within two degrees, the average force applied tangentially to the traverse hand crank to maintain cab movement shall not exceed 20 pounds.

3.6.14.4 Cab manual traverse response rate. One revolution of the traverse hand crank shall rotate the cab 10 mils.

3.6.14.5 Cab slope operation. With the vehicle pitched upward 3 degrees and canted upward 3 degrees, with both power and manual controls, the control system shall be capable of rotating the cab 360 degrees right and left, starting at any azimuth with the gun tube at zero degrees with respect to the vehicle hull.

3.6.15 Weapon control system.

3.6.15.1 Manual elevation effort. With the weapon properly equilibrated, the average force applied tangentially to the handcrank at a uniform rate to maintain gun mount movement shall not exceed 15 pounds, no individual reading shall exceed 20 pounds.

3.6.15.2 Manual elevation response rate. With the weapon at the level position within plus or minus 1 degree, the weapon shall move at a minimum rate of 4 mils per turn of the handcrank. The handcrank shall be turned at a rate of not less than 10 rpm and not more than 20 rpm to measure response rate.

3.6.15.3 Manual elevation supercharge pressure. For a minimum of 48 hours, the manual elevation hydraulic system shall maintain sufficient supercharge pressure to elevate or depress the weapon without recharging the manual circuit by use of the hand elevation pump.

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3.6.15.4 Weapon elevation speeds. The gunner's and assistant gunner's power controls shall control the weapon in elevation and depression at all speeds between one mil per second and 65 mils per second. The transition between these speeds shall be smooth and gradual. The system shall remain stable at all times.

3.6.15.5 Elevation system limits and protection. There shall be no damage to the control system or any component as a result of positioning the weapon against the elevation and depression stops by power or manual controls. Power and manual control shall be regained instantaneously from this action. The weapon shall engage the weapon stops at elevations of between minus 36 mils to minus 54 mils and between plus 1315 mils to plus 1333 mils.

3.6.15.6 Elevation and depression limits. The weapon shall be capable of movement throughout the range of minus 2 degrees to plus 74 degrees in elevation for all directions of cab traverse through 360 degrees.

3.6.15.7 Elevation and depression time limits. With power control operating the weapon, it shall be capable of moving from 0 mils elevation to the upper stop and from the upper stop to 0 mils elevation in not more than 20 seconds in each direction.

3.6.16 Cab and weapon system.

3.6.16.1 Hydraulic pressure limit switch. When power traversing the cab at a rate not to exceed 65 mils per second, the hydraulic system pressure switch shall actuate the hydraulic control power pack motor at a control system pressure of 880 to 970 (psi). With the gunners and assistant gunners power, and manual controls in neutral position, the hydraulic pressure switch shall deactivate the hydraulic power pack motor at a control system pressure as indicated on the gage between 1150 and 1500 psi. (The left weapon control operator is designated as the gunner, and the right weapon control operator is designated as the assistant gunner.)

3.6.16.2 System backlash. The system backlash with cab power switch off shall not exceed 1 mil movement of the cab in traverse and 1 mil in elevation when a force of 70 pounds is applied at the muzzle end of the weapon. The force shall be applied in a horizontal plane and at right angles to the weapon centerline with the weapon positioned in horizontal plus or minus 1 degree. The backlash shall be the angular movement of the weapon in traverse and elevation when the force at the end of the weapon is reversed and applied in an opposite direction.

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3.6.16.3 Control transfer. Control shall be selective at the gunners position and shall be instantaneously operative when selector switch is actuated. The gunner shall have power control for elevating and traversing. When selected, the assistant gunner shall have control of the elevation only. With the gunner's and assistant gunner's power controls in neutral position, and with accumulator charged to within its operating pressure, there shall be no movement of the weapon or cab caused by turning the cab control switch on or off.

3.6.16.4 Control system deadspot. The gunner's and assistant gunner's control handle shall not exceed 7 degrees movement from neutral position in any direction to initiate cab and weapon movement. The neutral position shall be defined as the handle position which divides the initial free handle movement in half. The deadspot angles each side of the neutral position in both elevation and traverse must be equal within 2 degrees.

3.6.16.5 Traverse and elevation stability. With the cab control power switch turned on or off, and without recharging the manual elevation system, the gun shall not move more than 1.5 mils under steady state condition, in traverse, elevation, or depression from target position in one hour, exclusive of hull movement.

3.6.16.6 Hydraulic control system leakage. With the hydraulic control system fully charged and power control handles in the neutral position, there shall be no evidence of system pressure loss during a ten minute period (observed at the system pressure gage).

3.6.16.7 Hydraulic fluid. When all requirements of the cab and weapon control system specified herein have been met and with all hydraulic fluid discharged from the two gallon accumulator, the hydraulic fluid in the control power pack reservoir shall contain not more than 0.1 percent water and shall meet the cleanliness requirements of MIL-STD-1246 (Level 200) for cleanliness (see 6.4.3). The contractor shall maintain a permanent record by vehicle serial number with the results of this test for further use and reference by the government.

3.6.16.8 Hydraulic accumulator. When all requirements of the cab and weapon control system specified herein have been met and with all hydraulic fluid discharged from the 2 gallon accumulator, the precharge nitrogen gas pressure in the 2 gallon accumulator shall be equal to the initial charged gas pressure corrected for permissible leakage and temperature change. Leakage from initial precharge condition shall be not more than 2 percent in 24 hours and 1 psi per degree of temperature change. When measuring the final precharge pressure with the control handle in neutral position, and the cab and weapon control system pressure gage stabilized at a zero pressure setting, the system pressure gage needle shall show no visible movement for a period of three minutes.



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3.6.17 Weapon fire control. The M146 telescope mount shall conform to MIL-M-46312. The M117 panoramic telescope shall conform to MIL-T-46313. The M145 telescope mount shall conform to MIL-M-46314. The M15 fire control quadrant shall conform to MIL-Q-46315. The M118 Elbow telescope shall conform to MIL-T-46316. The M117A1 panoramic telescope shall conform to MIL-T-60895. The M117A2 panoramic telescope shall conform to MIL-T-50782. The M118A2 elbow telescope shall conform to MIL-T-63359.

3.6.17.1 Gun elevation, plumb travel. The elevating trunnions of the carriage shall be leveled within 0.25 mils by having the cannon track a plumb line from zero elevation to maximum. Maximum elevation is to be at least 800 mils.

3.6.17.2 Vehicle level retention. The vehicle shall be leveled fore and aft so that at zero gun tube elevation the gun tube will remain at zero within 0.25 mils when the turret is traversed 30° to the right and 30° to the left.

3.6.17.3 Alignment of panoramic telescope. The vertical cross hair of the telescope reticle shall not deviate from the target point more than 0.5 mil.

3.6.17.4 Horizontal deflection of panoramic telescope. The deflection of the vertical cross hair relative to the aiming point shall be not more than 0.3 mil for zero cant and zero elevation and 1.75 mils for zero cant and 1100 mils elevation.

3.6.17.5 Accuracy of the elevation counters. The settings entered into the elevation of the telescope mount and elevation quadrant shall not deviate more than 0.5 mil from the weapon elevation at zero setting and 1.0 mil at any other weapon elevation.

3.6.17.6 Boresight adjustment of direct fire telescope. Lateral boresight adjustment and vertical boresight adjustment ranges shall be within plus or minus 0.5 mils of the target aiming point.

3.6.17.7 Boresight retention. The panoramic telescope line of sight shall maintain its original setting with respect to the weapon in azimuth within plus or minus 0.3 mil. The direct sighting telescope shall maintain the original setting with respect to the tube within plus or minus 0.3 mil in azimuth and plus or minus 0.3 mil in elevation.

3.6.17.8 Alignment device. The alignment device shall be mounted in accordance with installation instructions and procedures 11747268 and 11747269 and held to within 0.25 mils subsequent to boresighting the M117 Panoramic Telescope and the M118 Telescope.

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3.6.18 Mount. The M178 weapon mount shall conform to MIL-M-63988. All other mounts shall conform to MIL-M-45212.

3.6.19 Radio suppression. Complete vehicle shall be radio interference suppressed in accordance with tactical vehicle requirements of MIL-STD-461.

3.6.20 Rammer systems. The rammer system when installed in a vehicle shall be capable of operation under all vehicle operating conditions. Prior to installation in the vehicle, each rammer shall be tested as follows:

<u>VEHICLE</u>	<u>DRAWING</u>	<u>TEST PROCEDURES</u>
M109	K11643729	C11604929
M109A1	K11643728	C11604929
M109A1B	K8449184	C11604929
M109A2	K12012186	C12012207
M109A3	K12012425	C11604929

### 3.6.21 Fire extinguishers.

3.6.21.1 Fixed. In ambient air temperature the maximum effort required to discharge the system, either internally or externally, shall not be more than 55 pounds.

3.6.21.2 Portable. The portable fire extinguisher, when installed in accordance with applicable drawings, shall be readily accessible for servicing and use.

3.6.22 Cannon. The M126A1 155mm howitzer cannon shall conform to MIL-C-45525. The M185 155mm howitzer cannon shall conform to MIL-C-45964.

### 3.7 Finishing, marking and data plates.

3.7.1 Finishing. Unless otherwise specified, the exterior and interior of cab and hull components, assemblies, subassemblies and parts that require finishing shall be prepared and finished in accordance with applicable drawings and MIL-STD-171. MIL-C-46168 shall dictate camouflage paints to be used for exterior coatings of cab and hull; paint shall have color, gloss and infrared reflectance in accordance with stated specification. Application and inspection of CARC shall be in accordance with MIL-C-53072.

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3.7.2 Marking. Marking shall be in accordance with MIL-STD-642.

3.7.3 Name, shipping, and identification data plates. Data plates shall be photographic aluminum plate (sensitized). The plates shall have the photosensitive silver components imbedded within the oxide layer; and after photographic pressing, the letters, numbers and all other characters shall be sealed in the oxide layer by suitable chemical treatment of the layer. The plates shall have a black background, with white letters and letter blanks, except that caution and warning plates shall have red letters and letter blanks. The size of the plate, type and size of lettering, and the information to be included shall be in accordance with applicable drawings or as specified by the procuring activity. Thickness of the plates shall be .030 inch minimum. The plates shall meet the performance requirements of MIL-P-514.

3.8 Workmanship. Workmanship shall be of a quality to assure the vehicle and components are free of defects resulting from improper manufacturing or assembly practices and shall conform to requirements herein specified.

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## 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirement specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of section 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Contractor quality control system. Unless otherwise specified by the procuring activity, the contractor shall provide and maintain an effective inspection and quality control system acceptable to the Government covering the supplies under the contract. A current written description of the system shall be submitted to the contracting officer prior to initiation of production. The contractor will not be restricted to the inspection station or to the method of inspection listed provided that an equivalent limitation is included in the approved quality control procedure. The contractor shall notify the Government and obtain approval for any change to the written procedure that might affect the degree of control required by this specification or other applicable documents referenced therein.

4.1.3 Parts and components. Parts, components, and assemblies shall be inspected in accordance with drawing 8736372 for the M109, 8449200 for the M109A1, 8736916 for the M109A1B, 12012100 for the M109A2, and 12012200 for the M109A3.

4.1.4 Inspection equipment. Inspection equipment drawings referenced by numbers herein are details of Master List of Inspection Equipment Drawings 8736372 for M109, 8449200 for M109A1, 8736916 for M109A1B, EL12012100-1 for M109A2, EL 12012200 for M109A3 as applicable. Inspection equipment drawings listed thereon will serve as standards for determining the adequacy of contractor's inspection equipment. See 6.5.

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4.1.5 Qualified products. The contractor's inspection records shall be checked to determine contractor's conformance to 3.3.1.

4.2 Preproduction and first production inspection.

4.2.1 Preproduction inspection. A preproduction vehicle (see 3.1) when furnished shall be inspected to ascertain vehicle conformance with requirements of this specification. Inspection shall be performed at a location approved by the Government. Failure of the preproduction model to comply with any of the requirements specified shall be cause for refusal by the Government to conduct a retest until corrective measures satisfactory to the Government have been taken.

4.2.2 First production inspection.

4.2.2.1 Special process inspection. A special process inspection will be conducted by the Government representatives during fabrication of the first production vehicle (see 3.2) to evaluate conformance of materials and workmanship with drawing and specification requirements.

4.2.2.1.1 Review and evaluation. Review and evaluation of records for processing procedure, inspection systems and plan of quality control, will be conducted on the following: material, welding, surface hardening, heat treating, protective finishes, etc.

4.2.2.1.2 Hull inspection. The hull shall be inspected prior to covering the weldments with paint or other pertinent components or assemblies.

4.2.2.2 Complete vehicle inspection. The first vehicle when complete, shall be inspected by the Government subsequent to contractor's inspection at the contractor's plant to determine conformance to contract and specification requirements.

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4.2.2.3 Production vehicle test. After completion of the first vehicle inspection, a second vehicle shall be selected from the first month's production or one of the first 10 shall be subjected to examination (see 4.4) and tests as specified in 4.5 (a) and (b). Subsequent to examination and tests, the selected vehicle shall be subjected to the 4,000 mile test specified in Table III. These tests shall be performed by the Government, at a site approved by the Government. Delays caused by vehicle breakdown due to poor quality of workmanship or material, or failure of the contractor to comply with specifications or drawing requirements shall not be the basis for adjustment of the contract performance dates or delivery schedule or contract price. Under separate contractual authority, the contractor will expeditiously furnish repair parts, as required to adequately support the above tests. Delays caused by vehicle breakdown and failure of the contractor to adequately support the vehicle with parts during the tests shall not be the responsibility of the Government.

TABLE III. 4000 mile test combat loaded or simulated load (Government proving grounds).

<u>COURSE</u>	<u>MILEAGE AND SPEED</u>
Hard surface roads	1000 miles at varying speeds up to maximum.
Gravel and dirt roads	2000 miles at varying speeds up to maximum with 300 miles of this distance over hilly conditions.
Level cross-country	600 miles at varying speeds up to maximum.
Hilly cross-country	400 miles at varying speeds up to maximum.

4.2.3 Test failure. Failure of the vehicle to comply with any of the requirements specified or any deficiency of a workmanship or materials nature found on the vehicle during or as a result of the 4000 mile test, will be cause for rejection of the vehicle. Further, the Government will refuse to continue acceptance of production vehicles until evidence has been provided by the

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manufacturer that corrective action has been taken to eliminate the deficiency. Any deficiency found during or as a result of 4000 mile test shall be prima facie evidence that all vehicles already accepted prior to completion of the 4000 mile test are similarly deficient, unless evidence satisfactory to the contracting officer 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.

4.2.3.1 Reliability verification. To determine conformance to 3.2.1, reliability requirement will be verified as a point estimate while the vehicles are subjected to production vehicle test. The mean miles/rounds between failure shall not be less than specified.

4.2.3.2 Durability verification. To determine conformance to 3.2.2, the durability requirements will be verified as a point estimate while the vehicle is subjected to production vehicle test.

4.2.3.3 Maintainability verification. To determine conformance to 3.2.3, the maintainability requirement will be verified during production vehicle test.

4.3 Break-in run, track. To determine conformance to 3.5.1, 3.5.2 and 3.5.3, each vehicle shall be lubricated and serviced prior to the break-in run. The run shall be on smooth, level, hard surface roads, and for the distance specified in Table I. The vehicle shall be operated in reverse after each division as specified in 3.5.4. The undulating portion of the test shall be accomplished twice in each direction at speeds between 5 and 10 mph during division "a" and between 11 and 14.5 mph during division "b".

4.3.1 Simulated break-in run. To determine conformance to 3.5.1, 3.5.2 and 3.5.3, a simulated break-in run (see Table IV) may be accomplished, in the Skid Type Dynamometer, 8752238 and 8752262, in lieu of the run specified in 4.3. Prior to the break-in run, each vehicle shall be lubricated, serviced and warmed up for not less than twenty minutes. Records shall be kept of the vehicle instrument readings. The final ten miles of the total break-in run shall be on smooth, level, hard surface roads. During this ten mile test, the vehicle shall be subjected to undulation operation, in accordance with 3.5.3, by being operated over the section of road conforming to Figure I. After completion of divisions b and d, Table IV, the vehicle shall be operated in reverse as specified in 3.5.4. The undulating portion of the test shall be accomplished twice in each direction at speeds between 5 and 10 mph during division "b" and between 11 and 14.5 mph during division "d". The results of the break-in runs on the first twenty vehicles that meet all requirements will serve as a standard for the evaluation of the balance of production.



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TABLE IV. Dynamometer and test track.

<u>DIVISION OF RUN</u>	<u>SPEED MPH</u>	<u>MILES OF TEST</u>	<u>TEST CONDITIONS</u>
a	0 to 10	10	Dynamometer
b	11 to 20	15	Dynamometer
c	Maximum	5	Dynamometer
d	10 to Maximum	10	Track (road)

4.3.2 Condition after run. After the break-in run, the vehicle shall be inspected to determine conformance to 3.5.5.

4.4 Inspection provisions. Visual, dimensional, and primary functional examination shall consist of examination of each vehicle for conformance to the applicable drawings and this specification. Examination shall be performed against the defects shown in Table V. The following constitutes a part of the defects (see 6.4):

- a. Any drip constitutes a defect when the vehicle has been standing idle and the components are at ambient temperature.
- b. Any leak that occurs at a static fit, metal or gasket combination that results in the formation of a droplet shall constitute a defect.

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TABLE V. Defects.

<u>CHARACTERISTICS</u>	<u>DEFECTS</u>	<u>METHOD OF INSPECTION</u>
a. Engine	Malfunction, leaks (see 6.4.1) mounting improper, damage, improper component assembly or installation.	Visual and Functional
b. Engine Governors	Improper setting, malfunction, missing or defective seals.	Functional
c. Power Train	Malfunction, mounting improper, damage, and leakage (see 6.4.1), improper component assembly or installation.	Visual and Functional
d. Fuel System Components	Malfunction, damage, leaks (see 6.4.1), improper assembly, installation or clearance.	Visual and Functional
e. Fuel and Oil Lines, Valves	Defective, clearance improper, malfunction, leaks (see 6.4.1), improper assembly or installation.	Visual and Functional
f. Cooling System Components (Engine and Transmission)	Malfunction, damage, leaks (see 6.4.1), improper assembly or installation.	Visual and Functional
g. Exhaust System Components	Damage, leaks, improper assembly or installation.	Visual and Functional
h. * Electrical System Components, Lights (includes Wiring and Instrumentation)	Malfunction, damage, improper assembly, installation circuit identification, clearance or protection, illumination of reticle and cant connection level vial.	Visual and Functional
i. Suspension System Components	Damage, tire or track pad separation, improper clearance or alignment, welding defects, leaks, (see 6.4.1), malfunction, improper assembly, installation, bolt or nut torque and track tension.	Visual

\* NOTE: Filament failures are not to be classified as a major or minor defect.

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TABLE V. Defects. (cont'd)

<u>CHARACTERISTICS</u>	<u>DEFECTS</u>	<u>METHOD OF INSPECTION</u>
j. Hull	Structure and welding defect.	Visual
k. Control and Adjusting Mechanisms	Malfunction, improper clearance, improper assembly or installation welding defects.	Visual and Functional
l. Doors, Fenders, Grilles, Panels, Ducts, Stowage, Brackets, Boxes, Racks and Stops	Malfunction: torque spring and hold-open devices, improper fit, adjustment assembly or installation.	Visual and Functional
m. Drain Valves	Valve seating improper, improper assembly installation, or control adjustment.	Visual
n. Cushions, seats, Rests and Crash Pads Hatch Seals	Seat control malfunction, damage leakage (see 6.4.1), improper assembly or installation adhesion damage.	Visual and Functional
o. Howitzer Travel Lock	Locking lug, malfunction, damage, improper assembly, installation.	Visual and Functional
p. Traversing and Elevating Mechanisms	Clearance improper, component damage, improper assembly, installation or chain adjustment.	Visual and Functional
q. Recoil Mechanism, Replenisher and Lines	Component damage, indicators or lines defective, improper assembly, installation, fluid level and type improper.	Visual and Functional
r. Main Armament	Component damage, improper assembly or trunnion cap bolt torque.	Visual and Functional
s. Breech Operating Mechanisms and Controls	Malfunction, bind, improper assembly, installation.	Visual and Functional

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TABLE V. Defects. (cont'd)

<u>CHARACTERISTICS</u>	<u>DEFECTS</u>	<u>METHOD OF INSPECTION</u>
t. Weapon Control System (Includes Panels, Solenoids, Switches, Wiring, and Other Components)	Component damage, defective wiring, improper clearance, assembly installation, circuit identification, protection markings.	Visual and Functional
u. Miscellaneous Items Accessories	Malfunction, damage, missing, improper assembly or installation.	Visual and Functional
v. Fire Extinguisher Systems Components	Seals missing or defective, data card incomplete, improper assembly or installation.	Visual
w. Speed	Non-conformance.	Functional
x. Acceleration	Non-conformance.	Functional
y. Turning Ability and Steering	Non-conformance, wander, side-pull, unusual noise.	Functional
z. Braking Ability (Parking and Service Brakes)	Non-conformance: grade holding or stopping distance, equilization improper, unusual noise.	Functional
aa. Forging (shallow)	Water leakage excessive.	Visual
bb. Paint Protective and Anti-Skid Coatings	Application, coverage and materials improper.	Visual
cc. Lube Fittings and Lubrication	Fittings missing, defective or improperly installed, lubrication improper.	Visual
dd. Decals, Markings Data and Instruction Plates	Incomplete data, missing improper location or size, illegible.	Visual

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4.5 Classification of tests.

- a. Acceptance tests, 4.5.1.1 through 4.5.1.25.9.
- b. Control tests, 4.5.2 through 4.5.2.12.
- c. Inspection Comparison Test (ICT), 4.5.3.2 through 4.5.3.14.

4.5.1 Tests.

4.5.1.1 Acceptance tests. To determine conformance to 3.6, after the break-in run (see 3.5), each vehicle shall be operated for a distance of eight miles or more and shall be inspected as specified in 4.4. These acceptance tests will be conducted at the place of manufacture (see Table VI). Vehicles shall be completely assembled and serviced, with fuel, lubricants, and tested as specified in 3.5.1. For these tests, vehicles shall be operated on roads as specified. The acceptance tests for the automotive and cab control and gun control system and fire control system may be run simultaneously where applicable. After the tests, the vehicle shall be examined for evidence of fuel and lubricant leakage, or other deficiencies.

4.5.1.1.1 Test failure. If a vehicle fails to pass any acceptance test specified herein, the Government inspector shall stop acceptance until evidence has been provided by the contractor that the corrective action has been taken.

TABLE VI. Location for tests.

<u>TITLE</u>	<u>PARAGRAPH NUMBER</u>	<u>PLACE OF MANUFACTURER</u>	<u>GOVERNMENT PROVING GROUND</u>
Acceptance Tests	4.5.1.1	X	X
Sealing and Seals Check	4.5.1.2	X	X
Controls and Linkage Check	4.5.1.3	X	X
Adjustment Mechanism Check	4.5.1.4	X	X
Fastener and Lock Check	4.5.1.5	X	X
Fuel System Leakage Check	4.5.1.6	X	X

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TABLE VI. Location for tests. (cont'd)

<u>TITLE</u>	<u>PARAGRAPH NUMBER</u>	<u>PLACE OF MANUFACTURER</u>	<u>GOVERNMENT PROVING GROUND</u>
Hydraulic Reservoir and Line Check	4.5.1.7	X	X
Generating System Vol- tage Check (Alternator)	4.5.1.8	X	X
Light Check	4.5.1.9	X	X
Bilge Pump Electrical Check	4.5.1.10	X	X
Air Cleaner Blower Electrical Check	4.5.1.11	X	X
Personnel Heater Electrical Check	4.5.1.12	X	X
Communication Equipment and Slip Ring Electri- cal Check	4.5.1.13	X	X
Welding and Weld Repair Check	4.5.1.14	X	X
Power Package and Train Test	4.5.1.15	X	X
Speed Test	4.5.1.16	X	X
Acceleration Test	4.5.1.17	X	X
Engine Starting on Grades and Side Slope Tests	4.5.1.18	X	X
Stopping Tests	4.5.1.19	X	X
Holding Test	4.5.1.20	X	X
Turning Test	4.5.1.21	X	X
Shallow Water Fording Test	4.5.1.22.1	X	X
Flotation Test	4.5.1.22.2	X	X
NOTE: Flotation test not applicable to M109A2 or M109A3.			
Cab Traversing Speed Test	4.5.1.23.1	X	X
Cab Manual Traverse Effort	4.5.1.23.2	X	X
Cab Manual Traverse Response Rate Check	4.5.1.23.3	X	X
Cab Slop Operation Check	4.5.1.23.4	X	X

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TABLE VI. Location for tests. (cont'd)

<u>TITLE</u>	<u>PARAGRAPH NUMBER</u>	<u>PLACE OF MANUFACTURER</u>	<u>GOVERNMENT PROVING GROUND</u>
Manual Elevation Effort Check	4.5.1.24.1	X	X
Manual Elevation Response Rate Check	4.5.1.24.2	X	X
Weapon Elevation Speed Check	4.5.1.24.3	X	X
Elevation System Protec- tion Check	4.5.1.24.4	X	X
Elevation and Depression Limits and Time Check	4.5.1.24.5	X	X
Hydraulic Pressure Limits System Backlash Check	4.5.1.24.6	X	X
Control Transfer Check	4.5.1.24.7	X	X
Control System Deadspot Check	4.5.1.24.8	X	X
Hydraulic Control System Leakage Check	4.5.1.24.9	X	X
Hydraulic Accumulator Test	4.5.1.24.10	X	X
Fire Control System Tests	4.5.1.24.11	X	X
Equipment	4.5.1.25	X	X
Preliminary Checks and Adjustments	4.5.1.25.1	X	X
Alignment of Panoramic Telescope Test	4.5.1.25.2	X	X
Horizontal Deflection of Panoramic Telescope Check	4.5.1.25.3	X	X
Accuracy of Elevation Counter Check	4.5.1.25.4	X	X
Boresight Check of Direct Fire Telescope	4.5.1.25.5	X	X
Boresight Retention	4.5.1.25.6	X	X
Mount Check	4.5.1.25.7	X	X
Rammer System Check	4.5.1.25.8	X	X
Control Tests	4.5.1.25.9	X	X
Frequency	4.5.2	X	X
Contamination Test	4.5.2.1	X	X
	4.5.2.3	X	X



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TABLE VI. Location for tests. (cont'd)

<u>TITLE</u>	<u>PARAGRAPH NUMBER</u>	<u>PLACE OF MANUFACTURER</u>	<u>GOVERNMENT PROVING GROUND</u>
Fuel System Slope Test	4.5.2.4	X	X
Fuel Tank and Line Test	4.5.2.5	X	X
Stowed Equipment Test	4.5.2.6	X	X
Flotation Operational Test	4.5.2.7	X	X
Cab Ring Friction Test	4.5.2.8	X	X
Manual Elevation Super- charge Check	4.5.2.9	X	X
Traverse and Elevation Stability Check	4.5.2.10	X	X
Reservoir Hydraulic Fluid Test	4.5.2.11	X	X
Fire Extinguisher Test	4.5.2.12	X	X
Inspection Comparison Test	4.5.3		X
Winterization Equipment Test	4.5.3.2		X
Carbon Monoxide Concen- tration Test	4.5.3.3		X
Communications Equipment Functional Test	4.5.3.4		X
Temperature Operational Tests	4.5.3.5		X
Cooling Systems Tests	4.5.3.6		X
Air Cleaner Operation Check	4.5.3.7		X
Water Removal (Bilge Pump) Test	4.5.3.8		X
Speeds with Towed Load Test	4.5.3.9		X
Slope Operational Test	4.5.3.10		X
Climbing Test	4.5.3.11		X
Trench Crossing Test	4.5.3.12		X
Vertical Obstacle Test	4.5.3.13		X
Radio Suppression Test	4.5.3.14		X
Alignment	4.5.3.15		X

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4.5.1.2 Sealing and seals check. To determine conformance to 3.4.1 through 3.4.1.3, the sealing, hatch doors, periscope, and turret ring seal shall be checked for leakage of water into the hull.

4.5.1.3 Controls and linkage checks. To determine conformance to 3.4.4 and 3.4.5, all controls and throttle linkage shall be operated and checked for functional requirements.

4.5.1.4 Adjustment and mechanism check. To determine conformance to 3.4.6, all fastener and locking devices shall be operated and checked for positive fastening and locking.

4.5.1.5 Fastener and lock check. To determine conformance to 3.4.7, all fastener and locking devices shall be operated and checked for positive fastening and locking.

4.5.1.6 Fuel system leakage check. To determine conformance to 3.4.8.1 and 3.4.8.2, prior to engine installation, the fuel system shall be pressurized with dry air at a pressure of 3 to 4 pounds per square inch (psi), and check fittings, lines, and fuel tank seals for leaks by applying soapy water or equivalent.

4.5.1.7 Hydraulic reservoir and line check. To determine conformance to 3.4.9, prior to initial operation of the hydraulic system, the reservoir and lines shall be checked for leaks and cleanliness.

4.5.1.8 Generating system voltage check (alternator). To determine conformance to 3.4.10.1, prior to performance tests, the generating system voltage shall be checked with master volt meter, and the voltage shall be within  $28 + .7$  volts with all vehicle lights turned on. An ammeter placed in Circuit 2 between the rectifier assembly and voltage regulator can be used to measure the total systems current demand for instances when the voltage falls out of the above limits to assure that the current load limit of 100 amperes is not being exceeded.

4.5.1.9 Light check. To determine conformance to 3.4.10.2, all lights shall be operated during and after break-in run throughout all stages of operation, and checked for functional requirements.

4.5.1.10 Bilge pump electrical check. To determine conformance to 3.4.10.3, the bilge pump electrical controls shall be turned on and the pump checked for operation.

4.5.1.11 Air cleaner blower electrical check. To determine conformance to 3.4.10.4, the air cleaner electrical controls shall be turned on and the blower checked for operation and air flow.

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4.5.1.12 Personnel Heater Electrical Check. To determine conformance to 3.4.10.5, the personnel heater electrical controls shall be turned on and the heater checked for operation.

4.5.1.13 Communication equipment and slip ring electrical check. To determine conformance to 3.4.10.6 and 3.4.10.7, the electrical circuits supplying current to the communication equipment and slip ring shall be checked at all points to assure continuity.

4.5.1.14 Welding and weld repair check. To determine conformance to 3.4.11, all welding and weld repairs shall be examined for possible defects and repairs accomplished in accordance with approved procedure.

4.5.1.15 Power package and drive train test. To determine conformance to 3.6.2, the vehicle shall be operated throughout all gear and speed ranges, the power plant, power train, final drives, tracks, suspension system, and applicable controls shall be checked for functional requirements.

4.5.1.16 Speed tests without towed load. To determine conformance to 3.6.5.1, the vehicle shall be operated at specified speeds and checked for functional requirements.

4.5.1.17 Acceleration test. To determine conformance to 3.6.6, the vehicle shall be accelerated from a standing start to the required speeds and the time checked.

4.5.1.18 Engine starting on grades and side slope tests. To determine conformance to 3.5.2 and 3.6.7.1, the engine shall start, and oil pressure and temperature shall be maintained when operating on specified grades and slopes. The 60 percent grade test may be conducted in conjunction with brake holding test.

4.5.1.19 Stopping test. To determine conformance to 3.6.8.1, the vehicle shall be operated on a dry, level, hard-surfaced road free of loose material, and checked for functional requirements.

4.5.1.20 Holding test. To determine conformance to 3.6.8.2, the vehicle shall be driven up a specified grade, service brakes applied and the vehicle observed for movement, then with parking brakes locked, the vehicle shall be observed for movement. During this test, vehicle shall be combat loaded or a simulated load of equal weight shall be placed on the vehicle, in a position that will not restrict the flow of engine air (intake or exhaust).

4.5.1.21 Turning test. To determine conformance to 3.6.9, the vehicle shall be operated and turned to right and left as specified and checked for radius of turns.

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4.5.1.22 Shallow water fording and flotation test.

4.5.1.22.1 Shallow water fording test. To determine conformance to 3.6.10.1, after 4000 miles of system operation, the vehicle shall be driven into water of specified depth, without special equipment. Water accumulation shall not exceed specified depth in hull bottom after 15 minutes of fording operation. The engine shall idle at 1000 rpm for 15 minutes, be stopped, and shall restart in not more than 3 minutes with all accessories functioning satisfactorily during and after fording.

4.5.1.22.2 Flotation test. To determine conformance to 3.6.10.2, at the conclusion of the break-in run, the vehicle shall be driven into water of a depth to assure that vehicle flotation requirements are met. After acceptance of the first production vehicle, all subsequent vehicles shall be tested in accordance with 4.5.2.1. Flotation test is not applicable to the M109A2 or M109A3 vehicle.

4.5.1.23 Cab control system tests.

4.5.1.23.1 Cab traversing speed test. To determine conformance to 3.6.14.2 by use of the gunner and commander's power controls, the cab shall be traversed clockwise and counterclockwise as specified, and the transition, maximum velocity, and stability of cab observed. The accumulator shall be fully charged prior to beginning the maximum speed test. Maximum traverse speed shall be measured after allowing the cab to accelerate approximately 400 mils from stop. The first revolution of the cab after this acceleration shall be accomplished at the specified rate.

4.5.1.23.2 Cab manual traverse effort check. To determine conformance to 3.6.14.3, with the specified average force applied tangentially to the traverse handcrank, the effort shall not exceed that specified.

4.5.1.23.3 Cab manual traverse response rate check. To determine conformance to 3.6.14.4, the response shall not exceed that specified.

4.5.1.23.4 Cab slope operations check. To determine conformance to 3.6.14.5, the vehicle shall be checked at the specified side slope without combat load for functional requirements.

4.5.1.24 Weapon control systems.

4.5.1.24.1 Manual elevation effort check. To determine conformance to 3.6.15.1, with the specified average force applied tangentially to the handcrank, the effort to maintain weapon movement shall not exceed that specified.

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4.5.1.24.2 Manual elevation response rate check. To determine conformance to 3.6.15.2, with the gun horizontal within plus or minus one degree, the response rate shall not exceed that specified.

4.5.1.24.3 Weapon elevation speeds check. To determine conformance to 3.6.15.4, when elevating and depressing the gun, the speeds shall be controllable as specified.

4.5.1.24.4 Elevation System Protection Check. To determine conformance to 3.6.15.5, with the weapon driven against stops, the control system shall be checked for damage.

4.5.1.24.5 Elevation and depression limits, and time limits check. To determine conformance to 3.6.15.6 and 3.6.15.7, the weapon shall be operated throughout elevation and depression ranges and checked for specified limits. (The correction procedures of 4.5.1.25.2f shall apply.)

4.5.1.24.6 Hydraulic pressure limits switch test. To determine conformance to 3.6.16.1, the cab shall be traversed as specified and the system pressure gage observed for specified pressure as the power pack motor cuts in. With power pack motor running and the controls in their neutral position, the power pack motor shall cut out at the specified system pressure.

4.5.1.24.7 System backlash check. To determine conformance to 3.6.16.2, with the power off and specified force applied to muzzle end of gun, the backlash shall not exceed that specified.

4.5.1.24.8 Control transfer check. To determine conformance to 3.6.16.3, the controls shall be operated as specified and the gun and turret observed for functional response as selected. There shall be no movement of the gun or cab when the cab control switch is turned "ON" or "OFF" not less than three times, with the controls in neutral position, and the accumulator charge as specified.

4.5.1.24.9 Control system deadspot check. To determine conformance to 3.6.16.4, with the system fully charged, the pressure drop shall not be less than that specified.

4.5.1.24.10 Hydraulic control system leakage check. To determine conformance to 3.6.16.6, with the system fully charged, the pressure drop shall be not less than that specified.

4.5.1.24.11 Hydraulic accumulator test. To determine conformance to 3.6.16.8, with the elevation and traverse power switch "Off" and the cab lock engaged, all oil shall be discharged from the main accumulator by actuating the cab power shut off solenoid button and moving the power traverse handle to extreme right or left until the system pressure gage is stabilized at a zero pressure setting. Leakage and PSI change per degree of

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temperature change from initial precharge condition shall be not more than that specified. With the specified nitrogen pressure on the gas gage, the controls in neutral position, and the oil pressure at zero, the test shall be continued by observing the oil gage for a period of 3 minutes with no gage movement.

4.5.1.25 Fire control systems tests.

4.5.1.25.1 Equipment. The following fire control test equipment shall be used:

- a. Mechanical jacks or a leveling platform leveling the vehicle.
- b. A plumb line 1/16 inch in diameter shall be suspended less than 1 foot from the muzzle of the weapon. The line shall be shielded from wind currents and the plumb bob shall be immersed in a container of oil to act as a dampener.
- c. A boresight retention and checking target shall be constructed of non-warping and non-shrinking material designed as shown in Figure 2. The target shall be placed at a distance of not less than 50 feet from the center of the weapon trunnions in a plane perpendicular to the weapon bore at zero weapon elevation. The reference line on the target shall be plumb. The height of the target above ground shall be such that at zero weapon elevation the center line of the weapon bore shall fall on the weapon aiming point within plus or minus 1/8 inch.
- d. An approved borescope shall be used. This shall be a telescope with a cross hairs reticle mounted in a self aligning fixture to be inserted in the breech of the weapon so that the cross hairs of the telescope fall on the center line of the bore. The telescope shall have a separate focus for reticle and field and be adjustable from 5 to 5000 yards. The reticle of the telescope shall be centered with respect to the outside diameter of the adapter within 0.1 mil. The telescope shall have a magnification of 20X or higher.
- e. Parallax shields with a centrally located 1/16-inch maximum diameter holes shall be placed over the eyepiece of the telescope to eliminate parallax.

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- f. A master panoramic telescope M117A2 and a master direct sighting telescope M118A2. A master telescope is defined as a scope with line of sight mixed in correct relation to the mounting surfaces.
- g. A calibrated gunner's quadrant M1A1. A calibrated gunner's quadrant is defined as a quadrant that has been checked on a sine plate at each of the elevations for which the quadrant will be employed during the test and the deviation from true elevation recorded in a table which will be furnished with the quadrant. The readings of the quadrant shall be corrected accordingly when checking specification tolerances.

4.5.1.25.2 Preliminary checks and adjustments. The following preliminary checks and adjustments shall be made:

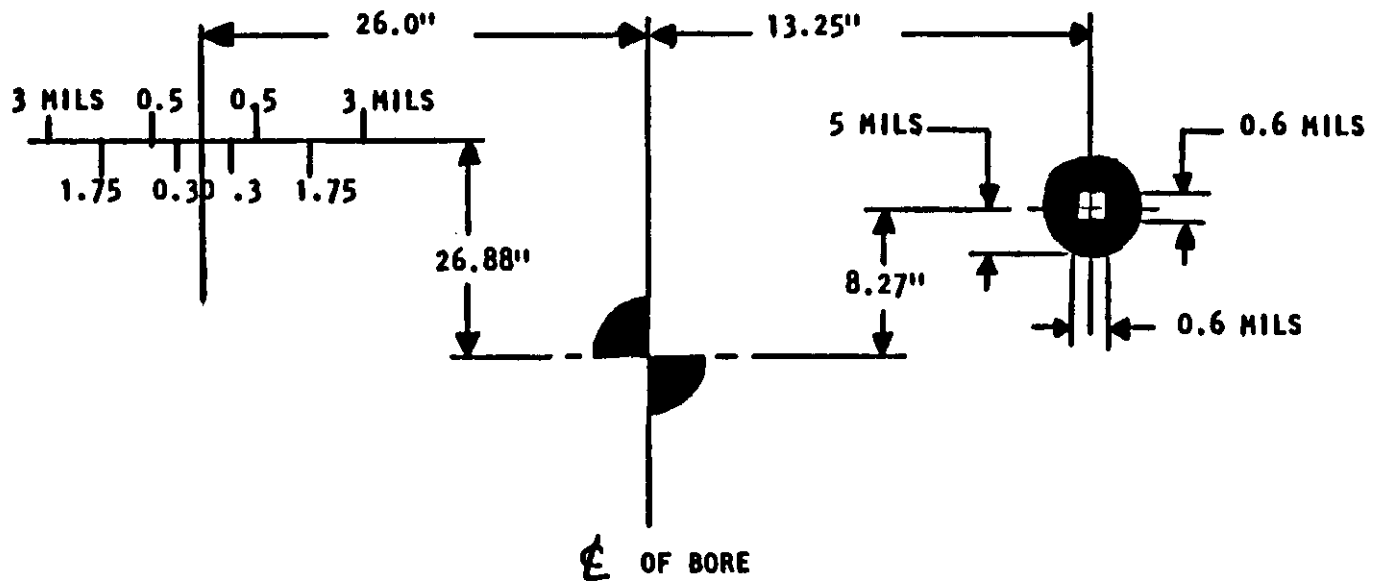
- a. Prior to installing the M15 (elevation) quadrant, the keys of the quadrant support bracket shall be checked for parallelism with respect to the zero reference of the weapon within the prescribed tolerance of 0.2 mil.
- b. The mounts shall be inspected for tight mechanical installation.
- c. No interference shall exist between or with components of fire control components and components of the vehicle or between the maximum limits of elevations.
- d. All level vials shall be illuminated for a minimum of five (5) minutes prior to their use. Unless otherwise specified, the level vials of the fire control instruments shall be construed to be level when the bubble in the vial is centered within the width of the graduation line.
- e. The vehicle shall be cross leveled so that the weapon will track the plumb line within the thickness (1/16 inch) of the line. This shall be done by using the bore-scope (see 4.5.1.25.1(d)) inserted in the breech and setting the muzzle cross wires on the plumb line at zero weapons elevation. The vehicle shall be leveled fore and aft and cross-leveled to meet the requirements of 3.6.17.1 and 3.6.17.2. The above shall be checked with a calibrated gunner's quadrant on the breech pads of the weapon. Cross leveling of the vehicle shall be checked periodically throughout the test.



VEHICLE	A
M109A3	M118A2
M109A2	M118A2
M109A1B	M118A2
M109A1	M118A2
M109	M11B

PANORAMIC TELESCOPE

DIRECT FILE TELESCOPE A



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TOLERANCES

INCHES  $\pm$  .005"

MILS  $\pm$  .01 MILS

FIGURE 2. Boresight retention and checking target for self-propelled vehicles M109 series.

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- f. With regard to true elevation, all elevation settings readings indicated by an M1A1 gunner's quadrant placed on the quadrant pads of the breech ring shall be in accordance with zero elevation established. Therefore, the mil correction value imbedded on the breech ring shall be added or subtracted from the reading on the gunner's quadrant; plus corrections shall be added, minus corrections shall be subtracted from the M1A1 quadrant to achieve a specified tube elevation. Zero elevation shall be established with the muzzle brake assembled on the gun tube.
- g. The M140 alignment device mounting bracket shall be installed in accordance with 3.6.17.8.

4.5.1.25.3 Alignment of panoramic telescope test. The master panoramic telescope shall be placed in the socket and locked in place. A parallax shield shall be placed over the eyepiece. The cross leveling mechanism shall be adjusted until cant vial is level. With elevation and pitch vials level, the vertical cross hair of the panoramic telescope shall be placed on the aiming point. The weapon shall be elevated from zero to 1100 mils and checked for conformance to 3.6.17.3.

4.5.1.25.4 Horizontal deflection of panoramic telescope test. A gradual pressure of 20 pounds shall be applied to the telescope mount socket, tangentially to the right and perpendicular to the axis of the telescope and then gradually released. While sighting through the telescope, place the vertical cross hair on the center of the panoramic telescope aiming point. Repeat procedure specified in first sentence above and sight through the telescope to ascertain that the vertical cross hair of the telescope has not moved off the aiming point. A 20 pound pressure shall then be applied in the opposite direction and gradually released. The deflection of the vertical cross hair relative to the aiming point shall be checked for conformance to 3.6.17.4.

4.5.1.25.5 Accuracy of elevation counter check. A calibrated gunner's quadrant shall be placed on the breech pads of the weapons and the difference between counter reading and weapon elevation shall be checked and noted. The check point shall include zero, 100, 500, 600, 1000 and 1100 mils counter elevation. At each elevation counter setting, the weapon shall be laid in elevation utilizing a calibrated gunner's quadrant placed on the breech pads and elevating the weapon from low to high to exclude backlash. The elevation vial in the mount and elevation quadrant shall then be leveled and the counter reading noted for conformance to 3.6.17.5. The elevation connection counters shall be set to zero and the pitch and cant vials leveled prior to performing this test.

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4.5.1.25.6 Boresight check of direct fire telescope. The weapon shall be placed on its aiming point on the boresight retention and checking target. With the master telescope locked in place, the line of sight shall be adjusted on its aiming point. Lateral and vertical boresight adjustment screws shall be rotated for conformance to 3.6.17.6.

4.5.1.25.7 Boresight retention. Prior to the 8 mile road test specified herein, the cross hairs of the panoramic telescope and direct sighting telescope shall be placed on the center of their respective aiming points shown in Figure 2 after laying the weapon exactly on the center. Following the 8 mile road test, the vehicle shall be returned to the place from which the original settings were made. Approaching the weapon aiming point from the same direction as before the test, the weapon shall be boresighted at proper aiming point on the target and observation shall be made through the panoramic telescope and the direct sighting telescope to ascertain conformance to 3.6.17.7.

4.5.1.25.8 Mount check. To determine conformance to 3.6.18, the mount shall be checked for proper installation and any damage that may cause failure.

4.5.1.25.9 Rammer system check. To determine conformance to 3.6.20, the rammer system shall be operated and observed for functional requirements.

4.5.1.26 Chemical agent resistant coating (CARC) tests. To determine conformance to 3.7.1, inspection and testing shall be performed in accordance with the Quality Assurance Provisions outlined in MIL-C-53072.

4.5.2 Control test. Control tests for maintaining control of those requirements whose inspection would be of too long duration to be included under acceptance tests shall be conducted by the manufacturer as specified herein.

4.5.2.1 Frequency. The first vehicle off the production line, or one of the first ten vehicles produced, and thereafter one per month, shall be checked in accordance with the control tests.

4.5.2.2 Test failure. If a vehicle fails to pass any control test specified herein, the Government inspector shall stop acceptance until evidence has been provided by the contractor that corrective action has been taken.

4.5.2.3 Contamination test. To determine conformance to 3.4.2.2 and 3.6.10.3, the vehicle after the water fording and flotation test shall be examined for contamination of lubricants of the transmission, engine, final drives, and road wheels, 2, 3, 4, 5, and one of their corresponding arms, on each side of the vehicle. Contamination shall not exceed that specified.

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4.5.2.4 Fuel system slope test. To determine conformance to 3.4.8, with vehicle headed up and down a 60 percent longitudinal slope and each side up a 40 percent slope, vehicle shall be checked for functional requirements.

4.5.2.5 Fuel tank and lines test. To determine conformance to 3.4.8.1 and 3.4.8.2, the fuel tanks shall be filled to capacity at a rate of not less than 50 gallons per minute. The tanks and lines shall be checked for leaks before and after a two mile road test on smooth, level, hard surfaced roads.

4.5.2.6 Stowed equipment test. To determine conformance to 3.4.12, all manufacturer and depot installed "on vehicle equipment" shall be stowed (combat loaded) on the selected vehicle. The equipment shall be removed after the test. The on vehicle equipment shall be made available to the contractor, and the contractor shall be permitted to unpackage and repackage for domestic shipment only the equipment used for test.

4.5.2.7 Flotation operational test. To determine conformance to 3.6.10.2, the vehicle shall be operated in water of specified depth and vehicle checked for performance requirements. Flotation test is not applicable to M109A2 and M109A3 vehicles.

4.5.2.8 Cab ring friction test. To determine conformance to 3.6.14.1, one vehicle in 20 shall be selected. The turret assembly shall be rotated throughout the 360 degree rotation, with a tangential force of 50 pounds applied at the end of the gun tube, parallel to plane of rotation. The torque required to maintain rotation shall be measured, and checked for functional requirements.

4.5.2.9 Manual elevation supercharge check. To determine conformance to 3.6.15.3 with the manual elevation hydraulic system supercharged, the system shall maintain supercharge pressure as specified.

4.5.2.10 Traverse and elevation stability check. To determine conformance to 3.6.16.5, with the cab control switch turned on or off the gun movement shall not exceed that specified. Prior to performing the stability test, equilibrate the gun tube at 266 mils elevation. Test shall be conducted at elevation between 500 and 600 mils.

4.5.2.11 Reservoir hydraulic fluid test. To determine conformance to 3.6.16.7, the hydraulic oil in the control power pack shall be tested for water contamination and cleanliness. Obtain oil sample in the following manner:

- (1) Cycle rammer 5 times.
- (2) Traverse the turret in any direction for a total of 720 degrees.

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(3) Elevate from lowest QE to highest QE 5 times.

(4) Immediately thereafter, but not longer than 5 minutes drain approximately one quart from the reservoir (drain at oil level gage).

(5) Take an additional 100 ml at the same location as referenced in (4) above, this 100 ml will be the hydraulic fluid test sample.

Test the sample in accordance with the requirements of MIL-STD-1246, Level 200 (Para. 5.1.2 and Table 1A)."

4.5.2.12 Fire extinguisher test. To determine conformance to 3.6.21.1 and 3.6.21.2, the fixed fire extinguisher system shall be functionally tested both inside and out, subsequent tests of one in each fifty testing alternately.

4.5.3 Inspection comparison tests. The Government may select vehicles any time during the contract production period and subject vehicle to tests listed in Table VI and Table VII to reveal deficiencies of manufacturer or design that may reduce the effective operation of these items in the field and to compare existing quality with previous standards. These tests shall be conducted at Government laboratories or proving grounds designated by the contracting officer. Selection of vehicles shall be on a spot check basis. Comparison test vehicles shall be combat loaded with all on-vehicle equipment stowed in their applicable spaces to conform to 3.4.12. Vehicles selected shall not include any vehicles previously tested for conformance to 4.5.2 (control tests).

4.5.3.1 Test failure. Failure of any vehicle tested as specified in 4.5.3 to comply with any of the requirements specified in the contract, or any deficiency of a workmanship or materials nature occurring during, or as a result of the test, may be cause for refusal to continue acceptance of vehicles by the Government until evidence has been provided by the manufacturer that corrective action has been taken to eliminate the conditions.

TABLE VII. 2000 mile test combat loaded or with a simulated simulated load (Government proving Grounds).

<u>COURSE</u>	<u>MILEAGE AND SPEEDS</u>
Hard Surface Road	200 miles at varying speeds up to maximum
Gravel and Dirt Roads	500 miles at varying speeds up to maximum with 75 miles of this distance on hilly conditions.
Level Cross Country	650 miles at varying speeds up to maximum
Hilly Cross Country	650 miles at varying speeds up to maximum

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4.5.3.2 Winterization equipment test. Winterization equipment shall be installed in accordance with applicable drawings and specifications. The vehicle, properly serviced and equipped, shall be stabilized and then subjected to respective ambient temperature of 0° to minus 65°F. The engine shall satisfactorily start and operate and the personnel heaters shall function as specified in 3.4.2.1.

4.5.3.3 Carbon monoxide concentration test. To determine conformance to 3.4.3, the crew compartment shall be checked for carbon monoxide concentration.

4.5.3.4 Communications equipment test. To determine conformance to 3.4.10.6, communication system equipment shall be installed, subjected to tests and checked for functional requirements.

4.5.3.5 Temperature operational tests. To determine conformance to 3.6.1, the vehicle, properly serviced and equipped, shall be subjected to the applicable tests in high and low temperatures.

4.5.3.6 Cooling system tests. To determine conformance to 3.6.2.1, the vehicle shall be operated as specified and cooling systems checked for functional requirements.

4.5.3.7 Air cleaner operational check. To determine conformance to 3.6.3 during and after operation, the air cleaners shall be checked for functional requirements.

4.5.3.8 Water removal (bilge pump) test. To determine conformance to 3.6.4, the vehicle shall have sufficient water in hull to operate bilge pump and check the rate of water removal with the specified discharge head.

4.5.3.9 Speeds with towed load test. To determine conformance to 3.6.5.2, the vehicle shall be operated towing specified vehicle, at indicated speeds for a distance of not less than that required to meet performance requirements.

4.5.3.10 Slope operational test. To determine conformance to 3.6.7, the vehicle shall be operated as specified, on applicable slopes and checked for performance requirements.

4.5.3.11 Climbing operational test. To determine conformance to 3.6.11, the vehicle selected shall be driven in forward and reverse gear up approved 60 percent grade.

4.5.3.12 Trench crossing tests. To determine conformance to 3.6.12, the vehicle selected shall be driven without stalling over trenches as specified and then examined for damage.

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4.5.3.13 Vertical obstacle tests. To determine conformance to 3.6.13, the vehicle selected shall be driven without stalling over obstacles as specified and then examined for damage as specified.

4.5.3.14 Radio suppression tests. To determine conformance to 3.6.19, the vehicle shall be subjected to a radio interference suppression test.

4.5.3.15 Alignment. To determine conformance to 3.6.17.8 the alignment device shall be mounted in accordance with 11747268 and 11747269.

## 5. PACKAGING

5.1 Preparation for delivery and storage shall be in accordance with MIL-H-46709.

## 6. NOTES

6.1 Intended use. The vehicle is intended for use by the Armed Forces as a combat vehicle.

6.2 Procurement documents should specify the following:

- a. Title, number and date of this specification.
- b. Preproduction model if required (see 3.1).
- c. Special kits if required (see 3.4.2).

6.3 Safety precautions. Caution should be exercised in handling carbon dioxide fire-extinguisher cylinders. They should not be dropped, permitted to strike each other, or be handled roughly. Extreme care should be exercised during reinstallation to avoid tripping fire-extinguisher control system since physical injury is highly probable.

6.4 Definitions.

6.4.1 The following definitions shall be used for the classification of defects for leaks:

- a. Weep - Any evidence of fluid beyond the seal.
- b. Seep - Any evidence of fluid beyond the seal that does not result in formation of a droplet.
- c. Droplet - Any evidence of fluid beyond the seal that results in the formation of a droplet.
- d. Drip - Any evidence of fluid beyond the seal where droplet forms and falls.



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6.4.2 Reliability. For the purpose of assessing reliability, a failure is defined as any malfunction which the operator/crew cannot or is not authorized to remedy by adjustment, repair or replacement action within 5 minutes, using controls, Basic Issue Items (BII), Items Troop Installed or Authorized (OTIA) and parts authorized to the crew, and which causes or could cause the loss of any mission essential function; a critical or catastrophic hazard to personnel or equipment as defined by MIL-STD-882. This shall pertain only to those failures chargeable to hardware. For related malfunction, only the primary malfunction will be counted against reliability.

6.4.3 Hydraulic fluid cleanliness. A contamination control plan shall be submitted to AMSMC-QAR-Q (D) in accordance with MIL-STD-1246, Section 4.1.4.

6.5 Inspection equipment calibration and inspection. In inspecting the supplier's inspection equipment, the Government Inspector will determine that the supplier has available, and utilizes correctly, gaging, measuring, and test equipment of the required accuracy and precision. Except as otherwise specified, the supplier will have available a set of master gages, standards, and appropriate instruments for regularly scheduled calibration of his inspection equipment. Records of such regularly scheduled calibration will be maintained by the supplier and made available for review by the Government. The calibration of gages, standards, and instruments will be periodically checked by authorized Government personnel and the Government reserves the right to verify any gages, standards or instruments it feels are improperly calibrated..

6.6 Drawings. Drawings listed in Section 2 of this specification under the heading US Army Armament Research, Development and Engineering Center (ARDEC) may also include drawings prepared by and identified as Edgewood Arsenal, Frankford Arsenal, Rock Island Arsenal, Picatinny Arsenal, or ARRADCOM. drawings and technical data originally prepared by these activities is now under the cognizance of ARDEC.



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6.8 Subject term (key word) listing.

Howitzer  
Self-propelled  
Gun mount  
Cannon  
Panoramic telescope  
Fire control quadrant  
Elbow telescope  
Aluminum welding  
Tracked vehicle  
Chemical agent resistant coating  
Hydraulic fluid  
Optical alignment device

Custodian:  
Army-AR

Preparing activity:  
Army-AR

(Project 2350-A402)

