

MIL-G-45397D(AT)  
16 June 1969  
~~SUPERSEDING~~  
MIL-G-45397(MO)  
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## MILITARY SPECIFICATION

GUN, FIELD ARTILLERY, SELF-PROPELLED: 175MM, M107  
HOWITZER, HEAVY, SELF-PROPELLED: 8 INCH, M110

### 1. SCOPE

1.1 Scope. This specification covers a front-sprocket-driven, full-tracked, lightly armored combat vehicle, with individual torsion bar suspension, and mounting a 175MM gun or 8 inch howitzer.

### 2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of this specification to the extend specified herein.

#### SPECIFICATIONS

##### Federal

VV-F-800 - Fuel Oil, Diesel.

##### Military

MIL-P-514 - Plates; Identification, Transportation Data and Blank.  
MIL-R-3065 - Rubber, Fabricated Parts.  
MIL-H-6083 - Hydraulic Fluid, Petroleum Base, Preservative.  
MIL-M-45212 - Mount, Gun; Mount Howitzer.  
MIL-G-46723 - Gun, Self-Propelled, Full-Track: 175MM, M107, and Howitzer, Self-Propelled, Full-Track, 8-Inch, M110; Preparation for Storage and Shipment of.

#### STANDARDS

##### Federal

Fed. Std. No. 595 - Colors.

FSC-2350

## MIL-G-45397D(AT)

## Military

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-130 - Identification Marking of U. S. Military Property.
- MIL-STD-193 - Painting Procedures Tactical Vehicles (Tracked and Wheeled).
- MIL-STD-210 - Climatic Extremes for Military Equipment.
- MIL-STD-417 - Rubber, Compositions, Vulcanized General Purpose, Solid (Symbols and Tests).
- MIL-STD-461 - Electromagnetic Interference Characteristics Requirements for Equipment.
- MIL-STD-642 - Identification Marking Combat, and Tactical Transport Vehicles.

## Human Engineering Laboratories (HEL)

- HEL 8 -1-63B - Maximum Noise Level for Army Materiel Command Equipment.

## DRAWINGS

## Engineering List of Drawings (LD)

- LD-8736338 - Howitzer, Heavy Self-Propelled: 8 Inch, M110.
- LD-8736339 - Gun, Field Artillery, Self-Propelled: 175MM, M107.

## PUBLICATIONS

## Engineering Lists of Parts List (LP)

- LP-8736338 - Howitzer, Heavy Self-Propelled: 8 Inch, M110.
- LP-8736339 - Gun, Field Artillery, Self-Propelled: 175MM, M107.

## Engineering List of Specifications (LS)

- LS-8736338 - Howitzer, Heavy Self-Propelled: 8 Inch, M110.
- LS-8736339 - Gun, Field Artillery, Self-Propelled: 175MM, M107.

## Master List of Supplementary Quality Assurance Provisions (QM)

- QM-8736338 - Howitzer, Heavy Self-Propelled: 8 Inch, M110.
- QM-8736339 - Gun, Field Artillery, Self-Propelled: 175MM, M107.
- HEL 8-1-63B - Maximum Noise Level for Army Materiel Command Equipment.

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

## 3. REQUIREMENTS

3.1 Preproduction vehicle. When specified (sec 6.2), a complete preproduction vehicle(s) shall be produced prior to the manufacture or fabrication of vehicles in quantity. The complete vehicle(s) shall be submitted to the Government for inspection 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 as contemplated under the supply contract.

MIL-G-45397D(AT)

**3.2 First production vehicle.** A first production vehicle, which shall be fully representative of vehicles proposed to be furnished under the contract, shall be submitted to the Government for inspection to determine conformance to the requirements of this specification.

**3.2.1 Workmanship and reliability.** The workmanship shall be of a quality to assure that the vehicle and components thereof are free from any defects that compromise, limit, or reduce the vehicle or component capabilities herein specified. Vehicles made in accordance with this design shall be subjected to examinations and tests by the Government to prove vehicle capabilities and performance are in accordance with the following:

- (a) Vehicle shall require only organizational maintenance (first and second echelon) during 2,000 miles of normal operation.
- (b) Vehicle shall require no replacement or major overhaul of any major automotive component during 4,000 miles of normal operation.
- (c) With no exception of track rubber components all components of complete track assemblies shall require no more than 10 percent replacement during 3,000 miles of operation.

**3.2.1.1 Reliability operations.** To assure that workmanship and reliability requirements are met during the 4,000 miles of operation, the vehicle combat loaded or with a simulated load of equal weight shall be capable of operating as follows:

- |  |            |
|--|------------|
| (a) Hard surface roads   | 25 percent |
| (b) Gravel and dirt roads, with 10 percent of this distance under mud conditions | 65 percent |
| (c) Cross country level and hilly terrain  | 10 percent |

### **3.3 Materials.**

**3.3.1 Qualified products list (QPL).** The contractor shall be responsible for using all assemblies and parts necessary in vehicle construction that are listed as qualified products on the QPL and those approved for inclusion on the QPL. Assemblies and parts determined as QPL items appear on the Engineering List of Specifications cited in 3.4. The contractor's manufacturing inspection records shall specifically list all QPL items by part or drawing number(s), name of supplier(s), and number and date of the QPL. When assemblies and parts are approved as qualified products but not yet listed on the QPL, the contractor shall list the products by number and date of the approval document with name of supplier(s).

**3.3.2 Ozone resistant.** Unless otherwise specified, all rubber products procured under requirements of MIL-R-3065 are to be ozone resistant to the degree specified herein. Rubber components controlled by detail specifications shall be ozone resistant only when required by the specification referenced on the drawing.

MIL-G-45397D(AT)

3.4 Construction. All vehicles, sub-assemblies, assemblies shall be fabricated and assembled into a complete vehicle in accordance with drawings, parts lists, and specifications as specified on LD-8736338 for the M110, LD-8736339 for the M107 LP-8736338 for the M110, LP-8736339 for the M107, LS-8736338 for the M110, LS-8736339 for the M107, and associated documents and publications referenced therein. All parts requiring identification shall be marked in accordance with MIL-STD-130.

#### 3.4.1 Sealing.

3.4.1.1 Sealer. The sealer used to seal vehicle shall prevent the entrance of water into the hull when vehicle is fording streams or rivers during cross country operation and when operating in deep water (see 3.6.8).

3.4.1.2 Seals. Seals shall prevent the entrance of all foreign matter into the bearings when fording shallow or deep water. All seals shall prevent the leaking of lubricants from the bearings.

3.4.1.3 Hatch and door seals. When hatches and doors are closed the seals shall prevent the entrance of water into the occupied portions of the vehicle.

3.4.2 Winterization kit. When specified and installed (see 6.2), the winterization kit shall assure satisfactory engine starting and operation in ambient temperature of minus 25°F to minus 65°F within 20 hours of previous run.

3.4.3 Exhaust system. The exhaust system shall prevent the accumulation of carbon monoxide in the occupied portions of the vehicle in excess of 0.01 percent under normal condition of vehicle operation.

3.4.4 Air cleaners. With a maximum air flow of 615 cubic feet per minute through each air cleaner, the cleaners shall be capable of removing not less than 99 percent of dust and foreign material from engine intake air under all vehicle operating conditions.

3.4.5 Fuel system. During engine operation, the fuel system shall maintain fuel supply to the engine when standing on, ascending and descending 60 percent grades in forward and reverse gear, and when vehicle is standing on or being operated on 30 percent side slopes, with each side of vehicle up slope.

3.4.5.1 Fuel tank. Provisions shall be made to assure the internal cleanliness of the fuel tank. All weld slag and foreign material shall be removed prior to initial filling of fuel tank. The fuel tank and all connections shall be free from leakage during all conditions of vehicle operation. The fuel tank shall be capable of receiving 50 gallons of fuel per minute.

3.4.5.2 Fuel and hydraulic lines. Provisions shall be made to assure internal cleanliness of fuel and hydraulic lines and connections prior to initial servicing of vehicle. All fuel and hydraulic line connections shall be free from leakage.

MIL-G-45397D(AT)

3.4.6 Hydraulic reservoir. Provisions shall be made to assure the internal cleanliness of the hydraulic reservoir. All weld slag and foreign material shall be removed prior to initial filling of reservoir. The reservoir and all connections shall be free from leakage during all conditions of vehicle operation.

3.4.7 Suspension lockout. The lockout cylinder shall be capable of locking the suspension system, to provide a firm base, from which the gun or howitzer may be fired.

3.4.8 Controls. All electrical, mechanical, and hydraulic controls shall operate without malfunction throughout all ranges of operation, under all vehicle operating conditions.

3.4.9 Adjustment mechanisms. All adjustment mechanisms shall function properly and maintain adjustment during all vehicle operating conditions.

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

3.4.11 Stowed equipment. All on vehicle equipment (OVE) items shall be stowed (combat loaded) on the vehicle in the spaces provided.

3.4.12 Engine air induction system. Engine air induction system as fabricated and installed from air cleaner element mounting face to engine turbo-charger intake shall be free of all weld slag, shall prevent the entrance of all foreign material, and shall withstand pressure between 3 and 5 PSI.

3.4.13 Throttle linkage. With throttle linkage attached to engine, and throttle pedal fully depressed, the throttle shall be at full rack position.

3.4.14 Fuel shut-off valve. With the engine operating at not more than 1000 RPM, the engine shall stop within one minute when the manual fuel shut-off valve is placed in the "OFF" position.

3.4.15 Seating. All sliding parts and operating contact surfaces shall be free of paint.

3.4.16 Electrical system.

3.4.16.1 Generator voltage. The engine shall be operated at a minimum of 1,000 revolutions per minute (rpm) for 30 minutes before setting voltage regulator. The vehicle generator output voltage shall be between 27.5 and 29 volts under all conditions of vehicle operation.

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

MIL-G-45397D(AT)

3.4.16.3 Communication equipment electrical circuits. The communication equipment electrical circuits shall be capable of delivering 24 volts nominal to the communication equipment.

3.4.17 Vision devices and receptacles. Provisions shall be made to assure that receptacles incorporated in the vehicle will accept applicable vision devices without binding or interference. When installed, the receptacles, vision devices, and seals shall prevent the entrance of water into vehicle.

3.4.18 Welding repairs. Welding repairs of any type or class shall be made only when, and to the extent, specifically authorized by the procuring activity.

3.4.19 Interchangeability. The Gun, Field Artillery, Self-Propelled, 175MM, M107, with ammunition and related parts and subassemblies shall conform to military characteristics; and be physically and functionally interchangeable in compliance with ABCA-ARMY-STD-150 (see 6.9).

### 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 adjustment completed. Vehicle, including all components requiring lubrication shall be lubricated and serviced with fuel conforming to Grade DF 2 of VV-F-800 and lubricated as specified in production lubrication Drawing C10904393, referenced in LP-8736338 and LP-8736339. Specific applications by grades or types for various expected seasonal temperature ranges shall be as specified.

3.5.2 Oil pressure and temperature. Prior to the start of the break-in run, the engine shall be operated at 750 to 1,000 rpm until lubricating oil is at operating pressure and temperature. If at any time during the break-in run the engine has been stopped 30 minutes or more the engine shall again be operated as above, before continuing break-in run. Proper oil pressure and temperature shall be maintained during operation on level ground, 60 percent grades and 30 percent side slope.

3.5.3 Operation and distance. Prior to tests, each vehicle shall be given a break-in run for the distances specified in Table I on smooth, level, hard-surfaced roads. The vehicle shall be operated in both directions over the undulating section of road (see figure 1) during "a" and "b" divisions of the break-in run.

Table I. Speeds and distances for break-in run

Division of run	Speed mph	Distance miles	Test conditions
a	0 to 10	10	Track (road)
b	11 to 20	25	Track (road)
c	21 to Max.	5	Track (road)

MIL-G-45397D(AT)

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. Prior to vehicle being submitted to the Government for acceptance, all suspension wheel bearings shall be checked to determine if adjustments are correct and readjusted as required. 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 (see 3.4.11) 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. Vehicle shall be capable of operating on 60 percent longitudinal grades, headed up and headed down grades and on right and left 30 percent side slopes, with each side of vehicle up slope. Performance shall be demonstrated on smooth, level, hard-surfaces 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° to minus 25°F, and with special equipment installed, at temperature ranges of minus 25° to minus 65°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 train. When power package is installed in accordance with applicable drawings, it shall function throughout all gear and speed ranges without, loss of lubricants, and damage that may cause failure of vehicle. The power 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 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 temperature up to 115°F.
- b. Under full load.
- c. At highest available torque output.
- d. At all speeds including a maximum speed of 2 1/2 mph in low gear with no track slippage when operating vehicle on smooth, level, hard-surfaced roads.



MIL-G-45397D(AT)

Table II. Operating temperatures

Maximum water temp. from engine	Maximum engine oil temp. in sump	Maximum transmission oil temp. into cooler
230°F	275°F	300°F

3.6.3 Speeds.

3.6.3.1 Speeds no load. Vehicle shall be capable of operating at a sustained speed of 30 mph and shall be capable of maintaining a minimum of 1.5 mph in lowest gear without towed load. The vehicle shall be capable of attaining a maximum speed of 34 mph. With vehicle traveling between 20 mph and maximum speeds, the drift from a straight line shall be not more than 3 feet in 100 feet.

3.6.3.2 Speeds with towed load. The vehicle shall be capable of towing a load of 25 ton track laying, free rolling at a maximum speed of not less than 20 mph and shall be capable of sustained speed at 15 mph. The vehicle shall also be capable of attaining speeds of 2 1/2 mph with towed load on level and hilly cross country terrain.

3.6.4 Acceleration. Vehicle shall accelerate from a standing start to 20 mph in not more than 25 seconds.

3.6.5 Engine starting on grades and slopes. When standing on a 60 percent grade, for not less than 2 minutes, with engine operating under no load between 750 and 1000 rpm, the engine shall be stopped for not less than 2 minutes. The engine shall restart in not more than 1 minute when headed up and headed down grade. Similar engine stopping and starting shall be accomplished on 30 percent right and left side slopes.

3.6.6 Braking.

3.6.6.1 Stopping. Vehicle traveling at a speed of 20 mph shall stop within a distance of 35 feet from point of brake application; drift not to exceed 3 feet.

3.6.6.2 Holding. With vehicle combat loaded or with a simulated load of equal weight and standing on a 60 percent grade with service brakes applied, the vehicle shall be held stationary when headed up and headed down grade. With parking brake engaged and all other holding devices inoperative, the vehicle shall be held stationary when headed up and headed down grade.

3.6.7 Turning. The vehicle shall make continuous, full 360 degree turns to the right and to the left when operating on smooth, level, hard-surfaced terrain. When gear steer is employed the rear point of the outer edge of the vehicle shall be within a 100 foot diameter circle. When clutch brake steer is employed, the vehicle's track pattern shall be within a 35 foot diameter circle.



MIL-G-45397D(AT)

3.6.8 Fording shallow water. Vehicle shall ford hard-bottom salt or fresh water crossing of 42 inches in depth, including wave height without special equipment. With vehicle relatively level and operating in water up to 42 inches in depth for 15 minutes, the average accumulation of water shall be not more than 1 inch in bottom of the hull.

3.6.9 Climbing. Vehicle shall climb longitudinal grades of 60 percent in forward and reverse gear without stalling or damage to power plant and power train.

3.6.10 Trench crossing. Vehicle shall cross trenches 36 inches in depth and 75 inches in width without stalling or damage to vehicle and components.

3.6.11 Vertical obstacle. Vehicle, with fender extensions installed shall cross vertical obstacles up to 34 inches in height without damage to vehicle and components. Vehicle without fender extension shall cross vertical obstacles up to 40 inches in height without damage to vehicle and components.

3.6.12 Hydraulic system. Hydraulic oil conforming to MIL-H-6083 shall be used, and the system shall provide an oil pressure of not less than 1,600 psi or more than 2850 psi.

3.6.12.1 Main hydraulic pump. The main hydraulic pump mechanically driven, at 2080 rpm shall be capable of supplying hydraulic oil at a pressure of 2850 psi, at a flow of not less than 20 gpm throughout the hydraulic systems. The hydraulic system shall under all load conditions be capable of continuous operation for periods of not less than 5 minutes at 2850 psi and 10 minutes at 1600 to 2450 psi.

3.6.12.2 Auxiliary hydraulic pump. The auxiliary hydraulic pump electrically driven with 24 to 29 volts power supply shall be capable of supplying oil at a pressure of 2850 psi at a flow of not less than 2 gpm. With the engine inoperative the auxiliary supply shall be capable of operating the turret and gun controls, spade, weapon firing, and hydraulic systems individually, during all conditions of vehicle operation.

3.6.12.3 Emergency hydraulic pump. A hydraulic pump manually operated shall be capable of supplying adequate oil pressure for limited operation of hydraulic system under emergency conditions when power driven pumps are inoperative.

3.6.12.4 Spade. The spade when in operating position (down) shall be capable of stabilizing the vehicle against the recoil of howitzer or gun, and limited dozing operation. With spade released from locked position, the spade hydraulic system shall limit settling of spade to not more than five inches per minute, and return spade to locked position under all conditions of operation.

3.6.13 Weapon stops. The weapon shall engage the weapon stops at elevations of 0 to plus 30 mils and plus 1157 to plus 1175 mils.

MIL-G-45397D(AT)

3.6.14 Alinement of panoramic telescope. The vertical cross-hair of the telescope reticle shall not deviate from the target point more than 1.0 mil.

3.6.15 Levelness of support plane for panoramic telescope. The level bubble of the cross leveling adjustments shall remain centered within plus or minus 1/2 vial graduation. One graduation equals 0.1 inch.

3.6.16 Accuracy of elevation counter. The maximum allowable deviation of the quadrant elevation from the elevation counter setting is 0.8 mil at zero counter setting and 1.3 mil at all other counter settings.

3.6.17 Backlash. The backlash of the elevation counter shall be not more than 0.7 mil at any elevation counter reading.

3.6.18 Boresight adjustment of direct fire telescope.

3.6.18.1 Deflection. Rotation of the deflection eccentric adjusting screw shall move the telescope socket a minimum of 5 mils to the right and 5 mils to the left of the target aiming point.

3.6.18.2 Elevation. Rotation of the elevation adjusting screw shall move the telescope socket a minimum of 5 mils above and 5 mils below the target aiming point.

3.6.19 Boresight retention. The panoramic telescope line of sight shall maintain its original setting with respect to the weapon tube in azimuth within plus or minus 0.3 mil, and its original setting of elevation counter with respect to the quadrant pads of the breech within plus or minus 0.3 mil. The direct sighting telescope shall maintain its 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. These values exclude the effect of panoramic telescope and elevation counter backlash.

3.6.20 Mount and recoil mechanism. The gun mount and recoil mechanism shall conform to MIL-M-45212.

3.6.21 Equilibrator. The equilibrator shall maintain compensation throughout the vertical range of the gun and howitzer under all operating conditions.

3.6.22 Elevating mechanism. The elevating mechanism shall provide vertical travel from plus 2 degrees to 65 degrees elevation. The power unit shall elevate the gun at a rate of 5.6 degrees per second. With equilibrator in adjustment, the tangential pull at the manual elevating handle shall be not more than 15 pounds in all vertical positions of the gun and howitzer.

3.6.23 Traversing mechanism. The traversing mechanism shall traverse the gun and howitzer 30 degrees to right and 30 degrees to the left of vehicle center line under all operating conditions excepting slopes of more than 10 degrees. The power unit shall be capable of traversing the 175MM gun and 8 inch howitzer at 6 degrees per second on level pad of less than 2 degrees slope and manually at not less than .14 degrees per one turn of the input hand wheel. With the vehicle level the tangential pull at the manual traverse handle shall be not more than 15 pounds.

MIL-G-45397D(AT)

3.6.24 Loader and rammer system. The hydraulically operated, combination loader and rammer shall pick up projectiles from the rear of left side of the vehicle, placing them in position, and ramming them into the chamber of the gun. The manual operated handcranks when installed shall complete the ramming cycle without failure, should the hydraulic system fail to operate. The loader and rammer system shall operate under all conditions of firing without failure.

3.7 Radio suppression. Unless otherwise specified (see 6.2) the complete vehicle shall be radio interference suppressed in accordance with tactical vehicle requirements of Class IIIA of MIL-STD-461.

### 3.8 Painting, marking and data plates.

3.8.1 Painting. Unless otherwise specified (see 6.2) the exterior and interior of turret, components, assemblies, subassemblies, and parts that require painting shall be prepared and painted in accordance with MIL-STD-193. Vehicle exterior paint and non-skid paints shall match color chip X24087 (olive drab) Fed. Std. No. 595.

3.8.2 Marking. Marking (see 6.2) shall be in accordance with MIL-STD-642.

3.8.3 Name, shipping, and service data plates. Data plates shall be in accordance with applicable drawings or as specified by the procuring activity. The plates shall meet the performance requirements of MIL-P-514.

### 3.9 Vibration and noise.

3.9.1 Equipment operation. Equipment operation for training or maintenance purposes shall not exceed the maximum acceptable noise level in accordance with HEL S-1-63B. Noise reduction principles and techniques applied to the equipment shall be determined by the procuring activity. Should the cost of reducing the sound pressure levels to meet the maximum of or below the requirements of HEL S-1-63B become prohibitive, it shall be necessary to obtain the approval of the procuring activity before proceeding with the reduction.

3.9.2 System effectiveness. The reduction of the sound pressure level to or below the maximum acceptable noise level of HEL S-1-63B shall not degrade the system effectiveness.

3.9.3 Crew positions. The noise level at crew positions shall not exceed the limits specified in HEL S-1-63B.

3.9.3.1 Operator's protection. With the equipment operating the sound pressure level of the item or equipment exceeds the maximum acceptable noise levels of HEL S-1-63B equipment shall be conspicuously marked as follows: "Warning, ear protection required within the distance specified herein when equipment is operating."

MIL-G-45397D(AT)

3.10 Fire extinguisher. The fixed fire extinguisher system, when installed in accordance with applicable drawings shall be readily accessible for servicing and for external and internal operation. In ambient temperature of 72°F. the maximum effort required to discharge the system, either internally or externally, shall be not more than 35 pounds.

#### 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 requirements 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 Contractor's 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 control is included in the approved quality control procedure. The contractor shall notify the Government of 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.

4.1.2 Parts and components. Parts, components and assemblies shall be inspected in accordance with the documents listed on LD-8736338, QM-8736338 for the M10, LD-8736339, and QM-8736339 for the M107. Items requiring ozone resistant shall have met "C<sub>1</sub>" test requirements of MIL-STD-417.

4.1.3 Government verification. All quality assurance operations performed by the contractor will be subject to Government verification at unscheduled intervals. Verification will consist of (a) surveillance of the operations to determine that practices, methods, and procedures of the written inspection plan are being properly applied, and (b) Government product inspection to measure quality of product offered for acceptance. Deviation from the prescribed or agreed-upon procedures, or instances of poor practices which might have an effect upon the quality of the product, will immediately be called to the attention of the contractor. Failure of the contractor to promptly correct deficiencies discovered shall be cause for suspension of acceptance until corrective action has been made or until conformance of product to prescribed criteria has been demonstrated.

MIL-G-45397D(AT)

4.1.5 Qualified products. The contractor's inspection records shall be checked to determine contractor 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 the 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 welaments 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.

4.2.2.2.1 Corrections. Corrections found necessary as a result of above inspection shall be made by the contractor on the vehicle.

4.2.2.3 Production vehicle test. After completion of the first vehicle inspection, a second vehicle shall be selected from the first months production or one of the first ten shall be subjected to examination (see 4.4.2) 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 IV. These tests shall be performed by the Government, at a site approved by the Government, which will require a maximum of 90 days. Delays caused by vehicle break-down 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 break-down and failure of the contractor to adequately support the vehicle with parts during the tests shall not be the responsibility of the Government.

MIL-G-45397D(AT)

Table IV. 4000 mile test combat loaded (Government Proving Grounds)

Course	Mileage & speeds
Hard surface roads	1000 miles at varying speeds up to maximum
Gravel and dirt roads	2600 miles at varying speeds up to maximum
Level cross country	200 miles at varying speeds up to maximum
Hilly cross country	200 miles at varying speeds up to maximum

4.2.3 Test failure. Failure of the vehicle as the result of any deficiency of a workmanship or materials nature during or as result of the 4,000 mile, will 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 manufacturer that corrective action has been taken to eliminate the deficiency. Any deficiency found during or as a result of 4,000 mile test shall be prima facie evidence that all vehicles already accepted prior to completion of the 4,000 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 not cost to the Government.

4.3 Break-in 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 distances 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".

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 V) may be accomplished, in the Skid Type Dynamometer in lieu of run specified in 4.3. Prior to the break-in run, each vehicle shall be warmed up in accordance with 3.5.2. Records shall be kept of the instruments readings. The final ten miles of the total break-in run shall be on smooth, level, hard surfaced roads. During this ten mile test, the vehicle shall be subjected to undulating operation, in accordance with 3.5.3 by being operated over the section of road conforming to Figure 1. After completion of divisions "b" and "c", Table V, 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 and at speeds between 5 and 10 mph during division "d". The results of the break-in run in the first twenty vehicles, that meet all requirements, will serve as a standard for the evaluation of the balance of production.



MIL-G-45397D(AT)

Table V. Simulated break-in run

Division of run	Speed mph	Miles of test	Test conditions
a	0 to 10	10	Dynamometer
b	11 to 20	15	Dynamometer
c	21 to Max.	5	Dynamometer
d	10 to Max.	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.

4.4.1 Lot size. An inspection lot shall consist of all vehicles of one type, from one day's production, submitted at one time for acceptance inspection.

4.4.1.1 Sampling for inspection. For the purpose of visual, dimensional, and primary functional inspection, a representative sample shall be selected, from each inspection lot in accordance with inspection level II of Standard MIL-STD-105. Before sampling may be accomplished by the contractor, the contractor shall 100 percent inspect the first 20 vehicles to establish a process average (see 6.7) to allow normal sampling in accordance with Standard MIL-STD-105.

4.4.2 Examinations. Visual, dimensional, and primary functional examination shall consist of examination of the vehicle for conformance to the applicable drawings and this specification. Examination shall be performed against the classification of defects and with the acceptable quality levels shown in Table VI. The following constitutes a part of the classification of defects (see 6.5):

- (a) Any drip constitutes a major 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 to metal or gasket combination shall constitute a major defect.



Table VI. Classification of Defects

Characteristics	Major: AQL 25 Defects/100 Units	Minor: AQL 150 Defects/100 Units	Method of Inspection
Engine	101. Malfunction, leaks (see 6.4) (b), mounting improper, damage	201. Improper component assembly or installation	Visual and functional
Engine governors	102. Improper setting, malfunction	202. Missing or defective seals	Functional
Power train	103. Malfunction, mounting improper, damage	203. Improper component assembly or installation	Visual and functional
Fuel system components	104. Malfunction, leaks (see 6.4) (a), damage	204. Improper assembly, installation or clearance	Visual and functional
Fuel and oil lines valves and hose	105. Defective, clearance improper, malfunction, leaks (see 6.4) (a)	205. Improper assembly or installation	Visual and functional
Cooling system components (engine and transmission)	106. Malfunction, damage, leaks (see 6.4) (b)	206. Improper assembly or installation	Visual and functional
Exhaust system components	107. Damage, leaks	207. Improper assembly, installation or clearance	Visual
Electrical system components (includes wiring and instrumentation)	108. Malfunction damage	208. Improper assembly installation, circuit identification, clearance or protection, illumination of reticle and cant corrector level vial	Visual functional
Suspension system components	109. Damage, tire or track pedal separation, improper clearance or alignment, welding defects leaks, (see 6.4) (b) malfunction	209. Improper assembly, installation, bolt or nut torque and track tension	Visual and functional

MIL-G-45397D(AT)

MIL-G-45397D(AT)

Table VI. Classification of Defects (Cont.)

Characteristics	Major: AQL Defects/100 Units	Minor: AQL 150 Defects/100 Units	Method of Inspection
Full	110. Structure and welding defects		Visual
Controls and adjusting mechanisms	111. Malfunction, improper clearance	210. Improper assembly or installation	Visual and functional
Doors, fenders, grilles, panels, ducts, storage brackets, boxes, shocks and stops	112. Malfunction: torsion spring and hold open devices	211. Improper fits, adjustments, assembly or installation	Visual and functional
Drain valves	113. Valve seating improper	212. Improper assembly, installation of control adjustments	Visual and functional
Cushions, seats, rests, and crash pads	114. Seat control malfunction	213. Improper fit damage, installation or adhesion	Visual and functional
Gun and howitzer travel lock	115. Locking lug, damage, malfunction	214. Improper assembly or installation	Visual and functional
Spade and controls	116. Malfunction, misalignment	215. Improper assembly or installation	Visual and functional
Traversing and elevating mechanisms	117. Clearance improper, component damage	216. Improper assembly, installation or chain adjustment	Visual and functional
Hydraulic power pack, motors and lines	118. Component damage, leaks (see 6.4) (b)	217. Improper assembly, installation, hydraulic fluid level and type improper	Visual and functional
Recoil mechanisms, replenisher and lines	119. Component damage, indicators or lines defective	218. Improper assembly, installation, fluid level and type improper	Visual and functional

Table VI. Classification of Defects (Cont'd)

Characteristics	Major: AQL Defects/100 Units	Minor: AQL 150 Defects/100 Units	Method of Inspection
Rammer hydraulic system and controls	120. Component damage, leaks (see 6.4) (b) clearance improper	210. Improper component assembly, installation, fluid level and type improper	Visual and functional
Main armament	121. Component damage, improper assembly or trunnion cap bolt torque		
Gun equilibrators	122. Malfunctional, casting defects damage	220. Improper assembly installation and adjustment	Visual and functional
Breech operating mechanisms and controls	123. Malfunction binding	221. Improper assembly and installation	Visual and functional
Weapon control system, (includes panels, solenoids, switches, wiring and other components)	124. Component damage, defective wiring	222. Improper clearance assembly and installation, circuit identification, protection or markings	Visual and functional
Misc. items or accessories	125. Malfunction, damage, missing	223. Improper assembly and installation	Visual and functional
Fire extinguisher system components	126. Seals missing or defective	224. Data card incomplete, improper assembly or installation	Visual and functional
Painting and protective and anti-skid coatings		225. Application, coverage and materials improper	Visual
Lube fittings and lubrication		226. Fittings missing, defective or improperly installed, lubrication improper	Visual
Decals, marking data and instruction plates		227. Incomplete data, missing, improper location or size, illegible	

MIL-G-45397D(AT)

MIL-D-45397D(AT)

4.4.2.1 Unclassified defects. All defects having no bearing on function safety, interchangeability or life, but are considered departures from good workmanship will be noted in writing. Workmanship deficiencies falling within this category and recurring in 5 consecutive lots or ten lots or more within a thirty-day period will be added to the minor classification with no increase in AQL's.

4.4.2.2 Recurring major deficiencies. A major deficiency is recurring when the same defect occurs more than once in the same sample or when the defect occurs in two successive samples. A major defect may be considered recurring when the historical inspection records ("P" chart of approved equivalent) reflect such a condition. Recurring major deficiencies shall be cause for the entire lot or lots to be inspected for the recurring deficiencies. The deficiencies shall be corrected when found (see 6.8).

4.4.2.3 Recurring minor deficiencies. A minor deficiency is recurring if it occurs more than twice in the same sample or when the defect occurs in four successive samples. Recurring minor deficiencies shall be cause for the entire lot or lots to be inspected for the recurring deficiency. Correction of all deficiencies shall be accomplished prior to acceptance (see 6.8).

#### 4.5 Classification of tests

- (a) Acceptance test 4.5.1 through 4.5.1.24.12.
- (b) Control tests 4.5.2 through 4.5.2.10.
- (c) Comparison tests 4.5.3 through 4.5.3.14.

##### 4.5.1 Tests.

4.5.1.1 Acceptance tests. To determine conformance to 3.6, after break-in run, (see 3.5) each vehicle selected in accordance with 4.4.1.1 shall be operated for a distance of eight miles or more and shall be inspected as specified in 4.4.2 and subjected to Acceptance Tests specified at place of manufacture in Table VII. Except for equipment and component installation and servicing performed by the contractor as a final processing of vehicles for acceptance, vehicles shall be completely assembled and serviced with fuel, lubricants, and fluid as specified, but need not be combat loaded except for holding test as specified in 4.5.1.18. After the test, the vehicle shall be examined for evidence of fuel or 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 corrective action has been taken.

MIL-D-45397D(AT)

Table VII. Location for tests

Title	Paragraph References	Place of Mfg.	Government Proving Ground
Acceptance tests	4.5.1	X	X
Sealing and seals leakage check	4.5.1.2	X	X
Sealing and seals check	4.5.1.2.1	X	X
Hatch and door seal test	4.5.1.2.2	X	X
Fuel system slope check	4.5.1.3	X	X
Hydraulic reservoir check	4.5.1.4	X	X
Controls and adjustment mechanisms check	4.5.1.5	x	x
Throttle linkage check	4.5.1.6	X	X
Fuel shut-off valve check	4.5.1.7	X	X
Seating check	4.5.1.8	X	X
Generator voltage check	4.5.1.9	X	X
Light check	4.5.1.10	X	X
Communication equipment electrical circuits check	4.5.1.11	X	X
Vision devices and receptacle test	4.5.1.12	X	X
Power package and train test	4.5.1.13	X	X
Speed test no load	4.5.1.14	X	X
Acceleration test	4.5.1.15	X	X
Engine starting on grades and slopes test	4.5.1.16	X	X
Stopping test	4.5.1.17	X	X
Holding test	4.5.1.18	X	X
Turning test	4.5.1.19	X	X
Shallow water fording test	4.5.1.20	X	X
Hydraulic system and hydraulic pump test	4.5.1.21	X	X
Spade test	4.5.1.22	X	X
Weapon stop tests	4.5.1.23	X	X
Fire control sighting and gun control tests	4.5.1.24	X	X
Equipment	4.5.1.24.1	X	X
Preliminary checks and adjustments	4.5.1.24.2	X	X
Alignment of panoramic telescope check	4.5.1.24.3	X	X
Levelness of support plane for panoramic telescope test	4.5.1.24.4	X	X
Accuracy of elevation counter check	4.5.1.24.5	X	X
Backlash check	4.5.1.24.6	X	X
Boresight adjustment of direct fire telescope check	4.5.1.24.7	X	X
Boresight retention	4.5.1.24.8	X	X
Mount, recoil mechanism and equilibrator check	4.5.1.24.9	X	X
Elevating mechanism check	4.5.1.24.10	X	X

MIL-G-45397D(AT)

Table VII. Location for tests (Con't)

Title	Paragraph References	Place of Mfg.	Government Proving Ground
Traversing mechanism test	4.5.1.24.11	X	X
Loader and rammer system check	4.5.1.24.12	X	X
Control test	4.5.2	X	X
Contamination test	4.5.2.3	X	X
Carbon monoxide concentration test	4.5.2.4	X	X
Fuel tank test	4.5.2.5	X	X
Suspension lockout test	4.5.2.6	X	X
Fasteners and lock checks	4.5.2.7	X	X
Stowed equipment test	4.5.2.8	X	X
Engine air induction system test	4.5.2.9	X	X
Fire extinguisher test	4.5.2.10	X	X
Comparison test (CT)	4.5.3	X	X
Winterization equipment test	4.5.3.2	X	X
Air cleaner check	4.5.3.3	X	X
Fuel system operational test	4.5.3.4		X
Communications equipment operational test	4.5.3.5		X
Environmental test	4.5.3.6		X
Cooling system test	4.5.3.7		X
Speed test with towed load	4.5.3.8		X
Climbing test	4.5.3.9		X
Trench crossing test	4.5.3.10		X
Vertical obstacle test	4.5.3.11		X
Radio suppression test	4.5.3.12		X
Vibration and noise level check	4.5.3.13		X
Sound level meter and microphone	4.5.3.13.1		X
Fire extinguisher system test	4.5.3.14		X

#### 4.5.1.2 Sealing and seals leakage check.

4.5.1.2.1 Sealing and seals check. To determine conformance to 3.4.1.1 and 3.4.1.2, prior to and after fording and amphibious operations the vehicle shall be checked for the amount of water in vehicle and the leaking of lubricants.

4.5.1.2.2 Hatch and door seal test. To determine conformance to 3.4.1.3, the hatch and doors shall be closed and locked, and a spray of water directed on the hatch and door for a period of 3 minutes. Hatch and door shall be checked for leakage.

4.5.1.3 Fuel system slope check. To determine conformance to 3.4.5, 3.4.5.1 and 3.4.5.2, with the vehicle specified grades and slopes; the engine operating between 750 and 1000 rpm the fuel system shall be checked for leaks and supply of fuel to the engine.

MIL-G-45397D(AT)

4.5.1.4 Hydraulic reservoir check. To determine conformance to 3.4.6, the hydraulic reservoir shall be checked for cleanliness and leaks.

4.5.1.5 Controls and adjustment mechanisms check. To determine conformance to 3.4.8 and 3.4.9, all controls shall be operated and checked for functional requirements. Adjustment mechanisms shall be examined for proper adjustments.

4.5.1.6 Throttle linkage check. To determine conformance to 3.4.13, the throttle pedal shall be operated to full throttle, and checked to assure that full rack position has been reached.

4.5.1.7 Fuel shut-off valve check. To determine conformance to 3.4.14, with the engine operating at 750 to 900 rpm, the fuel shut-off handle shall be pulled to the "off" position. The time for the engine stop operation shall be determined.

4.5.1.8 Seating check. To determine conformance to 3.4.15 the seat shall be operated throughout its entire functional requirements.

4.5.1.9 Generator voltage check. To determine conformance to 3.4.16.1, the generator voltage shall be checked using a calibrated master voltage meter.

4.5.1.10 Light check. To determine conformance to 3.4.16.2, all lights shall be operated during and after the break-in run throughout all stages of operation, and checked for functional requirements.

4.5.1.11 Communication equipment electrical circuits check. To determine conformance to 3.4.16.3, all communication equipment electrical circuits shall be checked for continuity and shorts.

4.5.1.12 Vision devices and receptacle test. To determine conformance to 3.4.17, the driver's periscopes shall be installed in the proper receptacles and checked for leaks.

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

4.5.1.14 Speed test no load. To determine conformance to 3.6.3.1, the vehicle shall be operated as specified and checked for functional requirements.

4.5.1.15 Acceleration test. To determine conformance to 3.6.4, the vehicle shall be operated as specified and the speed and time checked.

4.5.1.16 Engine starting on grades and slopes test. To determine conformance to 3.5.2 and 3.6.5, the engine shall start and oil pressure 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.



MIL-G-45397D(AT)

4.5.1.17 Stopping test. To determine conformance to 3.6.6.1, the vehicle shall be operated on dry level hard-surfaced road without loose material and checked for functional requirements.

4.5.1.18 Holding test. To determine conformance to 3.6.6.2, the vehicle shall be driven up the specified grade, service brakes applied and held for not less than one minute and vehicle observed for movement. With brakes locked for parking the vehicle shall be held stationary for not less than 2 minutes and observed for movement. During this test vehicle shall be combat loaded or with 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).

4.5.1.19 Turning test. To determine conformance to 3.6.7, vehicle shall be operated and turned to right and left in full 360 degrees pivot turn, and checked for diameter of turns.

4.5.1.20 Shallow water fording test. To determine conformance to 3.6.8, 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.

4.5.1.21 Hydraulic system and hydraulic pump tests. To determine conformance to 3.6.12, through 3.6.12.3, the hydraulic system and pumps shall be operated and checked for functional requirements.

4.5.1.22 Spade test. To determine conformance to 3.6.12.4, the spade test shall be operated as specified and checked for functional requirements.

4.5.1.23 Weapon stop tests. To determine conformance to 3.6.13, the weapon shall be operated in elevation as specified and the stop settings checked by a calibrated gunner's quadrant.

4.5.1.24 Fire control sighting and gun control tests.

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

- (a) Mechanical jacks or a leveling platform for orienting vehicle to level the gun tube.
- (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.

MIL-G-45397D(AT)

- (c) A boresight retention and checking target shall be constructed of non-warping and non-skrinking 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  $\frac{1}{8}$  inch.
- (d) An approved "borescope" shall be used. This shall be a telescope with a crosshair reticle mounted in a self aiming fixture to be inserted in the breach of the weapons so that the crosshairs of the telescope fall on the center line of the bore. The scope shall have a separate focus for reticle and field and be adjustable from 5 yards to 500 yards. The reticle of the telescope shall be centered with respect to the outside diameter of the adapter within 0.1 mil. The scope shall have a magnification of 20 X or higher.
- (e) Parallax shields with a centrally located 1/16-inch maximum diameter hole shall be placed over the eyepiece of the telescope to eliminate parallax.
- (f) A master Panoramic Telescope M115, and a master Direct Sighting Telescope M116 of M116C (see 6.4). A master telescope is defined as a scope with the line of sight fixed in correct relationship to the mounting surfaces.
- (g) A calibrated gunner's Quadrant M1. A calibrator 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.

4.5.1.24.2 Preliminary checks and adjustment. The following preliminary checks and adjustments shall be used:

- (a) The front of the vehicle shall be depressed as specified herein so the weapon can be leveled fore and aft without touching the guns stops. Fore and aft inclination of the turret ring shall be determined with a gunner's quadrant and level bar to compute the true gun stop limits.
- (b) The mounts shall be inspected for tight mechanical installation and proper pinning.
- (c) No interference shall exist between or among components of the fire control and components of the vehicle at or between the maximum limits of elevation.

MIL-G-45397D(AT)

- (d) The vehicle shall be cross leveled so that the weapon will track one edge of the plumbline. In no instance shall the weapon deviate more than one half the thickness (1/16-inch) of the plumb line. This shall be accomplished by using the borescope (see 4.5.1.24.1(d) inserted in the breech and setting the muzzle cross wires on the edge of the plumb line at zero elevation. The weapon shall be elevated to the maximum limit possible (not less than 30 degrees) and the above tolerance checked.

4.5.1.24.3 Alinement of panoramic telescope check. To determine conformance to 3.6.14, 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 vial level and weapon at zero elevation, 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 functional requirements.

4.5.1.24.4 Levelness of support plane for panoramic telescope test. To determine conformance to 3.6.15, without altering the cross level adjustment made at zero elevation in 4.5.1.24.3, the weapon shall be elevated to 1100 mils, and the weapon checked for functional requirements.

4.5.1.24.5 Accuracy of elevation counter check. To determine conformance to 3.6.16, a calibrated gunner's quadrant shall be placed on the breech pads of the weapon and the difference between each elevation counter reading shall be separately checked and noted. The check points shall include zero, 100, 500, 600, 1000 and 1100 mils counter elevation. At each setting, and for each counter separately, the elevation counter shall be set by rotating the adjusting knob slowly in a direction to increase the elevation values to the check points stated. The elevation level vial will be centered by laying the weapon from low to high to exclude backlash and the true weapon elevation shall be read with the gunner's quadrant to ascertain conformance to functional requirements.

4.5.1.24.6 Backlash check. To determine conformance to 3.6.17, for each elevation counter separately the counter shall be set by rotating the adjustment knob in a direction to increase the counter values to the check point. The weapon shall then be laid to center the vial bubble and the true elevation read with the gunner's quadrant on the breech pads. Record the reading. The elevation counter shall then be set by rotating the adjustment knob in a direction to decrease the counter reading to the check point. The weapon shall be laid to center the vial bubble and the true elevation read with the gunner's quadrant on the breech pads. The difference between these two readings is the backlash for that counter at the check point specified. Note counters must be checked separately.

4.5.1.24.7 Boresight adjustment of direct fire telescope check. To determine conformance to 3.6.18 through 3.6.18.2, the deflection and elevation adjusting screws shall be rotated, and the telescope socket checked for movement to the right and left.

MIL-G-45397D(AT)

4.5.1.24.8 Boresight retention.

- (a) Prior to performing any boresight retention test, cross level the trunnions within plus or minus 1.0 mil.
- (b) Prior to the eight mile road test specified herein, lay the weapon exactly on the center of its aiming point as shown in figure 2. Cross level the M-15 quadrant. Place the line of sight of the direct sighting telescope on its target aiming point and lock the adjustments. Cross level the M137 panoramic telescope mount. Place the vertical reticle line of the panoramic telescope on its target aiming point by rotating the azimuth counter knob in a direction to increase counter values. Record the reading.
- (c) Following the eight mile road test, lay the weapon exactly on its aiming point and cross level the M-15 quadrant and the M137 panoramic telescope mount, without disturbing the adjustments on the direct fire telescope view through the telescope to determine conformance with 3.6.19.
- (d) Rotate the azimuth counter knob in a direction to increase the counter values recorded in (b). Examine the sight picture on the boresighting board to determine conformance with 3.6.19.

4.5.1.24.9 Mount, recoil mechanism and equilibrator check. To determine conformance to 3.6.20 and 3.6.21 the mount, and recoil mechanism equilibrator shall be operated and checked for functional requirements.

4.5.1.24.10 Elevating mechanism test. To determine conformance to 3.6.22, the elevating mechanism shall be operated throughout all ranges, and checked for functional requirements.

4.5.1.24.11 Traversing mechanism test. To determine conformance to 3.6.23, the traversing mechanism shall be operated throughout all degrees of traversing and checked for functional requirements.

4.5.1.24.12 Loader and rammer system check. To determine conformance to 3.6.24, the rammer system shall be operated and checked for functional requirements.

4.5.2 Control tests. 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 following control test paragraphs.

MIL-G-45397D(AT)

4.5.2.2 Failure. If the vehicle selected fails to pass any of the control tests the Government inspector shall stop acceptance examination and testing on subsequent lots until such time as conditions causing the failure have been remedied.

4.5.2.3 Contamination test. To determine conformance to 3.4.1, 3.4.1.1, 3.4.1.2, and 3.6.8, the vehicle after the water fording test, shall be examined for contamination of lubricants of the transmission, engine, final drive, and road wheels 2, 3, 4, 5 and one of their corresponding arms, on each side of the vehicle. Contamination shall not exceed 2 percent.

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

4.5.2.5 Fuel tank test. To determine conformance to 3.4.5.1, 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 Suspension lockout test. To determine conformance to 3.4.7, the suspension lockout shall be operated and checked for functional requirements.

4.5.2.7 Fasteners and lock checks. To determine conformance to 3.4.10, fasteners and locks shall be operated and checked for functional requirements.

4.5.2.8 Stowed equipment test. To determine conformance to 3.4.11, all manufacturer and depot installed OVE shall be stowed (combat loaded) on the selected vehicle. All items shall fit with proper clearance in the spaces provided. The equipment shall be removed after the test. The OVE used shall be as specified in the contract and the contractor shall be permitted to unpackage and repackage (for domestic shipment only) equipment used for test.

4.5.2.9 Engine air induction system test. To determine conformance to 3.4.12, the engine air induction system shall be checked for internal cleanliness and for specified pressure.

4.5.2.10 Fire extinguisher test. To determine conformance to 3.10, the fire extinguisher system shall be functionally tested. One vehicle selected from the first ten produced shall have the fire extinguisher tested both sides, subsequent tests of one in each fifty testing alternately the internal and external controls.

4.5.3 Comparison tests (CT). The Government may select vehicles any time during the contract production period and subject vehicle to tests listed in table VII and table VIII to reveal deficiencies of manufacture 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

MIL-G-45397D(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 3.4.11. 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 major 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 VIII. 2000 mile test combat loaded  
(Government Proving Grounds)

Course	Mileage* & Speeds
Hard surface roads	300 miles at varying speeds up to maximum
Gravel and dirt roads	1300 miles at varying speeds up to maximum
Hilly cross country	200 miles at varying speeds up to maximum
Level cross country	200 miles at varying speeds up to maximum

4.5.3.2 Winterization equipment test. To determine conformance to 3.4.2, the vehicle properly serviced and equipped, shall be subjected to specified ambient temperatures and observed for satisfactory starting and operation of the engine and personnel heaters.

4.5.3.3 Air cleaner check. To determine conformance to 3.4.4, during and after operation, the air cleaners shall be checked for functional requirements.

4.5.3.4 Fuel system operational test. To determine conformance to 3.4.5, 3.4.5.1 and 3.6 in conjunction with all vehicle slope tests, the vehicle fuel system shall be checked for functional requirements. The tanks shall be filled, as specified, and rate of filling checked.

4.5.3.5 Communications equipment operational test. To determine conformance to 3.4.16.3 communication system equipment shall be installed, subjected to tests and checked for operational requirements.

4.5.3.6 Environmental 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.



MIL-G-45397D(AT)

4.5.3.7 PoCooling system tests. To determine conformance to 3.6.2.2, the vehicle shall be operated as specified and cooling systems checked for functional requirements.

4.5.3.8 Speed test with towed load. To determine conformance to 3.6.3.2, each vehicle selected shall be operated as specified and checked for functional requirements.

4.5.3.9 Climbing test. To determine conformance to 3.6.9, the vehicle shall be driven in forward and reverse gear up an approved 60 percent grade.

4.5.3.10 Trench crossing tests. To determine conformance to 3.6.10, the vehicle shall be driven without stalling over trenches, as specified, without damage to the vehicle or components.

4.5.3.11 Vertical obstacle tests. To determine conformance to 3.6.11, the vehicle shall be driven without stalling over obstacles as specified without damage to the vehicle or components.

4.5.3.12 Electromagnetic compatibility test. To determine conformance to 3.8, the vehicle shall be tested in accordance with the applicable provisions of MIL-STD-461 (see 6.11).

4.5.3.13 Vibration and noise level check. To determine conformance to 3.9 through 3.9.3.1, the average of 3 noise level readings at each octave band shall be determined for the following situations and combinations.

- (a) At each operation head position under normal operational procedures.
- (b) At each instruction and trainee head position where training is conducted.
- (c) At each maintenance personnel head position, where maintenance is conducted with the equipment operating.
- (d) All positions where other personnel may be present in or on the equipment, representative sample readings shall be made above.

4.5.3.13.1 Sound level meter and microphone. The sound level meter and microphone used shall be in accordance with applicable documents (see 6.6).

4.5.3.14 Fire extinguisher system test. To determine conformance to 3.10, the fire extinguisher system shall be separately exercised and results examined for distribution and performance.

## 5. PREPARATION FOR DELIVERY

5.1. Preparation for delivery and storage shall be in accordance with MIL-G-46723.



MIL-G-45397D(AT)

## 6. NOTES

6.1 Intended use. The vehicle is intended for use by the Army 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) Winterization equipment 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 Master panoramic telescope. If sufficient telescopes are not available telescopes furnished with the vehicle may be used for the purpose of test specified in 4.5.1.24.1(f) with concurrence of the regional contracting officers representative.

6.5 The following shall be used with the classification of defects:

- (a) Weep - Any evidence of fluid beyond the seal.
- (b) Seep: - Any evidence of fluid beyond the seal that does not result in function 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.

6.6 The following publications should be used in determining sound pressure level.

ASA Z24.10-1953

Octave-Band Filter Set for the  
Analysis of Noise and Other Sounds

ASA S1.1-1960

Acoustical Terminology

ASA S1.4-1961

General Purpose Sound Level Meters

(Applications for copies of these documents should be addressed to American Standards Association, 10 East 40th St., New York 16, N. Y.)

6.7 Process average. Sampling may be initiated if the process average value for the first twenty vehicles inspected is less than the AQL specified in the classification of defects for major and minor defects. Process average shall be computed as follows:

MIL-G-45397D(AT)

$$\text{Process Average} = \frac{\text{Number of Defects}}{\text{Number of Vehicles Inspected}} \times 100$$

If the computed process average exceeds the specified AQL, 11% inspection shall be performed and continued until such time that the process average for twenty consecutive vehicles is less than the specified AQL.

6.8 Definitions of recurring major and minor defects. The Government Inspector will verify that a thorough inspection of each vehicle is performed by the contractor not only for the listed characteristics, but also for any other departures from good workmanship. The Government Inspector will assure that all deficiencies encountered during the inspection are enumerated on the Deficiency Sheet for the vehicle. The defects noted on Deficiency Sheet shall contain sufficient description to enable the Government Inspector and the contractor's representative to classify the deficiency in accordance with the classification of defects of the vehicle specification and definitions contained in MIL-STD-105. Corrective action shall be taken for recurring deficiencies.

6.9 International standardization agreement. Certain provisions of this specification are the subject of international standardization agreement ABCA-ARMY-STD-150 (see 3.4.19) and NATO STANAG 2805-A (Edition 3) (see 3.6.8). When amendment, revision, or cancellation of this specification is proposed which will effect or violate the international agreement concerned, the preparing activity will take appropriate reconciliation action through international standardization channels, including departmental standardization offices, if required.

6.10 Electromagnetic compatibility test. The contracting officer should submit a copy of the report(s) required in 4.5.3.13 to the Commanding General, 07703, for approval.

Custodian:  
Army

Preparing activity:  
Army

Project No. 2350-A202

MIL-G-45397D(AT)

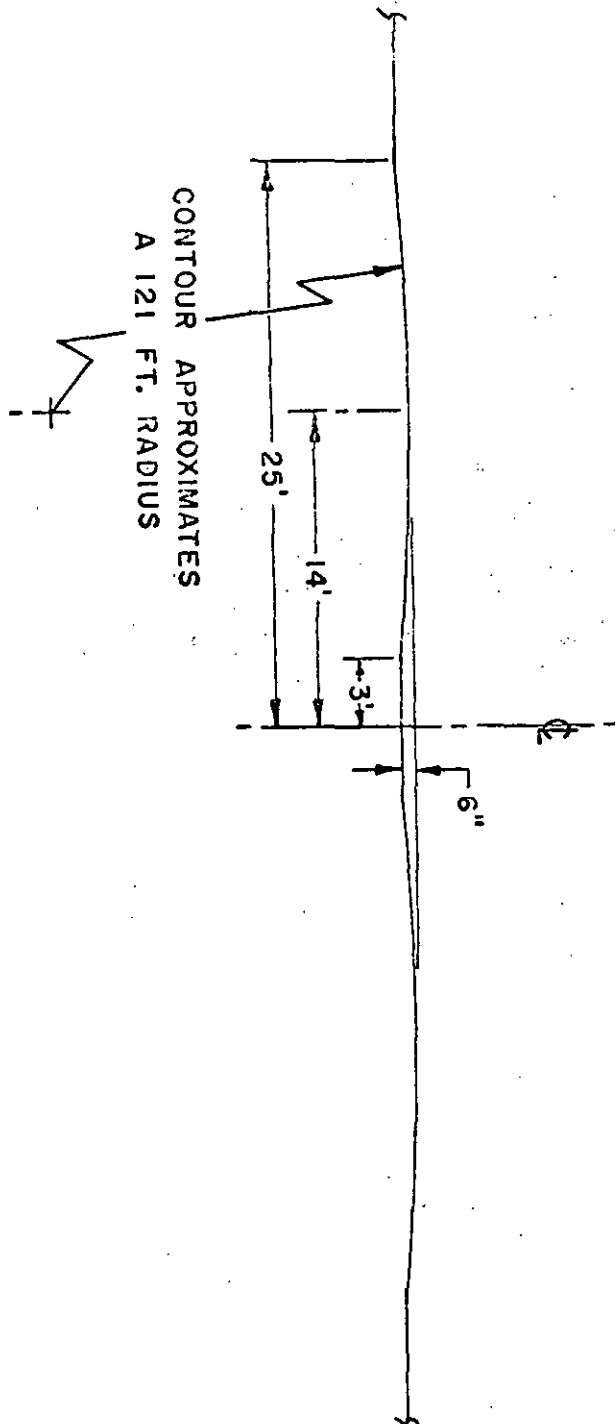
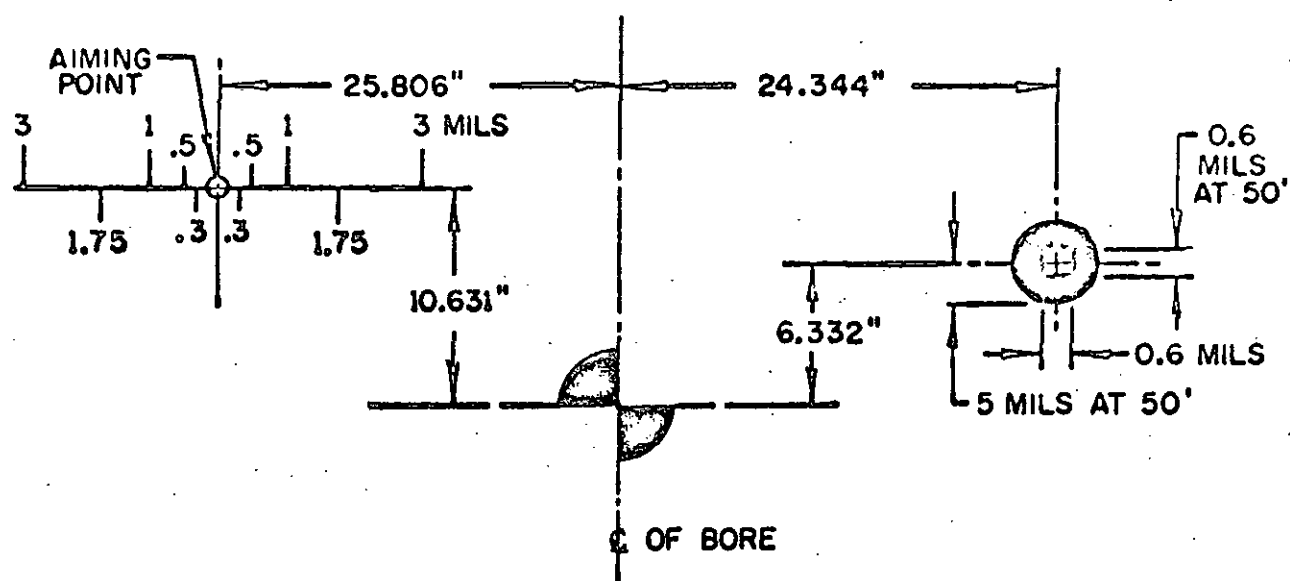


FIGURE 1 - PROFILE OF TEST TRACT  
(ARTIFICIAL BUMP)

MIL-G-45397D(AT)

PANORAMIC TELESCOPE M115

DIRECT FIRE TELESCOPE M116



TOLERANCES :  
 INCHES  $\pm .005"$   
 MILS  $\pm .01$  MILS AT 50'

BORESIGHT RETENTION AND CHECKING TARGET  
 FOR SELF-PROPELLED VEHICLES M107 & M110

FIGURE 2

FOLD

POSTAGE AND FEES PAID



**OFFICIAL BUSINESS**  
PENALTY FOR PRIVATE USE \$300

Commander  
Rock Island Arsenal  
ATTN: SARRI-LE-S  
Rock Island, IL 61201

FOLD

