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MILITARY SPECIFICATION

ARMORED RECONNAISSANCE, AIRBORNE ASSAULT VEHICLE: FULL TRACKED, 152MM, M551 AND M551A1 (W/LASER RANGE FINDER) (OVERHAUL)

1. SCOPE

1.1 Scope. This specification pertains to one type of air droppable, full-tracked, amphibious, cross-country, armored vehicle mounting a 152mm gun/launcher.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitations for bids or requests for proposals, form a part of this specification to the extent specified herein.

SPECIFICATIONS

Federal

VV-F-800 - Fuel Oil, Diesel.

Military

MIL-P-514 - Plates: Identification, Instructions and Marking Blank.

MIL-O-13830 - Optical Components for Fire-Control Instruments General Specification Governing the Manufacture, Assembly and Inspection of.

MIL-A-62019 - Armored Reconnaissance, Airborne Assault Vehicle M551; Processing for Storage and Shipment of.

MIL-R-50749(MU) - Laser Range Finder AN VVG-1.

STANDARDS

Federal

Federal Std. No. 595 - Colors.

FSC-2350

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 Composition, Vulcanized General Purpose, Solid (Symbols and Tests).
MIL-STD-461 - Electromagnetic, Interference Characteristics Requirements for Equipment.
MIL-STD-642 - Identification Marking of Administrative, Combat, and Tactical Transport Vehicles.

PUBLICATIONS

8736408 - Engineering Parts List for Armored Reconnaissance/Airborne Assault Vehicle: Full Tracked, 152mm, M551.
8736408 - Master List of Supplementary Quality Assurance Provisions for Armored Reconnaissance/Airborne Assault Vehicle: Full Tracked, 152mm, M551.

TB MED 269 - Carbon Monoxide, Systems, Etiology, Treatment and Prevention of Overexposure.

OSHA Part 1910 - Occupational Safety and Health Standards.

SHILLELAGH

Missile System Technical Procedure 6829 - Missile Guidance and Control System Checkout Procedures using Test Set AN/MSM-93 for M551 Turret.

(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 First overhauled vehicle. The first overhauled 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.

3.1.1 Workmanship and materials. The workmanship shall be of quality to assure that the overhauled vehicle and components thereof are free from any defects that compromise, limit, or reduce the vehicle or component capabilities herein expressed. Vehicles overhauled in accordance with this specification shall be subjected to examinations and tests to prove vehicle capabilities to perform in accordance with the following:

A. Reliability (Failure per Joint CDC/AMC Definition, dated 27 Mar 72)

1. Vehicle (Mobility)
0-1500 odometer miles; Mean Miles Between Failures (MMBF) not less than 1000, 1500-3200 odometer miles; MMBF not less than 700

2. Time dependent equipment (fire, turret, guidance control system, test equipment, vision devices and all nonmobility equipment)

3. Component Life

(a) Engine and transmission combined
0-3200 odometer miles; MMBF not less than 5000

(b) Gun launcher system (exluding tube)
0-500 rounds; Mean Rounds Between Failures (MRBF) not less than 200

(c) Tube life to be 200 effective rounds minimum

B. Maintainability

1. The total scheduled maintenance excluding driver/crew check and service shall not exceed 180 manhours and the total unscheduled maintenance shall not exceed 125 manhours during 5000 miles of operation.

2. Each maintenance requirement shall not exceed the following:

(a) Crew (24 hour day or 0-100 miles) = 30 minutes

(b) Scheduled maintenance (3 days or 300 miles) = 30 minutes

(c) Schedule maintenance (9 days or 900 miles) = 30 manhours

(d) Mean maintenance time (unscheduled) = 4 clockhours.

3.1.1.1 Vehicle operation. To assure that workmanship and materials requirements are met during the 3,200 miles of vehicle operation the vehicle combat loaded or with simulated load of equal weight shall operate as follows:

(a) 20 percent on paved roads, either concrete or asphalt or any combination of the two.
(b) 20 percent on gravel and dirt roads with at least 10 percent of this distance under mud conditions.
(c) 30 percent on level cross-country terrain.
(d) 30 percent on hilly cross-country terrain.

3.2 Materials.

3.2.1 Ozone resistance. Unless otherwise specified on detail drawings, rubber components which are subject to tension or flexure shall be ozone resistant to the degree required by the "C_1" test requirements of MIL-STD-417.

3.2.2 Qualified products. With respect to all assemblies and components parts requiring product qualification in accordance with the pertinent specifications or drawings listed on the EPL cited in 3.3, and necessary in the construction of this vehicle, the contractor shall be responsible for using only those products which are listed (by part or drawing number as QPL items) on the QPL or which have been approved for inclusion on such lists. Contractor's inspection records shall specifically list such component(s), name of supplier(s) (as listed on the QPL or in the approval letter), and number and date of the QPL from which the selection was made or date of approval letter when products are approved but not as yet listed on the QPL.

3.3 Overhaul. Vehicles shall be overhauled in accordance with contract, technical data package and this specification. When new parts are required, they shall conform to specifications, standards and drawings listed in EPL 8736408. All parts requiring identification shall be identified in accordance with MIL-STD-130.

3.3.1 Sealing and seals. After operation in water, the water content of the lubricants in the suspension system shall be not more than 2 percent (by volume). Also, seals shall restrict leakage of internal lubricants from bearings to an extent no greater than specified in 6.4(b). Static fit joints shall be adequate to prevent excessive leakage of water into the vehicle.

3.3.1.1 Hatch seals. With hatches closed, seals shall restrict the entrance of external water into the occupied portion of the vehicle to an extent no greater than specified in 6.4(d).

3.3.2 Special kits. When specified (see 6.2) vehicles with the following special kits, shall have the kits removed, overhauled and reinstalled.

3.3.2.1 Winterization kit. Provisions shall be made for installation of the winterization kit. When the kit is installed and operating, standby heat shall be provided by the kit to maintain temperatures of engine coolant and battery electrolyte. Engine start-up shall be assured after extended shutdown periods in ambient temperatures between minus 25°F and minus 65°F.

3.3.2.2 Collective protector kit. All vehicles shall be equipped with the components required for installation of the collective protector kit. When the kit is installed and operating, with a minimum voltage input to the filter assembly of 27 volts DC, a minimum of 3.5 cubic feet of air per minute shall be supplied to each of the four installed personnel masks.

3.3.3 Vision devices (excluding telescope mount). Upon installation of all mounts and Government supplied vision devices, the entrance of external water into the vehicle shall be restricted so as to not exceed the amount specified in 6.4(d). All vision devices/optical equipment shall be free of digs, chips and scratches in accordance with MIL-O-13830.

3.3.4 Carbon monoxide concentration. The combination of the vehicle exhaust and ventilating systems shall prevent the accumulation of carbon monoxide in the occupied portions of the vehicle in excess of 0.005 percent.

3.3.5 Controls. Controls for the engine, transmission, electrical equipment, armament and other mechanisms, as vehicle installed and adjusted, shall operate within the ranges specified on applicable drawings.

3.3.5.1 Throttle linkage. With the throttle linkage installed and the accelerator pedal fully depressed, the governor throttle shaft shall be at full open position and the accelerator pedal shall be in contact with accelerator pedal stop.

3.3.6 Hatch mechanisms. With the vehicle on level terrain, the following requirements shall be met.

3.3.6.1 Driver's hatch. The force required to rotate the unlatched hatch to the full open position shall not exceed 35 pounds when applied to the hatch locking lever.

3.3.6.2 Loader's hatch. The force required to open the unlatched hatch shall not exceed 30 pounds when applied to the edge of the hatch opposite the hinges.

. . 3.3.6.3 Escape hatch. The force required to unlatch the escape hatch shall not exceed 20 pounds when applied to the end of the hatch locking lever.

3.3.6.4 Battery access and air cleaner access doors. After unlatching, the force required to open the battery access door shall not exceed 30 pounds, and the force required to open the air cleaner access door shall not exceed 44 pounds, when these forces are applied to their respective lifting handles.

3.3.6.5 Commander's hatch. The commander's split hatch shall be capable of attaining three open positions: 90 degrees, 135 degrees and 180 degrees. The force required to open the unlatched hatch shall not exceed 30 pounds when applied to either hatch cover at the split line.

3.3.7 Seating. With the vehicle on level terrain, the following requirements shall be met.

3.3.7.1 Driver's seat. With the seat occupied, the actuating force required at the end of the fore and aft seat adjustment lever shall not exceed 12 pounds. With the seat unoccupied, the actuating force required at the end of the vertical

adjustment lever shall not exceed 35 pounds. The back rest shall be capable of being folded into the seat pan and then, upon manual actuation of the release lever, the seat assembly shall move into and remain in its vertical position.

3.3.7.2 Gunner's seat. When unoccupied, the seat shall be free of binding throughout its operating range. With the seat occupied, the force required to pull the fore and aft adjustment pin shall not exceed 10 pounds.

3.3.7.3 Commander's seat. With the seat unoccupied, the pin disengaging force required at the end of the seat adjustment lever shall not exceed 35 pounds. With the seat unoccupied, the seat pan shall move into, and remain in, its vertical position. With the seat unoccupied and in its lowest position, the seat shall be capable of being adjusted upward a minimum of 11 inches.

3.3.7.4 Loader's seat. With the seat unoccupied, the seat pan shall move into, and remain in, its vertical position.

3.3.8 Fuel system. The fuel tank, containing 10 to 15 gallons of fuel, shall maintain fuel supply to the engine when the vehicle is ascending and descending 60 percent grades in forward and reverse gears, and when the vehicle is operated on 40 percent side slopes, with each side of vehicle up slope.

3.3.8.1 Fuel tanks. Provisions shall be made to assure the internal cleanliness of the fuel tanks prior to initial fueling of the vehicle. The fuel tanks shall be capable of receiving fuel at an average rate of 50 gallons per minute (gpm).

3.3.8.2 Fuel lines. Provisions shall be made to assure internal cleanliness of fuel lines and connections prior to initial fueling of vehicle. Fuel lines and connections shall not leak after installation and after vehicle break-in run.

3.3.9 Cooling system. The engine coolant temperature and the engine and transmission lubricant temperatures shall not exceed those shown in Table I when the vehicle is operated under the following condition:

Ambient air temperature up to 125°F, under full load in first gear converter at a speed of 3 miles per hour.

Table I. Operating temperatures

Coolant Temp. from Engine	Engine Oil Temp. in Sump	Transmission Oil Temp. into Cooler
230°F Max.	275°F Max.	325°F Max.

3.3.10 Electrical system. The electrical system shall be a nominal 24 volt (dc) system.

3.3.10.1 Generator. The generator shall have the capacity of furnishing 300 amperes at 27.5 ± .5 volts at an engine speed of 750 rpm or higher.

3.3.10.2 Voltage regulator. The voltage regulator shall regulate generator output, as measured at the battery terminals, within ±0.5 volts throughout the full engine speed range, and with generator operating within its rated capacity.

3.3.10.3 Lights. The internal and external vehicle lights shall be operable under all vehicle operating conditions.

3.3.10.4 Bilge pump motors. Bilge pump motors shall operate on the electrical power supplied by the generator or batteries.

3.3.10.5 Personnel heater. The heater shall start and operate on 24 volts.

3.3.10.6 Electric contact ring (hull to turret). The main electrical system supply voltage shall be made available to the turret through the contact ring and there shall be continuity of the communications, power and ground circuits throughout 360 degrees of turret rotation, without evidence of short circuits.

3.3.10.6.1 Electric contact ring noise. The operation of the contact ring shall not introduce objectionable noise or static into the communication system.

3.3.10.7 Gun firing circuits The main gun firing circuits and the coaxial machine gun firing circuit shall exhibit continuity.

3.3.11 Personnel heater. The personnel heater shall be capable of operating on fuel conforming to Grade DF-A and DF-1 of VV F 800.

3.3.12 Stowage provisions. With the On Vehicle Material (OVM) combat loaded in spaces provided, the stowed equipment shall not interfere with the operation of the vehicle or its components.

3.3.13 Welding repairs and burning. Welding repairs of any type or class shall be made only when, and to the extent, specifically authorized by the procuring activity, except for in-process welding repairs to non-ballistic or non-structural members made necessary due to nonconformance to drawing or welding specifications.

3.4 Break-in run.

3.4.1 Preparation. Prior to break-in run, the vehicle shall be completely assembled and all adjustments completed except for those items of installation and service which are performed by the contractor as part of the final vehicle

processing for acceptance and shipment. The vehicle (including all components requiring lubrication) shall be lubricated in accordance with production lubrication drawing 10953937, a detail of EPL 8736408, and provided with fuel conforming to VV-F-800. Specific grades or types for expected seasonal temperature ranges shall be used.

3.4.2 Oil pressure and temperature. Prior to the start of the break-in run, the engine shall be operated at idle speed, between 650 and 700 rpm, until lubricating oil is at safe operating pressure and temperature, as indicated by control panel lights or gages. 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 run. Normal oil pressure and temperature shall be maintained during operation on level ground, 60 percent grades and 40 percent side slopes.

3.4.3 Operation and distance. Each vehicle shall be broken in by driving forward on smooth, level, hard-surfaced roads, except that a localized section of the road shall be as shown in figure 1. The vehicle shall be operated in each direction for one-half the total distance specified in "a" and "b" divisions of Table II, including that localized section of road shown in figure 1.

Table II. Speeds and distances for break-in run

Division of run	Speed mph	Distance miles
a	0 to 10	5
b	11 to 20	5
c	21 to max. governed	10

3.4.4 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.

3.4.5 Condition after break-in run. After completion of the break-in run, there shall be no evidence of damaged components or of maladjustments that may cause faulty vehicle operation.

3.5 Performance A complete vehicle, combat or simulated loaded and serviced, shall perform as specified herein. The vehicle, serviced and equipped for existing climatic conditions, shall perform as specified herein, 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.

3.5.1 Environmental. The vehicle shall be operable in ambient temperatures varying between plus 120°F and minus 50°F, except that below minus 25°F special kit (see 3.3.2.1) shall be used to assure starting and restarting of engine. The complete vehicle when in storage shall withstand climatic extremes of plus 155°F and minus 65°F, without deterioration that may cause failure of any component of the vehicle, and applicable portions of MIL STD-210.

3.5.2 Power train. The power train, including its associated controls, shall be operable throughout all gear and speed ranges and under all steering and braking conditions, without binding of linkages and without loss of lubricants to an extent greater than specified in 6.4(b)

3.5.3 Bilge pumps. The bilge pumps shall be capable of removing water from the vehicle as follows:

(a) Front pump - 35 gallons per minute against a discharge head of 6.0 feet.
(b) Rear pumps - 45 gallons per minute per pump against a discharge head of 6.0 feet.

3.5.4 Speeds, acceleration and braking ability.

3.5.4.1 Sustained speed. The vehicle shall be operable at a sustained speed of 30 mph and shall maintain a speed of 2.5 to 3.5 mph in lowest gear without towed load. With the vehicle traveling between 25 mph and maximum speed, the drift from a straight line shall be not more than 3 feet in 100 feet.

3.5.4.2 Maximum speed. The vehicle shall be operable at a speed of not less than 40 mph at an engine speed that does not exceed the maximum full load governed engine operating speed of 2800 rpm.

3.5.4.3 Minimum speed. The vehicle shall be operable at a speed of not more than 2.5 mph for a period of not less than 30 minutes.

3.5.4.4 Speeds with towed load. The vehicle shall be capable of towing a track-laying, free-rolling vehicle of equal weight at a speed of not less than 18 mph and shall operate at a sustained speed of 15 mph. The vehicle shall also be capable of attaining a minimum speed of 2.5 mph with towed load on level and hilly cross-country terrain.

3.5.4.5 Acceleration. The vehicle shall accelerate from a standing start to 20 mph in not more than 9.0 seconds.

3.5.4.6 Stopping. When traveling at 20 mph, the vehicle shall be stopped by application of the service brake within 45 feet from point of brake application. Vehicle drift during stopping shall not exceed 3 feet.

3.5.4.7 Holding. When the vehicle is standing on a 60 percent longitudinal grade with the parking brake applied and locked, the transmission in neutral, and the engine stopped; it shall remain stationary when headed up and down grade.

3.5.5 Turning. When controlled by geared steer and when travelling at a speed less than 10 mph, the vehicle shall make continuous 360 degree right and left turns, with the rear point of the outer edge of the vehicle remaining within an 80-foot diameter circle. Under pivot steer control, the vehicle shall be capable of being pivoted 360 degrees within a 30-foot diameter circle.

3.5.6 Slope and grade performance. The vehicle shall ascend and descend grades up to 60 percent and operate on side slopes up to 40 percent. The vehicle shall also maintain a sustained speed of 15 mph when ascending a 10 percent grade on a hard surfaced road.

3.5.6.1 Engine starting on grades and side slopes. With the vehicle standing on a 60 percent longitudinal grade for not less than 2 minutes, and with the engine idling between 650 and 700 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 grade and when headed down grade. A similar engine starting operation shall be conducted on a 40 percent side slope with each side of vehicle up slope.

3.5.7 Water operation.

3.5.7.1 Flotation operation. The combat or simulated loaded vehicle shall float in calm water of 7-foot minimum depth.

3.5.7.1.1 Surfboard and barrier system. After 15 minutes of floating with the surfboard and barrier equipment erected and with the bilge pumps off, the vehicle shall not have accumulated more than one inch of water depth in the hull bottom. The accumulation of water shall be measured with the vehicle on level terrain after removal from the water.

3.5.7.2 Speed. When afloat in calm water, the vehicle shall attain a speed of not less than 3.5 mph, excluding the effect of current.

3.5.7.3 Directional stability. The vehicle shall operate within a 30-foot corridor while crossing calm, open water, excluding the effect of current.

3.5.8 Trench crossing. When operating at low speed in forward gear, the vehicle shall cross trenches of 36 inches minimum depth up to 84 inches wide, without damage to the vehicle or its components.

3.5.9 Vertical obstacles. When operating at low speed, the vehicle shall cross over vertical obstacles up to 33 inches in height in forward gear and up to 12 inches in height in reverse gear, without damage to the vehicle or its components.

3.5.10 Cupola. Unless otherwise specified, the cupola shall meet all requirements specified herein under the following conditions:

(a) Cupola level within one degree.
(b) System supply voltage 27.5 ±0.5 volts (dc).
(c) Cupola combat (or simulated) loaded and with hatch fully open.

3.5.10.1 Power controls. M551 and M551A1 Vehicles.

3.5.10.1.1 Traverse and gun firing. The traverse switches and gun firing mechanism shall be capable of simultaneous use. With hatches closed, traverse shall be accomplishable by means of a slewing switch provided.

3.5.10.1.2 Powered traversing acceleration and speed. The cupola shall be capable of continous powered traverse in either direction. From a standing start, the cupola shall be capable of traversing a minimum of 90 degrees in 3 seconds. After a uniform traverse rate is achieved, the speed rate shall be 10.5 RPM plus or minus 1.5 RPM. Powered operation shall not exceed 2 minutes in any 12 minute period.

3.5.10.2 Power controls. M551 Vehicle only.

3.5.10.2.1 Control panel. With the "on/off" switch in the "off" position, cupola traverse shall be electrically inoperable.

3.5.10.2.2 Electric contact ring noise. The operation of the contact ring shall not introduce noise or static into the communication system at a level which prevents interpretable message reception.

3.5.10.2.3 Electric contact ring (turret to cupola). The main electrical system supply voltage shall be made available to the cupola through the contact ring and there shall be uniterrupted electrical continuity of the communications, power and ground circuits throughout 360 degrees of cupola traverse, without evidence of short circuits.

3.5.10.2.4 Manual traverse. With the manual traverse control handle in the "operate" position the brake shall be released permitting manual traverse of the cupola.

3.5.10.2.5 Manual traverse interlock. An interlock shall prevent cupola electrical operation with the manual traverse control handle in the engaged position.

3.5.10.2.6 Manual traverse effort. When the manual crank is ratcheted in either direction at a uniform rate, the average force applied tangentially at the end of the handle shall not exceed 30 lbs at ambient temperatures of 32°F and above.

3.5.10.3 Power controls. M551A1 Vehicle only. (W/Laser Range Finder).

3.5.10.3.1 Control panel. "On/off" switch in the "off" position cupola traverse shall be electrically inoperable. A momentary contact "cupola align" switch shall be provided which when activated will cause the cupola to traverse to an index position which is repeatable to within $\pm 2^{o}$.

3.5.10.3.2 Remote switch. Shall be provided on the commanders turret control assembly which will have the same function as the "cupola align" switch.

3.5.10.3.3 Electrical contact ring (turret to cupola). The main electrical system supply voltage shall be made available to the cupola through the contact ring at current level sufficient to operate the AN/VVG-1 Laser Range Finder system, and there shall be uninterrupted electrical continuity of the power and ground circuits throughout 360 degrees of cupola traverse without evidence of short circuits.

3.5.10.3.4 Manual Traverse. The cupola shall be equipped with a hand crank for manual traverse.

3.5.10.3.5 Locking mechanism. The manual cupola traversing system shall act as a travel lock for the cupola when the vehicle is driven cross country. Cupola movement shall not be transmitted to the hand crank with the lock released. The lock shall automatically release when the cupola is operated in the power mode.

3.5.10.3.6 Manual traverse effort. When the hand crank is rotated in either direction at a uniform rate the average force applied tangentially to the crank to maintain cupola traverse movement shall not exceed 15 lobs. No individual reading shall exceed 17 lbs. At uniform hand crank speeds, the cupola traversing operator shall be chatter-free.

3.5.11 Traverse and gun fire control system. Unless otherwise specified, the following requirements shall be met with the turret race ring level within one degree.

3.5.11.1 Turret control system.

3.5.11.1.1 Manual traverse effort. When the hand crank is rotated in either direction at a uniform rate, the average force applied tangentially to the crank to maintain turret traverse movement shall not exceed 14 pounds. No individual reading shall exceed 17 pounds. At uniform hand crank speeds, the turret traversing operation shall be chatter-free.

3.5.11.1.2 Manual elevating effort. When the gun is elevated or depressed, the average force applied tangentially to the hand crank to maintain gun movement in either direction shall not exceed 11 pounds. No individual reading shall exceed 17 pounds. At uniform hand crank speeds, the gun elevation and depression operations shall be chatter-free.

3.5.11.1.3 Manual traverse ratio. One revolution of the hand crank shall rotate the turret a minimum of 10 mils.

3.5.11.1.4 Manual elevation ratio. With the gun at horizontal position plus or minus one degree, the gun shall elevate or depress at a minimum of 9.5 mils per revolution of the hand crank.

3.5.11.1.5 System backlash and compliance. With the turret power off the system backlash and compliance shall not exceed 1.0 mil in traverse and 1.0 mil in elevation when a perpendicular force of 100 ± 10 pounds is applied in the plane of rotation at the muzzle end of the gun. The sum of the backlash and compliance shall be that total angular movement of the turret with respect to the hull in traverse and the gun shield (or gun mount) with respect to the turret in elevation measured when the force at the end of the gun is reversed and applied in the opposite direction.

3.5.11.1.6 Power and manual control. The gunner's firing triggers (manual and power) shall function with the turret control power switch wither on or off and with the fire control selector switch in any position other than off. The proper telescope reticle shall be displayed with the selected position of the fire control selector switch and the vehicle master switch on. When the main gun is selected, the firing switch (trigger) shall energize the main weapon circuitry. When the auxiliary is selected, the firing switch (trigger) shall energize the coaxial machine gun solenoid. The manual firing switch located on the elevation hand crank shall perform the same function as the gunner's firing switch.

3.5.11.1.7 Override control. When operating in power control, and the override switch in the commander's control handle is actuated, it shall instantaneously take over the power control of the turret, gun and firing circuits from the gunner control. Override of the system control by the commander's control shall be obtainable regardless of the handle position of the gunner control. With the commander and gunner controls in the neutral position, there shall be no movement of the gun or turret caused by depressing or releasing the override switch in the commander's control handle. The gunner's control shall regain system control instantaneously when the commander's control handle is released.

3.5.11.1.8 Control system deadspots. The turret and gun control system deadspot, as measured at the gunner and commander power controls, shall not exceed 3 degrees handle movement from the neutral center position in either direction in order to initiate turret movement, and shall not exceed 3 degrees handle movement from the neutral center position in either direction in order to initiate gun elevation or depression. The neutral center position shall be defined as that handle position which divides the initial free handle movement in half. The deadspot angles each side of the neutral center position (in both traverse and elevation) must be equal within one degree.

3.5.11.1.9 Gun elevation speeds. The gun shall be controllable in elevation and depression at all speeds from 0.5 to 71.0 mils per second. The elevation speed shall increase, with increased handle displacement, from 0.5 mil per second at 2.5 ± 1.0 degree handle displacement to 23.0 mils per second at 20 ± 2.0 degrees handle displacement. The slope of the response curve at the 0.5 mil per second point shall be 1.0 ± 0.1 mil per second per degree and shall increase smoothly to provide minimum of 71.0 mils per second, (4 degrees per second) at maximum handle displacement. The system shall remain stable at all times. These requirements are applicable to both gunner and commander power controls, in the non-stabilized mode only.

3.5.11.1.10 Turret traversing speeds. The turret shall be controllable in traverse at all speeds from 0.5 to 427 mils per second (4 rpm or 15 seconds per revolution). The traverse speed shall increase with increased handle displacement, from 0.5 mil per second at 2.25 ± 1.0 degree to 32.0 mils per second at 50 ± 6.0 degrees handle displacement. The slope of the response curve at the 0.5 mil per second point shall be 0.5 ± 0.075 mil per second per degree and shall increase smoothly to provide a minimum of 427 mils per second at maximum handle displacement. The system shall remain stable at all times. These requirements are applicable to both the gunner and commander power controls, in the non-stabilized mode only.

3.5.11.1.11 Traverse, elevation and depression step response. With the turret control power switch turned on, the gun rate response to step inputs resulting in steady-state rate changes from zero to 25 ± 5 mils per second and from 25 ± 5 mils per second to zero in each direction of traverse and elevation or depression shall exhibit an overshoot of less than 50 percent, followed by an undershoot of less than 40 percent, and be damped to within ± 12 percent of the steady-state rate within one-half second of the time the step input is applied. Upon application or removal of the step input, the gun and turret responses shall move to 66.6 percent of the final measured value within .075 seconds.

3.5.11.1.12 Elevation system protection. There shall be no damage to the control system or its components as the result of operating the gun at full speed against the elevation or depression limit switch stops by power control, or against the mechanical stops by manual control. Limit switches shall inhibit elevation and depression rates of the weapon prior to contacting the mechanical stops.

3.5.11.1.13 Interference zone When power traversing the turret, automatic control shall be provided to elevate the main gun over portions of the vehicle so as to prevent the gun from striking the sides of the vehicle or the upper structure of the vehicle (with flotation equipment stowed), and also to prevent projectiles from striking the hull when main gun or secondary armament is fired.

3.5.11.1.14 Elevation and depression range and limits. Throughout 360 degrees of manual traverse, the gun shall be capable of being elevated to between 19.0 and 19.5 degrees and of being depressed to at least 2.5 degrees. The angular movement of the gun parallel to the plane of the turret race ring shall be in accordance with the following requirements:

(a) Between 7.0 and 8.5 degrees depression for at least 126 degrees each side of vehicle from front centerline (by power control) and between 8.0 and 8.5 degrees depression for at least 137 degrees each side of vehicle front centerline (by manual control).
(b) At least 3.5 degrees depression from 43 degrees each side of vehicle rear centerline (by manual control).

3.5.11.1.15 Gun laying on moving target. The time required to lay the gunsight reticle within the borders of a moving target from an established lead angle shall not exceed 3.5 seconds under any set of conditions specified in Table III. After the reticle has been positioned within the borders of the target, the reticle shall remain within the target for the completion of the run in accordance with percentage of time on target specified in Table IV. This requirement shall be met by the gunner power controls only. When range distances shown in Table III are not available, it is permiissible to substitute another distance, preferably greater, providing that target speeds, target dimensions, and course distance are changed proportionately.

Table III. Gun laying on moving target

Traverse Rate Mils/Sec	Established Lead Mils	Target Size		Target Range Meters	Target Vencity mph	Length of Course Meters
		Mils	Centimeters			
0.5	1.0	0.25	45.72	1828.8	2.0	45.72
1.0	2.0	1.25	226.60	1828.8	4.0	91.44
3.3	7.5	1.25	228.60	1828.8	13.5	182.88
9.8	20.0	1.25	226.60	1828.8	40.0	182.88
19.6	7.5	1.25	34.29	274.32	12.0	365.76
32.6	10.0	1.25	34.29	274.32	20.0	365.76
65.2	20.0	5.0	137.16	274.32	40.0	365.76
70.1	20.0	5.0	137.16	274.32	43.0	365.76

NOTE: The traverse rates shown in Table III are approximate radial tracking values of the targets at the specified velocities and ranges. The traverse rate values (mils per second) are to be utilized when testing with a turret tracking instrument, and are not to be equated to the target positions at given velocities, times and ranges.

3.5.11.1.16 Target tracking accuracy. Under actual or simulated conditions, the gunner and commander power controls shall meet the minimum requirements for target tracking as specified in Table IV Target shall be square in size as specified in Table IV and shall be moved on a straight crossing course. When range distances shown in Table IV are not available, it is permissible to substitute another distance, preferably greater, providing that target speeds, target dimensions, and course distance are changed proportionately.

Table IV. Tracking accuracy

% of Time on Target	Traverse Rate Mils/Sec	Target Size Mils	Target Size Centimeters	Target Range Meters	Target Velocity mph	Length of Course Meters
90	0.5	0.25	45.72	1828.8	2.0	45.72
100	1.0	1.25	228.60	1828.8	4.0	91.44
100	3.3	1.25	228.60	1828.8	13.5	182.88
100	9.8	1.25	228.60	1828.8	40.0	182.88
100	19.6	1.25	34.29	274.32	12.0	365.76
100	32.6	1.25	34.29	274.32	20.0	365.76
100	65.2	5.0	137.16	274.32	40.0	365.76
100	70.1	5.0	137.16	274.32	43.0	365.76

NOTE: The traverse rates shown in Table IV are approximate radial tracking values of the targets at the specified velocities and ranges. The traverse rate values (mils per second) are to be utilized when testing with a turret tracking instrument, and are not to be equated to the target positions at given velocities, times and ranges.

3.5.11.1.17 Gun laying on stationary target. From a layoff position tabulated in Table V, the average time required for a total of 4, 8, or 12 trials to position the gunsight reticle within the borders of a 0.25 mil square target shall not exceed that tabulated in Table V. The time for layoff position number 3 shall be met for an equal number of trails from each of four directions from target. The time of all other layoff positions shall be met for two directions from target. These requirements apply to gunner's station only, as stipulated in Table V. The results of any one series of trails shall not be used in any other series.

Table V. Gun laying on stationary target

LAYOFF - MILS			AVERAGE TIME - SECONDS	
Position	Azimuth	Elevation Depression	Power Controls	Manual Controls
1	--	± 10	2	2
2	25	-	3	3
3	25	± 10	5	5
4	100	-	4	4.5
5	400	-	5	14
6	800	-	6	-
7	1600	-	8	-
8	3200	-	12	-

3.5.11.1.18 Turret and gun control system, operation on slope. When the vehicle is canted or pitched on slopes up to and including 10 degrees turret attitude, the turret and gun control system shall meet the requirements of 3.5.11.1.8, 3.5.11.1.9, 3.5.11.1.10, 3.5.11.1.15, 3.5.11.1.16 and 3.5.11.1.17, except that time limitations of Table V may be triple. The turret and gun control system performances on level terrain shall not be affected in any manner as a result of vehicle or control system operation on slopes up to and including 15 degrees. Turret chatter shall be allowed only when turret unbalance tends to cause turret rotation in the same direction as manual traverse.

3.5.11.1.19 Locking mechanism. The manual traversing and elevating system shall act as travel locks for the gun and turret when the vehicle is driven cross-country and all other locks are released. Turret and gun movement shall not be transmitted to either of the hand cranks with the lock released.

3.5.11.1.20 Control handle centering force. The control handle centering force, for both gunner and commander power controls, shall be everywhere positive with handle displacement. The handle torque shall vary with displacement from 5.0 ± 3.0 inch-pounds at 5 degrees displacement to not more than 11 inch-pounds at 50 degrees of azimuth displacement. In elevation, the torque shall vary from 6.0 ± 4.0 inch-pounds at 5 degrees displacement to not more than 18 inch-pounds at 20 degrees displacement.

3.5.11.1.21 Turret traverse friction. With the turret assembly mounted to the hull and level within one degree, but with the traverse gear box output pinion disengaged, the torque required to rotate the turret (after breakaway) shall not exceed 300 foot-pounds. During 360 degrees of turret rotation, the variation of torque in any 15 degrees of rotation shall not exceed 50 foot-pounds.

3.5.11.1.22 Turret creep and gun drift. With turret power on, after warm-up period, the turret shall not creep and the gun shall not drift more than 1.0 mil in a 5 minute period.

3.5.11.1.23 Firing stability. Assuming no residual hull movement between successive firings of conventional cartridges from the main armament, and with the turret control power switch turned off or on, the system shall hold the gun on target within 1.0 mil in any direction. During missile launch, line of sight motion, from all causes including vehicle motion, shall not exceed 5 mils peak angular displacement from zero. The amplitude envelope shall damp to 3.6 mils peak to peak within 0.4 seconds after first motion of the missile. Line of sight motion during missile flight, resulting from breech operation, shall not exceed 1.0 mil peak to peak damped to 0.2 mils peak to peak within 0.3 seconds of the maximum disturbance, and with a maximum residual offset of ± 0.25 mil from the original reference.

3.5.11.1.24 Stabilized mode. The gun and turret control system shall be capable of operating in a stabilized mode.

3.5.11.2 Gun fire control system.

3.5.11.2.1 Line of sight accuracy. The lines of sight of the telescope and periscope shall intersect with the main weapon centerline at distances of 1200 meters and 600 meters respectively, measured from centerline of trunnion. In gun positions from minus 7.5 degrees to plus 19 degrees, the lines of sight of the telescope and gunner's periscope shall move in synchronization with the centerline of the gun tube bore within plus or minus 0.2 mil and plus or minus 0.5 mil, respectively, in elevation and azimuth.

3.5.11.2.2 Gunner's periscope backlash. Backlash in the gunner's periscope shall not exceed 0.3 mil for any degree of gun elevation throughout the entire range of elevation and depression.

3.5.11.2.3 Boresight knob travel. The boresight knob on the gunner's periscope and telescope shall be adjustable to a minimum of 3 mils down, 7 mils up, 4 mils right and 4 mils left, as measured from the boresight position.

3.5.11.2.4 Elevation quadrant M13A1C. At zero gun elevation and with the bubble centered in the level vial, the knob scale and the index scale shall be adjusted to read zero. At all angles of elevation and depression, the reading on the elevation quadrant shall correspond to the position of the gun within plus or minus 1.0 mil.

3.5.11.2.5 Sighting system boresight retention. After 6 miles of vehicle operation over level, hard-surfaced roads, the lines of sight of the telescope and gunner's periscope (in both elevation and azimuth) shall maintain previously established boresight within plus or minus 0.25 mil and plus or minus 1.0 mil, respectively.

3.5.11.2.6 Azimuth indicator. At any position of the turret throughout 360 degrees of traverse in either direction, the backlash of the azimuth indicator shall not exceed plus or minus 0.5 mil.

3.5.11.2.7 Laser range finder (M551A1 only. The M551A1 shall be equipped with a Laser Range Finder which can be aligned in aximuth with the main gun within $\pm 2^{\circ}$ using the cupola alignment system (see 3.10.3) and Laser Range Finder controls.

3.5.11.3 Guidance and control sub system. All guidance and control group components shall be electrically grounded to the vehicle structure. The ground contact resistance shall not exceed 10 milliohms for the tracker and signal data converter or 80 milliohms for the other components. The tracker null axis shall be aligned to converge with the gun bore axis at 26.67 mils (1.5 degrees) $\pm$ 3.0 mils in elevation and at 0.0 mils $\pm$ 3.0 mils in traverse. The transmitter beam shall be parallel to the tracker null axis within $\pm$ 2.0 mils in both azimuth and elevation. Prescribed activation of "System Test" switch shall result in lighting the "GO" indication.

3.5.11.4 Grenade projector system.

3.5.11.4.1 Grenade projector system functioning. The grenade projector firing system shall be capable of allowing for grenade projector function during a 4 second maximum time interval after master switch is actuated.

3.5.11.4.2 Grenade projector system capability. The grenade projector firing system shall provide for the capability of salvo, right bank, left bank, and individual grenade projector(s) functioning.

3.6 Electromagnetic compatability. Unless otherwise specified (see 6.2), the entire vehicle shall have electromagnetic compatability suppression in accordance with tactical vehicle requirements class IIIA of MIL STD 461.

3.7 Painting, marking and data plates.

3.7.1 Painting. The exterior and interior of the vehicle, and its component assemblies and parts require painting, shall be prepared and painted in accordance with MIL-STD-193. Vehicle exterior, and interior portions, such as latches and covers which are exposed to outside view, shall be painted drab olive color chip X24087 of Federal Std. No. 595. The interior of the vehicle fighting compartment, driver's compartment, and engine compartment shall be painted white, matching color chip 27875 of Federal Std. No. 595.

3.7.2 Marking. Vehicle marking shall be in accordance with drawings and MIL-STD-642.

3.7.3 Name, shipping, and service data plates. All data plates shall be in accordance with drawings and MIL-P-514.

3.8 Fire extinguishers. The installed fixed fire extinguisher system shall be operable from inside and outside the vehicle. In ambient temperature of 72°F, the maximum effort required to discharge the system, either internally or externally, shall not exceed 55 pounds. Upon actuation of the internal fire extinguisher handle, the main fuel supply to the engine will be shut off.

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 inspection or quality control system. Unless otherwise specified by the procuring activity, the contractor shall provide and maintain an 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 overhaul. 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, components, and assemblies. Parts, components and assemblies shall be inspected in accordance with the drawings listed on EPL 8736408 and the Master List of Supplementary Quality Assurance Provisions 8736408.

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 applied, and (b) Government product inspection to determine quality of product being 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.

4.1.4 Qualified products. The contractor's inspection records shall be checked to determine conformance to 3.2.2.

4.2 First overhauled vehicle inspection.

4.2.1 Special process inspection A special process inspection shall be conducted by the Government during overhaul of the first vehicle (see 3.1) to evaluate conformance of materials and workmanship with technical data package.

4.2.1.1 Hull and turret inspection. The hull and turret shall be inspected prior to covering the weldments (see 3.3.13) with paint or other pertinent components or assemblies.

4.2.2 First overhauled vehicle inspection. Subsequent to the contractor's inspection of the first completed vehicle, the Government shall inspect this vehicle at the contractor's plant to determine conformance to contract and specification requirements.

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

4.2.3 Initial overhauled vehicle tests. After completion of the first overhauled vehicle inspection, another vehicle from the first month's overhaul or one of the first ten shall be subjected to examination (see 4.4.1) and tests as specified in 4.5 (a) and (b). Subsequent to examination and tests, the selected vehicle shall be subjected to the 3,200 mile test specified in Table VI and all applicable tests specified in Table VIII. 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 furnish repair parts as required to adequately support the test or 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.

Table VI. 3,200 mile test (combat loaded or a simulated load) (Government Proving Ground)

Course	Mileage and speeds
Hard-surface roads	640 miles at varying speeds up to maximum
Gravel and dirt roads	640 miles at varying speeds up to maximum
Level cross-country	960 miles at varying speeds up to maximum
Hilly cross-country	960 miles at varying speeds up to maximum

4.2.3.1 Reliability test. Reliability requirements of paragraph 3.1.1 will be verified at a 50% confidence level while vehicle is subjected to initial rebuild tests. Mean Miles Between Failures (MMBF) shall not be less than sepcified.

4.2.3.2 Durability test. Durability requirements of paragraph 3.1.1c(1) will be verified at a 50% confidence level while vehicle is subjected to initial rebuild tests.

4.2.3.3 Maintainability. The maintainability of the vehicle as specified in paragraph 3.1.1 will be verified during initial rebuild testing.

4.2.3.4 Test failure. Failure of the vehicle as the result of any deficiency of a workmanship or materials nature during or as a result of the 3,200 mile test may be cause for the Government to refuse to continue acceptance of overhauled vehicles until evidence has been provided by the contractor that corrective action has been taken to eliminate the deficiency. Any deficiency of this nature found during or as a result of 3,200 mile test shall be prima facie evidence that all vehicles already accepted prior to completion of the 3,200 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.

4.3 Break-in run. To determine conformance to 3.4.1, 3.4.2, and 3.4.3, each overhauled vehicle shall be lubricated and serviced prior to the break-in run. The run shall be on smooth, level, hard-surfaced roads, and for the distance specified in Table II. The vehicle shall be operated in reverse after each division as specified in 3.4.4. The undulating portion of the test shall be accomplished twice in each direction at speeds between 0 and 10 mph during division "a" and between 11 and 20 mph during division "b".

4.3.1 Condition after run. To determine conformance to 3.4.5, after completion of the break-in run, the vehicle shall be checked to determine that there is no damage or malfunction to the vehicle and that adjustments are as required.

4.4 Inspection provisions.

4.4.1 Examinations. Visual, dimensional, and primary functional examination shall be performed on each vehicle for conformance to the technical data package and this specification. Examinations shall be performed against the classification of defects shown in Table VII. Functional defects found in properly installed Government furnished equipment will be classified as special and shall not be used as a basis for rejection of the vehicle. The following constitutes a part of the classification of defects (see 6.4).

(a) Any drip from the inside to the outside of a self-contained reservoir constitutes a major defect when the vehicle has been standing idle and the components are at ambient temperature.
(b) Any seep that occurs from the inside to the outside of a static fit (metal to metal, or gasket combination) shall constitute a major defect.

Table VII. Classification of defects

Characteristic	Major: AQL 25 Defects/100 Units	Minor: AQL 150 Defects/100 Units	Method of Inspection
Engine	101. Malfunction, leaks (see 6.4 c), 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, leaks (see 6.4 c)	203. Improper component assembly or installation	Visual and functional
*Fuel system components	104. Malfunction, damage, leaks (see 6.4 a)	204. Improper assembly, installation or clearance	Visual and functional
Cooling system components (engine and transmission)	105. Malfunction, damage, leaks (see 6.4 b)	205. Improper assembly or installation	Visual and functional
Exhaust system components	106. Damage, leaks	206. Improper assembly, installation or clearance	Visual
**Electrical system components (includes wiring and instruments)	107. Malfunction, damage	207. Improper assy., installation circuit identification, clearance or protection, illumination of reticle	Visual and functional
Suspension system components	108. Damage, tire or track base separation, improper clearance or alignment welding defects, leaks (see 6.4 c), malfunction	208. Improper assy., installation bolt or nut torque and track tension	Visual
Hull	109. Structure and welding defects (Metal shrink or crater cracks excluded)		Visual
Controls and adjusting mech.	110. Malfunction, improper clearance	209. Improper assembly or installation	Visual and functional
Doors, fenders, grilles, panels, ducts, stowage brackets, boxes, shocks and stops	111. Malfunction: torsion spring and hold-open devices	210. Improper fits, adjustment, assembly or installation	Visual and functional

*Fuel leaks constitute a special defect and will result in total inspection of the lot for this deficiency.
**Filament failures are not to be classified as a major or minor defect.

Table VII. Classification of defects (Cont'd)

Characteristic	Major: AQL 25 Defects/100 Units	Minor: AQL 150 Defects/100 Units	Method of Inspection
Drain valves	112. Valve seating improper	211. Improper assy., installation of control adjustment	Visual and functional
Cushions, seats, rests and crash pads	113. Seat control malfunction	212. Improper fit, installation, adhesions or damage	Visual and functional
Turret traverse lock	114. Locking malfunction, damage	213. Improper assembly or installation	Visual and functional
Traversing and elevating mech.	115. Clearance improper, component damage	214. Improper assembly or installation	Visual and functional
Recoil mechanism, replenisher and lines	116. Component damage, indicators or lines defective	215. Improper assembly, installation, fluid level and type improper	Visual and functional
Main armament	117. Component damage, improper assembly or trunnion cap bolt torque		Visual and functional
Weapon control system, (includes panels, solenoids, switches, wiring and other components)	118. Component damage, defective wiring	216. Improper clearance, assy., installation, circuit identification, protection or markings	Visual and functional
Misc. items or accessories	119. Malfunction, damage, missing	217. Improper assembly or installation	Visual and functional
Fire extinguisher system components	120. Seals missing or defective	218. Data card incomplete, improper assembly or installation	Visual
Paint-protective and anti-skid coatings		219. Application, coverage and materials improper	Visual
Lube fittings and lubrication		220. Fittings missing, defective or improperly installed, lubrication improper	Visual
Decals, markings, data and instruction plates		221. Incomplete data, missing, improper location or site, illegible	Visual

4.4.1.1 Unclassified defects All component defects having no bearing on function, safety, interchangeability or life, but which are considered departures from good workmanship, will be noted in writing. Workmanship deficiencies falling within this category and recurring will be added to the minor classification of defects of this specification.

4.5 Classification of tests.

(a) Acceptance tests, 4.5.1.1 through 4.5.1.15.8.
(b) Control tests, 4.5.2 through 4.5.2.11.
(c) Comparison tests (CT), 4.5.1.2 through 4.5.3.17.

4.5.1 Tests.

4.5.1.1 Acceptance tests To determine conformance to 3.5, after break-in run (see 3.4), each vehicle shall be operated for a distance of 8 miles or more by the contractor and subjected to tests specified at the place of contractor in Table VIII. 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, all adjustments completed, and serviced with fuel, lubrication and fluid as specified, but need not be combat loaded except for holding and floatation tests. After the tests, 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 shall withhold acceptance until evidence has been provided by the contractor that corrective action has been taken.

Table VIII. Location for tests

Item Title	Paragraph Number	Place of Contractor	Government Proving Ground
Acceptance test	4.5.1.1	X	
Hatch seals check	4.5.1.2	X	X
Controls check	4.5.1.3	X	X
Throttle linkage check	4.5.1.3.1	X	X
Driver's hatch check	4.5.1.4.1	X	X
Loader's hatch cover check	4.5.1.4.2	X	X
Escape hatch check	4.5.1.4.3	X	X
Battery access and air cleaner access door check	4.5.1.4.4	X	X
Commander's hatch check	4.5.1.4.5	X	X
Driver's seat check	4.5.1.5.1	X	X
Gunner's seat check	4.5.1.5.2	X	X
Commander's seat check	4.5.1.5.3	X	X
Loader's seat check	4.5.1.5.4	X	X
Fuel lines check	4.5.1.6	X	X
Electrical system check	4.5.1.7	X	X
Lights check	4.5.1.7.1	X	X
Bilge pump motor check	4.5.1.7.2	X	X
Personnel operational heater check	4.5.1.7.3	X	X
Electric contact ring (hull to turret) check	4.5.1.7.4	X	X
Electric contact ring noises check	4.5.1.7.5	X	X
Gun firing circuits check	4.5.1.7.6	X	X
Welding repairs and burning check	4.5.1.8	X	X
Power train test	4.5.1.9	X	X
Sustained speeds test	4.5.1.10.1	X	X
Maximum speed test	4.5.1.10.2	X	X
Acceleration test	4.5.1.10.3	X	X
Stopping test	4.5.1.10.4	X	X
Holding test	4.5.1.10.5	X	X
Turning test	4.5.1.10.6	X	X
Fuel system and engine operation on grades & side slope test	4.5.1.11	X	X
Floatation surfboard and barrier system test	4.5.1.12	X	X

Table VIII. Location for tests (Cont'd)

Item Title	Paragraph Number	Place of Contractor	Government Proving Ground
Cupola check	4.5.1.13	X	X
Traverse and gun firing mechanism test	4.5.1.13.1	X	X
Control panel test	4.5.1.13.2	X	X
Powered traversing acceleration and speed test	4.5.1.13.3	X	X
Electric contact ring (turret to cupola) test	4.5.1.13.4	X	X
Manual traverse check	4.5.1.13.5	X	X
Turret and gun control test	4.5.1.14	X	X
Manual travese effort test	4.5.1.14.1	X	X
Manual elevating effort test	4.5.1.14.2	X	X
Manual traverse ratio test	4.5.1.14.3	X	X
Manual elevating ratio test	4.5.1.14.4	X	X
System backlash and compliance test	4.5.1.14.5	X	X
Power and manual control test	4.5.1.14.6	X	X
Override control test	4.5.1.14.7	X	X
Control system deadspot test	4.5.1.14.8	X	X
Gun elevation speeds test	4.5.1.14.9	X	X
Turret traversing speeds test	4.5.1.14.10	X	X
Traverse, elevation and depression step response test	4.5.1.14.11	X	X
Elevation system protection test	4.5.1.14.12	X	X
Interference zone test	4.5.1.14.13	X	X
Elevation and depression range and limits test	4.5.1.14.14	X	X
Target tracking accuracy and gun laying on moving target test	4.5.1.14.15	X	X
Gun laying on stationary target test	4.5.1.14.16	X	X
Turret and gun control systems and operation on slopes test	4.5.1.14.17	X	X
Control handle centering force test	4.5.1.14.18	X	X
Line of sight accuracy test	4.5.1.15	X	X
Gunner's periscope backlash test	4.5.1.15.1	X	X
Boresight knob travel test	4.5.1.15.2	X	X
Elevation quadrant M13A1C test	4.5.1.15.3	X	X
Sighting system boresight retention test	4.5.1.15.4	X	X
Azimuth indicator test	4.5.1.15.5	X	X
Guidance and control sub-system checkout	4.5.1.15.6	X	X
Grenade projector system functioning test	4.5.1.15.7	X	X

Table VIII. Location for tests (Cont'd)

Item Title	Paragraph Number	Place of Contractor	Government Proving Ground
Grenade projector system capability test	4.5.1.15.8	X	X
Control tests	4.5.2	X	X
Contamination test	4.5.2.3	X	X
Vision devices test	4.5.2.4	X	X
Fuel tanks and lines test	4.5.2.5	X	X
Electrical contact ring and communication equipment test	4.5.2.6	X	X
Stowed equipment test	4.5.2.7	X	X
Bilge pump operational test	4.5.2.8	X	X
Minimum speed test	4.5.2.9	X	X
Turret creep and gun drift test	4.5.2.10	X	X
Fire extinguisher test	4.5.2.11	X	X
Comparison test	4.5.3		X
Special kits check	4.5.3.2		X
Winterization kit test	4.5.3.2.1		X
Collective protector kit test	4.5.3.2.2		X
Carbon monoxide concentration test	4.5.3.3		X
Fuel system operational test	4.5.3.4		X
Cooling system test	4.5.3.5		X
Environmental test	4.5.3.6		X
Bilge pump water removal test	4.5.3.7		X
Towed load speed test	4.5.3.8		X
Slope and grade operation test	4.5.3.9		X
Water speed and directional stability test	4.5.3.10		X
Trench crossing test	4.5.3.11		X
Vertical obstacle test	4.5.3.12		X
Locking mechanism test	4.5.3.13		X
Turret traverse friction test	4.5.3.14		X
Firing stability test	4.5.3.15		X
Stabilized mode test	4.5.3.16		X
Electromagnetic compatability test	4.5.3.17		X

4.5.1.2 Hatch seals check To determine conformance to 3.3.1.1, the hatches shall be closed and locked and shall not exhibit excessive leakage while a spray of free flowing water from a 1/2 to 3/4 inch inside diameter hose is directed on the hatches from a distance of 3 feet for a period of 3 minutes.

4.5.1.3 Controls check. To determine conformance to 3.3.5, all controls shall be operated and checked for functional requirements and adjustments.

4.5.1.3.1 Throttle linkage check. To determine conformance to 3.3.5.1, the throttle linkage shall be operated as specified and the accelerator pedal checked for contact with the pedal stop.

4.5.1.4 Hatch mechanism check.

4.5.1.4.1 Driver's hatch check. To determine conformance to 3.3.6.1, force shall be applied to the unlocked hatch locking lever and the hatch cover pushed to full open position. The force required shall be as specified.

4.5.1.4.2 Loader's hatch check. To determine conformance to 3.3.6.2, force shall be applied to the edge of the hatch opposite the hinges and the force required to open the hatch shall be as specified.

4.5.1.4.3 Escape hatch check. To determine conformance to 3.3.6.3, force shall be applied to the end of the hatch locking lever and the force required to unlatch the escape hatch shall be as specified.

4.5.1.4.4 Battery access and air cleaner access door check. To determine conformance to 3.3.6.4, force shall be applied to the appropriate lifting handle and the force required to open a door shall be as specified.

4.5.1.4.5 Commander's hatch check. To determine conformance to 3.3.6.5, force shall be applied at the split line of each hatch cover and the force required to open a hatch cover from an unlocked closed position shall be as specified. The hatch cover shall be checked for positioning as specified.

4.5.1.5 Seat checks.

4.5.1.5.1 Driver's seat check. To determine conformance to 3.3.7.1, force shall be applied to the end of the appropriate lever of the seat and the force required to actuate positioning forward, backward, and vertically shall be as specified. The seat pan shall be functionally checked for positioning as specified.

4.5.1.5.2 Gunner's seat check. To determine conformance to 3.3.7.2, force shall be applied to the end of the fore and aft seat adjustment pin and the force required to pull the pin shall be as specified. Vertical positioning of the seat shall be accomplished as specified.

4.5.1.5.3 Commander's seat check. To determine conformance to 3.3.7.3, force shall be applied to the end of the seat adjustment lever and the force required to disengage the positioning pin shall be as specified. Vertical adjustment distance shall be as specified.

4.5.1.5.4 Loader's seat check To determine conformance to 3.3.7.4, vertical positioning and retention of the seat shall be accomplished as specified.

4.5.1.6 Fuel lines check. To determine conformance to 3.3.8.2, the fuel system shall be air pressurized to 4.5 pounds per square inch gauge (psig) prior to engine installation, and checked for leaks at the fittings, valves, and fuel tank seals by applying soapy water or equivalent. After break-in run, a visual check for leakage of the fuel system shall be made.

4.5.1.7 Electrical system check. To determine conformance to 3.3.10, 3.3.10.1, and 3.3.10.2, the engine shall be started and regulated to a minimum engine speed of 750 rpm as noted on the vehicle-installed tachometer. Under varying engine speeds and with varying electrical loads up to 300 amps, the voltage shall be checked at the battery terminals and shall be as originally regulated, ± 0.5 volts.

4.5.1.7.1 Light check To determine conformance to 3.3.10.3, all lights shall be checked for operation before, during, and after break-in run.

4.5.1.7.2 Bilge pump motors check. To determine conformance to 3.3.10.4, the bilge pump switches shall be actuated and the bilge pump motors checked for operation.

4.5.1.7.3 Personnel heater operational check. To determine conformance to 3.3.10.5 and 3.3.11, personnel heater switch shall be actuated as specified and the heater checked for operation using fuel as specified.

4.5.1.7.4 Electric contact ring (hull to turret) check. To determine conformance to 3.3.10.6, the master switch and the gun and turret control selector switch shall be actuated to the "ON" position as indicated by the indicator lights, and the turret rotated 360 degrees clockwise and counterclockwise. The indicator lights shall not flicker or go out at any point of rotation.

4.5.1.7.5 Electric contact ring noise. To determine conformance to 3.3.10.6.1 and 3.5.10.2.1, an audio generator shall be connected to the driver's intercom and a 1,000 cycles per second (cps) signal shall be introduced into the communication system. The turret and cupola shall be manually traversed 360 degrees and checked for noise or static in the earphone. The communication circuits shall be as specified.

4.5.1.7.6 Gun firing circuits check. To determine conformance to 3.3.10.7, connect a voltmeter to the electrical lead of the firing squib on the breech mechanism and to ground, and with power on, actuate the main gun firing switches in the circuit individually. Upon actuation of either trigger, continuity shall be demonstrated. Connect a voltmeter to the electrical lead of the machine gun solenoid, and to ground, and with power on actuate the firing switch. Upon actuation of firing switch, continuity of required voltage shall be demonstrated.

4.5.1.8 Welding repairs and burning check. To determine conformance to 3.3.13, all welding repairs and burning operations shall be checked for removal of slag and in approved procedures have been followed.

4.5.1.9 Power train test. To determine conformance to 3.5 and 3.5.2, the vehicle shall be operated throughout all gear and speed ranges and the power train and associated controls tested for operation as specified.

4.5.1.10 Speeds, acceleration, and braking ability.

4.5.1.10.1 Sustained speed test. To determine conformance to 3.5.4.1, the vehicle shall be operated without towed load at a sustained speed as specified for not less than 10 minutes and at a minimum speed as specified for not less than 5 minutes. Speeds shall be ascertained for conformance as evidenced by the vehicle installed speedometer. Vehicle drift shall be checked and shall be as specified.

4.5.1.10.2 Maximum speed test. To determine conformance to 3.5.4.2 the maximum speed shall be timed and shall be as specified. If a straight course track of sufficient length to achieve maximum speed is unavailable, the following alternate test is allowable: Achieve 19 miles per hour in 3rd range full throttle with the engine governor adjusted to provide a no-load speed of 2940-2990 rpm.

4.5.1.10.3 Acceleration test. To determine conformance to 3.5.4.5, the vehicle shall be accelerated from a standing start to the required speed in not more than the specified time. It is allowable to use a measured course distance for the time test. The equivalent distance to obtain the 0 to 20 mph speed in 9 seconds is 165 feet.

4.5.1.10.4 Stopping test To determine conformance to 3.5.4.6, the vehicle shall be operated on a dry, level, hard-surfaced road free of loose material, and the results of 3 consecutive stopping tests shall be averaged to make this determination. Vehicle drift shall be checked during these tests and shall be as specified.

4.5.1.10.5 Molding test. To determine conformance to 3.5.4.7, the vehicle shall be combat loaded (or a simulated load shall be placed on the vehicle in a position that will not restrict the flow of engine air), and driven upgrade and down grade on the specified grade. In each instance there shall be no movement of the vehicle when brakes are applied under conditions as specified. This test may be conducted in conjunction with 4.5.1.11.

4.5.1.10.6 Turning test To determine conformance to 3.5.5 the vehicle shall be operated clockwise and counterclockwise in 360 degree turns by geared steer and by pivot steer, and shall remain within the specified diameter circles.

4.5.1.11 Fuel system and engine operation on grades and slopes test. To determine conformance to 3.3.8, 3.4.2, and 3.5.6.1, the vehicle shall be positioned upgrade and downgrade on a 60 percent longitudinal grade, and left side up and right side up on a 40 percent slope, and in each instance, the engine shall be operated, stopped and restarted as specified. Normal oil pressure,

fuel supply and temperature shall be maintained when operating on specified grades and slopes. The 60 percent longitudinal brake holding test may be conducted in conjunction with this test (see 4.5.1.10.5).

4.5.1.12 Floatation surfboard and barrier system test. To determine conformance to 3.3.1, 3.5.7.1 and 3.5.7.1.1, at the conclusion of the break-in run, the vehicle, with surfboard and barrier equipment in erected position, shall be driven into water of sufficient depth to float the vehicle. After 15 minutes of floatation with bilge pumps off, the vehicle shall be driven to level terrain and the water accumulation in the hull bottom measured. Water accumulation shall not exceed the depth specified.

4.5.1.13 Cupola check. To determine conformance to 3.5.10, the specified conditions shall be met prior to testing.

4.5.1.13.1 Traverse and gun firing mechanism test. To determine conformance to 3.5.10.1.1, the cupola shall be traversed clockwise and counterclockwise and the gun firing mechanism tested at random positions for simultaneous capabilities as specified.

4.5.1.13.2 Control panel test. To determine conformance to 3.5.10.2.1 and 3.5.10.2.1, the "ON OFF" switch on the control panel shall be deactivated and the cupola electrical controls checked for requirements as specified.

4.5.1.13.3 Remote switch test. To determine conformance to 3.5.10.3.2.

4.5.1.13.4 Powered traversing acceleration and speed test. To determine conformance to 3.5.10.1.2, the cupola shall be accelerated and timed from a standing start to a rate of speed as specified for both clockwise and counterclockwise rotation. After a uniform rate of motion is achieved, the cupola speed shall be timed for rpm and shall be as specified.

4.5.1.13.5 Electric contact ring test (turret to cupola). To determine conformance to 3.5.10.2.3 or 3.5.10.3.3, electrical circuits shall be checked to assure continuity throughout the circuits as specified.

4.5.1.13.6 Manual traverse check. To determine conformance to 3.5.10.2.4, 3.5.10.3.5, and 3.5.10.2.6 or 3.5.10.3.4, 3.5.10.3.5, and 3.5.10.3.6, the manual traverse handle shall be displaced from the stowage position to the engaged position and the cupola traversed manually in both directions with the power switch in the "on" and again in the "off" position. Resultant capability shall be as specified.

4.5.1.14 Turret and gun control test. To determine conformance to 3.5.11 and 3.5.11.1, the turret shall be levelled to within one degree. For acceptance and control tests of 3.5.11 a turret stand may be utilized with the exception of the following paragraphs which require a complete vehicle test: 3.5.11.1.1, 3.5.11.1.12, 3.5.11.1.13, 3.5.11.1.14, 3.5.11.1.19, 3.5.11.1.21, 3.5.11.1.23, 3.5.11.1.24, 3.5.11.2.5. The speed rate requirement of 3.5.11.1.10 may be conducted on the turret stand while the maximum speed requirement shall be conducted on the complete vehicle.

4.5.1.14.1 Manual traverse effort test. To determine conformance to 3.5.11.1.1, the hand crank shall be rotated and the force to maintain turret movement measured. The force shall be measured in each direction of rotation at four points approximately 90 degrees apart, throughout 360 degrees of traverse and shall not exceed specified effort.

4.5.1.14.2 Manual elevating effort test. To determine conformance to 3.5.11.1.2, the hand crank shall be rotated to maintain movement of the gun in elevation and depression and, throughout the full range of elevation, the force required shall be as specified.

4.5.1.14.3 Manual traverse ratio test. To determine conformance to 3.5.11.1 3, after exclusion of backlash, the hand crank shall be rotated clockwise and the turret movement shall be as specified. The test will be repeated in the counter-clockwise direction.

4.5.1.14.4 Manual elevation ratio test. To determine conformance to 3.5.11.1.4, after exclusion of backlash, the hand crank shall be rotated in elevation and the gun angular movement shall be as specified. The test shall be repeated in depression.

4 5.1.14.5 System backlash and compliance test. To determine conformance to 3.5.11.1.5 the system shall be tested for backlash in elevation and traverse by applying force as specified at the muzzle end of the gun. Backlash in elevation and traverse shall be as specified.

4.5.1.14.6 Power and manual control test. To determine conformance to 3.5.11.1.6 the fire control selector switch and firing triggers shall be activated as specified and observed for proper functioning.

4.5.1.14.7 Override control test. To determine conformance to 3.5.11.1.7, the override control switch shall be operated as specified and the control and movement of the gun observed. The commander's over ride switch shall not be reactivated at intervals of less than 10 seconds.

4.5.1.14.8 Control system deadspot test. To determine conformance to 3.5.11.1.8, the gunner's and commander's control handles shall be operated as specified, and the degree of deflection necessary to initiate turret traverse, gun elevation, and gun depression shall be measured. When measuring the deadspot angle, initial free handle movement shall be determined as specified, in order to establish neutral center position of the installed handles.

4.5.1.14.9 Gun elevation speed test. To determine conformance to 3.5.11.1.9, the gun shall be elevated and depressed at specified speeds in the non-stabilized mode by use of the gunner's and commander's power controls, and the gun checked for speed and control. Handle displacement shall produce elevation speeds and control as specified.

4.5.1.14.10 Turret traversing speed test. To determine conformance to 3.5.11.1.10, the turret shall be traversed clockwise and counterclockwise by use of the gunner's and commander's power controls in the non-stabilized mode, and the speed rates produced by required handle displacement shall be checked and shall be as specified. After allowing the turret to accelerate approximately 1/4 revolution, maximum traverse speed shall be timed, and the first revolution of the turret after this acceleration shall be accomplished at the specified rate.

4.5.1.14.11 Traverse, elevation and depression step response test. To determine conformance to 3.5.11.1.11, with the turret control power switch turned on, the gun and turret rate responses to step inputs shall be as specified.

4.5.1.14.12 Elevation system protection test. To determine conformance to 3.5.11.1.12, the gun shall be operated at full speed against both the elevation and depression stops with both power and manual controls and checked for functional requirements as specified.

4.5.1.14.13 Interference zone test. To determine conformance to 3.5.11.1.13, the turret shall be rotated by power at maximum traverse rate with gun fully depressed and observed for clearance requirements. The test shall be conducted in stabilized and non-stabilized modes.

4.5.1.14.14 Elevation and depression range and limits test. To determine conformance to 3.5.11.1.14, the gun shall be elevated by power and manual control and checked for functional requirements as specified. Vehicle attitude shall be considered in measurements.

4.5.1.14.15 Gun laying on moving target and tracking accuracy test. To determine conformance to 3.5.11.1.15 and 3.5.11.1.16 for acceptance testing traverse rates of 0.5 and 70.1 mils per second as shown in Table IV shall be used. A suitable turret tracking instrument shall be used as an equivalent means of making this test. All ranges and target information in Tables III and IV will be used when performing ICT's at the Government Proving Grounds.

4.5.1.14.16 Gun laying on stationary target test. To determine conformance to 3.5.11.1.17 for acceptance testing, the gunsight reticle shall be brought within the border of the specified target for position 3 within the specified number of trials from four different directions, for both power and manual controls, and from two directions for positions 5 and 7. All positions will be used when performing ICT's at the Government Proving Grounds.

4.5.1.14.17 Turret and gun control systems, operation on slope test. To determine conformance to 3.5.11.1.18 for acceptance testing, the turret shall be placed on a 10 degree slope and the gunsight reticle shall be brought within the borders of the target specified for positions 3, 5 and 7 of Table V One determination shall be made for each of the 3 positions, using power and manual

controls, and shall be as specified. The turret and gun control system shall be checked for function in elevation and depression and clockwise and counterclockwise rotation when pitched or canted on a 15 degree slope, and then returned to level terrain and again functionally checked for conformance as specified.

4.5.1.14.18 Control handle centering force test. To determine conformance to 3.5.11.1.20, the displacement torque for the gunner and commander power control handles shall be measured for gun elevation and depression and for clockwise and counterclockwise turret rotation, and shall be as specified.

4.5.1.15 Line of sight accuracy test. To determine conformance to 3.5.11.2.1, the accuracy of the lines of sight of the gunner's telescope conventional reticle and the gunner's periscope reticle with the main weapon centerline shall be determined by elevations from maximum depression. Superimpose the borescope reticle center on each of the main weapon centerline positions (7.5°, 0°, 10°, 15°, 19°,) without overtravel laying from low to high. At each elevation position the gunner's telescope conventional reticle centerline and gunner's periscope reticle centerline shall fall within their respective specified tolerances.

4.5.1.15.1 Gunner's periscope backlash test. To determine conformance to 3.5.11.2.2, backlash shall be checked after synchronization requirements have been met. Tests shall be made in accordance with the following procedure:

(a) Gun shall be placed "dead on" aiming point of target by laying from low to high. This shall be accomplished without overtravel.
(b) The gunner's periscope reticle shall be placed "dead on" target relative to the gun. Boresight knobs shall be locked in this position and micrometer scales slipped to normal settings 4.
(c) The gun shall be realigned with the same target aiming point as in (a) by laying from high to low without overtravel.
(d) If necessary, the gunner's periscope reticle (excluding boresight knob backlash) shall be realigned "dead on" aiming point by use of elevation boresight knobs. Elevation boresight knob micrometer scale shall be used.
(e) The difference in reading between (b) and (d), above, shall not exceed the tolerance specified.
(f) Backlash shall be checked at gun positions of zero, 5°, 10° and 15° elevations.

4.5.1.15.2 Boresight knob travel test. To determine conformance to 3.5.11.2.3, after confirming that synchronization requirements have been met, boresight knob travel shall be tested from the positions established in 4.5.1.15.1.

4.5.1.15.3 Elevation quadrant M13A1C test. To determine conformance to 3.5.11.2.4, the gun shall be positioned to zero elevation by laying gun from low to high. The bubble in the level vial of elevation quadrant M13A1C shall be centered and the knob and index scales adjusted to read zero. The gun shall be elevated (without overtravel) to 19 degrees (337.78 mils) on the target, and the reading on the elevation quadrant M13A1C shall be as specified. This procedure shall be applied in reverse for depression at a depression of 7.5 degrees (133.33 mils).

4.5.1.15.4 Sighting system boresight retention test. To determine conformance to 3.5.11.2.5, prior to 8 mile road test, the weapon shall be boresighted and the gunner's periscope and telescope lines of sight synchronized on their respective aiming points. After completion of the 8 mile road test, the vehicle shall be returned to the place from which the original settings were made and the weapon boresighted as before the test. The gunner's periscope and telescope alignment shall be checked and shall be within their respective tolerances as specified.

NOTE: If weather conditions are suitable, it is permissible to use distant aiming points. The periscope aiming point shall then be located at a distance of 600 meters ± 50 meters and the telescope aiming point located at a minimum distance of 1200 meters from the weapon trunning axis.

4.5.1.15.5 Azimuth indicator test. To determine conformance to 3.5.11.2.6, the vertical line of the gunner's telescope reticle shall be laid on a fixed, well defined vertical aiming point. The zero of the gunner's aid (outer movable dial) on the azimuth indicator shall be positioned in line with the one mil pointer. The turret shall be rotated approximately 50 mils clockwise, and then counterclockwise to the original aiming point without overtravel. The backlash error, which is the difference between the original position and the final reading, shall not exceed 0.5 mil. Repeat this procedure by moving counterclockwise and returning clockwise.

4.5.1.15.6 Laser range finder. To determine that the Laser Range Finder can be repeatedly aligned in azimuth with the main gun as outlined in 3.5.11.2.7.

4.5.1.15.7 Missile guidance and control system checkout. To determine conformance to 3.5.11.3, the missile guidance and control system checkout procedure shall be as specified in SHILLELAGH Missile System Technical Procedure 6829 and TM 9-2350-230-12, Table 2-9 and paragraph 10-5b.

4.5.1.15.8 Grenade projector system functioning test. To determine conformance to 3.5.11.4.1 a minimum voltage input to the system shall be 18 volts DC. Upon actuation of the system master switch on the grenade projector control panel, the time interval for the ready light to be lighted shall be as specified.

4.5.1.15.9 Grenade projector system capability test. To determine conformance to 3.5.11.4.2 the grenade projector firing system shall be operated and checked for functional requirements.

4.5.2 Control tests. 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 contractor as specified herein.

4.5.2.1 Frequency. The first overhauled vehicle off the production line, or one of the first ten vehicles produced; and thereafter, one vehicle per month shall be subjected to the following control tests.

4.5.2.2 Test failure. If a vehicle fails to pass any control test specified herein, the Government may 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 3.3.1, the vehicle, after no more than one hour of water operation, shall be examined for contamination of lubricants of roadwheels 2, 3, 4, 5 and one of their corresponding arms, on each side of the vehicle. Contamination shall not exceed 2 percent (by volume). This test may be conducted in conjunction with 4.5.1.12. Examination shall be conducted for evidence of unacceptable internal leakage from bearings.

4.5.2.4 Vision device test. To determine conformance to 3.3.3, the vision devices shall be installed in the mounts and checked for binding, interference, and leaks. A spray of water from a 1/2 to 3/4 inch inside diameter hose shall be directed on the vision devices from a distance of 3 feet for a period of 3 minutes without excessive leakage. This test may be conducted in conjunction with 4.5.1.2.

4.5.2.5 Fuel tanks and lines test To determine conformance to 3.3.8.1 and 3.3.8.2, with both fuel filler caps removed, the fuel tanks shall be filled at the specified average fill rate. The tanks and lines shall be checked for leaks before and after the road test.

4.5.2.6 Electrical contact ring and communication equipment test. To determine conformance to 3.3.10.6, and 3.5.10.2, the electrical contact ring and communication equipment leads and cable assemblies shall be checked for installation and functional requirements.

4.5.2.7 Stowed equipment test. To determine conformance to 3.3.12, all manufacturer and depot installed OVE shall be stowed (combat loaded) on the selected vehicle. The equipment shall be removed after the test. The OVE used, as provided to the contractor, will represent the latest production available to the contractor.

4.5.2.8 Bilge pump operational test. To determine conformance to 3.5.3, the bilge pumps shall be operated and checked for functional requirements.

4.5.2.9 Minimum speed test. To determine conformance to 3.5.4.3, the vehicle shall be operated at specified speed and length of time and checked for performance requirements.

4.5.2.10 Turret creep and gun drift test. To determine conformance to 3.5.11.1.22 the turret power shall be turned on and the system allowed to warm up. After nulling out the system, the turret and gun positions shall be noted; and, after a waiting period of 5 minutes with power on and palm switch depressed, turret and gun positions shall again be checked. Gun and turret creep and drift shall not exceed the tolerances specified.

4.5.2.11 Fire extinguisher test. To determine conformance to 3.8, the fire extinguisher system shall be functionally tested by use of inside and outside controls. Subsequent monthly tests shall be made by testing alternating sides each month (inside control one month, outside controls the next month, etc.).

4.5.3 Comparison test. The Government may select vehicle(s) at any time during a production contract period and subject such vehicle(s) to all tests listed in table VIII (4.5.1.2 through 4.5.3.17) and table IX to determine if any deficiencies of a workmanship or materials nature exist. These tests shall be conducted at Government laboratories or proving grounds designated by the contracting officer. Comparison test vehicles shall be combat loaded with all on-vehicle material stowed in the spaces provided (see 3.3.12). Vehicle(s) 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 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 contractor that corrective action has been taken to eliminate the conditions.

Table IX. 2,000 mile test - combat loaded (Government Proving Grounds)

Course	Mileage and speeds
Hard-surface or gravel	400 miles at varying speeds up to maximum
Gravel and dirt road	400 miles at varying speeds up to maximum
Level cross-country	600 miles at varying speeds up to maximum
Hilly cross-country	600 miles at varying speeds up to maximum

4.5.3.2 Special kits check.

4.5.3.2.1 Winterization kit test. To determine conformance to 3.3.2.1, the kit shall be installed in accordance with applicable drawings and specifications. The vehicle, thus equipped and properly serviced, shall be adequately warmed up and then subjected to temperatures as specified. The engine shall start and operate as specified.

4.5.3.2.2 Collective protector kit test. To determine conformance to 3.3.2.2, the kit shall be installed and operated and each outlet shall be individually checked for minimum flow of air as specified.

4.5.3.3 Carbon monoxide concentration test. To determine conformance to 3.3.4 the vehicle shall be "buttoned up" and the engine operated at 900 to 1,000 rpm for a period of not less than 30 minutes with all ventilating systems in operation. Then the main weapon shall be fired once (conventional) and the machine gun shall be fired (one burst) and the carbon monoxide (CO) content of the crew compartment measured.

4.5.3.4 Fuel system operational test. To determine conformance to 3.3.8 and 3.3.8.1, in conjunction with other vehicle slope tests, the vehicle fuel system shall be checked for functional requirements and shall be as specified. The tanks shall be filled as specified and average rate of filling shall be as specified.

4.5.3.5 Cooling system tests. To determine conformance to 3.3.9, the vehicle shall be operated as specified, and the cooling system operating temperatures shall be as specified.

4.5.3.6 Environmental tests. To determine conformance to 3.5.1, the vehicle, when properly serviced and equipped, shall be subjected to the applicable tests in high and low temperatures.

4.5.3.7 Bilge pump water removal test. To determine conformance to 3.5.3, the vehicle shall have sufficient water in hull to operate bilge pumps and rate of water removal shall be as specified.

4.5.3.8 Towed load speed test. To determine conformance to 3.5.4.4, the vehicle shall be operated at specified speeds and checked for functional requirements.

4.5.3.9 Slope and grade operation test. To determine conformance to 3.4.2, 3.5.6 and 3.5.11.1.18, the vehicle shall be operated on applicable slopes, as specified, and checked for performance requirements. The test grades and slopes shall possess surface characteristics which prevent treck slippage.

4.5.3.10 Water speed and directional stability test To determine conformance to 3.5.7.2 and 3.5.7.3 the vehicle shall be operated as specified. Six runs shall be made with directions alternated to nullify the effect of current. The speed shall be calculated as the average of the fastest speed run in each direction and shall be as specified.

4.5.3.11 Trench crossing test. To determine conformance to 3.5.8, the vehicle selected shall be driven, without stalling, over trenches as specified and then examined for damage.

4.5.3.12 Vertical obstacle test To determine conformance to 3.5.9, the vehicle selected shall be driven, without stalling, over obstacles as specified and then examined for damage.

4.5.3.13 Locking mechanism test. To determine conformance to 3.5.11.1.19, with power off and all manual locks released, the vehicle shall be driven as specified and the turret and gun handcranks observed for functional requirements.

4.5.3.14 Turret traverse friction check. To determine conformance to 3.5.11.1.21, the turret shall be prepared as specified, the turret assembly shall be rotated throughout the 360 degrees of rotation, and the torque required to maintain rotation shall not exceed specified foot pounds, with a tangential force applied and parallel to plane of rotation.

4.5.3.15 Firing stability test. To determine conformance to 3.5.11.23, the line of sight motion shall be stabilized by firing the main armament and shall be within specified limits.

4.5.3.16 Stabilized mode test. Tc determine conformance to 3.5.11.1.24, the gun and turret control system shall be tested and shall prove operational capabilities as specified.

4.5.3.17 Electromagnetic compatability test. To determine conformance to 3.6, the vehicle shall be subjected to a electromagnetic compatability test as specified.

5. PREPARATION FOR DELIVERY

5.1 Preparation for delivery and storage shall be in accordance with MIL-A-62019.

6. NOTES

6.1 Intended use. The vehicle is intended for use by the Armed Forces as an Armored Reconnaissance and Airborne Assault Vehicle.

6.2 Procurement documents should specify the following:

(a) Title, number, and date of this specification.
(b) Preproduction vehicle, if required (see 3.1).
(c) Special kits, to be overhauled when required (see 3.3.2).
(d) If electromagnetic compatability requirement is other than specified (see 3.6).

6.3 Safety precautions. Caution should be exercised in handling Freon 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.

6.3.1 Safety precautions during repair. During repair operations such as cleaning, welding and painting, the breathing zone of the operator shall not exceed the latest TLV as designed by American Conference of Government Industrial Hygienists.

6.4 The following shall be considered part of the classification of defects for leaks, Table VII:

(a) Weep: - Any non-recurring evidence of fluid beyond the seal.

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

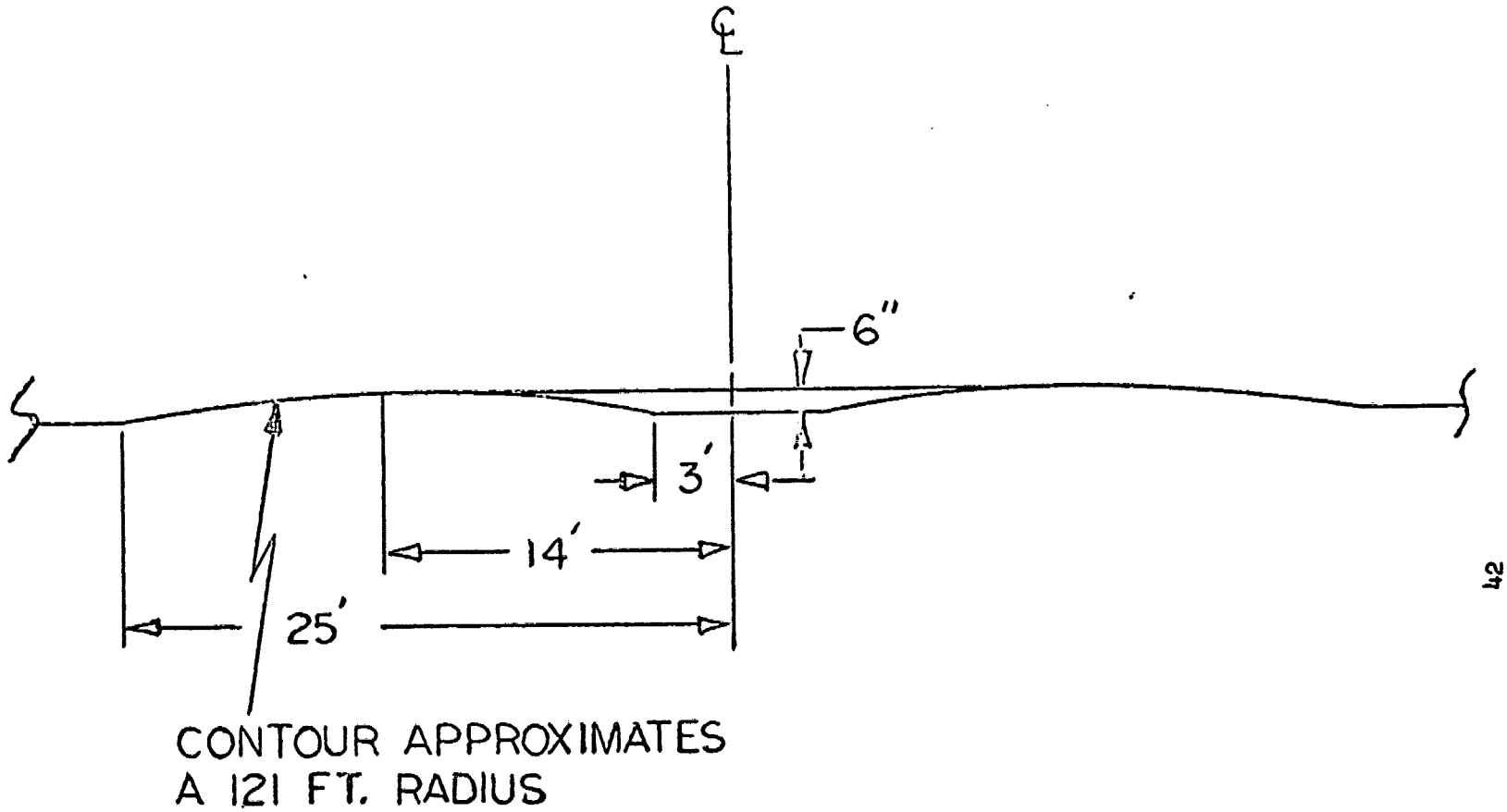
(c) Droplet: - Any recurring evidence of fluid beyond the seal that results in formation of a non-falling droplet.

(d) Drip: - Any recurring evidence of fluid beyond the seal where droplet forms and falls.

Custodian:
Army - AT

Preparing activity:
Army - AT

Project No. 2350-A225



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MIL-A-62247(AT)

PROFILE OF TEST TRACK
(ARTIFICIAL BUMP)

FIG. 1

FOLD

POSTAGE AND FEES PAID

DOD-314

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

Commander
US Army Tank-Automotive Command
ATTN: AMSTA-RSES
Warren, Michigan 48090

FOLD