MIL-T-62222(AT)
1 July 1985
SUPERSEDING
(see 6.7)

MILITARY SPECIFICATION

TANK, COMBAT, FULL-TRACKED: 105MM GUN, M48A5

This specification is approved for use by US Army Tank-Automotive Command, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers one type of full-tracked, armored combat vehicle, which mounts a 105MM gun as the primary weapon.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: US Army Tank-Automotive Command, ATTN: AMSTA-GSS, Warren, MI 48397-5000, by using the self addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter.

FSC 2350

SPECIFICATIONS
FEDERAL

TT-E-527	- Enamel, Alkyd, Lusterless.
VV-F-800	- Fuel Oil, Diesel.

MILITARY

MIL-L-2104	- Lubricating Oil, Internal Combustion Engine, Tactical Services.
MIL-E-52798	- Enamel, Alkyd, Camouflage.
MIL-T-62050	- Tank, Combat, Full Tracked; l05MM Gun, M48A5, Processing for Stowage and Shipment of.

STANDARDS
FEDERAL

FED-STD-595	- Colors.

MILITARY

MIL-STD-105	- Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-193	- Painting Procedures Tactical Vehicles (Tracked and Wheeled).
MIIL-STD-461	- Electromagnetic Interference Characteristics, Requirements for Equipment, Subsystem and System.
MIL-STD-462	- Electromagnetic Interference Characteristics, Measurement of.
MIL-STD-810	- Environmental Test Methods.
MIL-STD-1474	- Noise Limits for Army Materiel.

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

DRAWINGS
ARMY

8736758	- Tank, Combat, Full-Tracked: l05MM Gun, M485A5.
11655710	- Conversion Kits M48Al to M48A5 (M48A3E1).
12270442	- Balancing Procedure for Main Gun Combination System M48A5.

OTHER PUBLICATIONS

2-2-614	- USA TECOM Material Test Procedure.

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

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

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), the contractor shall furnish vehicles which shall be subjected to first article inspection (see 4.4.1 and 6.2). First article inspection samples, properly marked with identifying information shall be representative of the unit to be furnished to the Government. All subsequent vehicles delivered to the Government shall conform to these samples in all of their pertinent physical and performance attributes.

3.2 Materials. Materials shall be as specified herein and in referenced specifications, standards, and drawings. Material shall be free from defects which adversely affect performance or serviceability of the finished product (see 4.6.1 and 6.6).

3.2.1 Ozone resistance. When rubber components are required to be ozone resistant, the degree of resistance shall be as specified in applicable specifications or drawings (see 4.6.1).

3.3 Design and construction. Vehicles, components, subassemblies and assemblies shall be manufactured and assembled into a complete vehicle in accordance with Drawing 11655710 and applicable specifications and documents. Vehicles shall meet all requirements specified herein and be of a quality that assures a vehicle free from defects that would compromise, limit, or reduce its performance (see 4.6.1).

3.3.1 Qualified products. The contractor shall be responsible for using parts and assemblies from Qualified Products Lists (QPLs) whenever available. Contractor's inspection records shall specifically list all QPL items by number and date of the QPL, name of supplier and part or drawing number(s). When parts and assemblies are approved as qualified products, but not yet listed on the QPL, the contractor shall list the products by number and date of the approved document and name of supplier(s) (see 4.6.1).

3.3.2 Break-in run. The vehicle shall subjected to a break-in run. The break-in run will include preliminary checks of suspension, controls, power pack, and provide wear-in for final adjustments. Prior to the break-in run will involve the following activities and conditions (see 4.6.1):

a. Preparation. Prior to the break-in run, except for equipment and component installations and servicing performed by the contractor as a final processing of the vehicle for acceptance, the vehicle shall be completely assembled and all adjustments completed. The vehicle, including all applicable components requiring lubrication, shall be lubricated in accordance with production lubrication chart. The vehicle shall be serviced with fuel conforming to applicable seasonal grades of VV-F-800. Engine oil conforming to the applicable seasonal grade of MIL-L-2104 may be used. Specific applications by grades or types for various expected seasonal temperature ranges shall be specified. Fuel and water separator and the primary fuel filter shall be bled of air by removing each respective bleed plug and operating the in-tank fuel pump. After air is bled, replace the bleed plugs.

b. Oil pressure and temperature. Prior to the start of the break-in run, the engine shall be operated at 800 to 1200 revolutions per minute (rpm) until lubricating oil is at operating pressure and temperature. If at any time during 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. Proper oil pressure and temperature shall be maintained during operation on level ground, 60 percent grades and 30 percent side slopes.

3.3.2.1 Operation and distance. Each vehicle shall be given a break-in run for the distances specified in table I on smooth, level, hard-surfaced roads. The vehicle shall be operated over the undulating section of road (see figure 1) during "a" and "b" divisions of the break-in run in both directions (see 4.6.1).

3.3.2.2 Reverse operation. After each division of the break-in run, the vehicle shall be stopped, the engine allowed to idle for not less than ten minutes, and the vehicle driven in reverse for a distance of not less than 50 feet at speeds between 2 and 7 miles per hour (mph) (see 4.6.1).

3.3.2.3 Condition after run. After completion of the break-in run, the engine shall idle between 700 and 750 rpm. Prior to vehicle being submitted to the Government for acceptance, all suspension wheel bearings shall be checked to determine if adjustments are correct and readjusted, as required. Track fasteners shall also be re-torqued (see 4.6.1).

3.3.3 Fording kit. When specified (see 6.2), the vehicle shall be furnished with a fording kit installed, providing a capability to ford a 96 inch water depth (see 4.6.1).

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

Division of run	Speed mph	Distance miles	Test conditions
a	0 to 10	10	Track (road)
b	11 to 15	15	Track (road)
c	16 to 20	10	Track (road)
d	21 to Max.	10	Track (road)

3.4 Physical characteristics.

3.4.1 Sealing. Unless otherwise specified, all seals and sealer shall prevent the entrance of water and foreign matter. Static seals shall provide an interference fit of sealing surfaces preventing the loss of leakage of fluids intended to contained by the seals. Dynamic seals shall prevent fluid leakage in the form of a drip (see 6.5.1) when the vehicle is standing idle. Evidence of lubricant at seals specifically designed to allow exit of flushed lubricants shall be permitted (see 4.6.2.1).

3.4.1.1 Hatch seals. Hatch seals shall prevent leakage of water into the crew compartment (see 4.6.2.1.1).

3.4.1.2 Vision device and receptacle seals. When installed, the driver's, gunner's, and commander's periscopes shall be sealed to prevent any entry of water into the vehicle. The driver's infrared (IR) periscope shall not permit water entry in excess of a continuous drip (see 6.5.1) into the vehicle (see 4.6.2.1.1 and 4.6.2.1.2).

3.4.2 Hydraulic lines. Provisions shall be made to assure internal cleanliness of hydraulic lines and connections. Brake hydraulic lines and connections shall be free from leakage in the form of a drip (see 6.5.1) (see 4.6.3).

3.4.3 Ventilation system.

3.4.3.1 Vent blower. The vent blower shall pressurize the air inside the occupied areas of the vehicle (see 4.6.4.1).

3.4.3.2 Carbon monoxide. The ventilation system shall prevent harmful accumulations of carbon monoxide (CO) in the occupied areas of the vehicle. The concentrations of CO shall not exceed the percentage levels as indicated below throughout the respective time periods specified in table II (see 4.6.4.2).

TABLE II. Carbon monoxide concentration.

Percentage levels	Duration
0.6	One minute or less
0.12	1 to 5 minutes
0.04	5 to 15 minutes
0.02	15 to 30 minutes
0.01	30 to 60 minutes
0.005	Over 60 minutes

3.4.4 Controls. When installed in accordance with applicable drawings, all electrical, mechanical, and hydraulic controls shall operate without malfunction throughout all ranges of operation under all vehicle operating conditions (see 4.6.5).

3.4.5 Adjustment mechanisms. When installed and adjusted in accordance with applicable drawings, all adjustment mechanisms shall function properly, and maintain adjustment settings during all vehicle operating conditions (see 4.6.6).

3.4.6 Vision devices and receptacles. Provisions shall be made to assure that receptacles incorporated on the vehicle will accept applicable vision devices without binding or interference. The gunner's periscope receptacle shall accept the periscope, and when the periscope is installed, removed and reinstalled, the line of sight of the periscope shall not deviate more than 0.2 mil from the line of sight of initial installation (see 4.6.7).

3.4.7 Gas particulate system.

3.4.7.1 Air flow. The air flow shall be not less than 3.0 cubic feet per minute (cfm) and not more than 4.5 cfm at each crew position outlet (see 4.6.8.1).

3.4.8 Stowed equipment. The vehicle shall be capable of stowing all basic issue items (BII) in spaces provided, to assure that items do not interfere with operation of the vehicle and components in any manner (see 4.6.9).

3.4.9 Engine shroud. The space between the upper metal surface of the engine shroud and the top deck grille sealing surface shall be not less than .82 nor more than 1.25 inches (see 4.6.10).

3.4.10 Cooling system. With the vehicle operating in an ambient temperature of 115 degrees Fahrenheit (°F), the engine oil temperature shall not exceed 250°F at the heat exchanger outlet, and the transmission oil temperature shall not exceed 300°F at the heat exchanger inlet (see 4.6.11 and 4.9.1).

3.4.11 Fuel system.

3.4.11.1 Fuel Tanks and lines. Provisions shall be made to assure the internal cleanliness of the fuel tanks and lines prior to initial fueling of vehicle. The fuel tanks shall be free from leakage. The fuel tanks shall be capable of receiving 50 gallons of fuel per minute (see 4.6.12.1).

3.4.11.2 Intake fuel pumps. Each pump shall be capable of producing a minimum pressure of 5 pounds per square inch (psi) at the engine end of fuel line disconnect, under no-flow conditions (see 4.6.12.2).

3.4.11.3 Fuel return systems. The fuel return selector valve shall divert fuel to the tanks as indicated by the pointer on top of the valve (see 4.6.12.3).

3.4.11.4 Fuel shutoff valve. The engine shall stop firing and rotating within a maximum of 30 seconds after the manual fuel shut-off valve is actuated to the "OFF" position (see 4.6.12.4).

3.4.11.5 Throttle linkage. With the throttle linkage attached to engine and the throttle pedal depressed to within a range of 0.12 to 0.62 inch of the pedal stop, the throttle shall be at full rack position. At the foregoing adjustment and with the throttle pedal depressed to the pedal stop, a minimum of 0.01 inch clearance shall remain at the engine throttle stop (see 4.6.12.5).

3.4.11.6 Fuel system, grades and slopes. During engine operation, the fuel system shall maintain a continuous fuel supply to the engine with ascending and descending 60 percent grades in forward and reverse gear, and when the vehicle is being operated on 30 percent side slopes, with either side of the vehicle up slope (see 4.6.12.6).

3.4.12 Hatches.

3.4.12.1 Driver's hatch. The force required to breakaway and turn the driver's hatch cover across the opening shall not exceed 30 pounds at the handle. The force required to lock the driver's hatch cover in the closed position shall not exceed 75 pounds at the end of the locking lever (see 4.6.13.1).

3.4.12.2 Driver's escape hatch. The force required to operate the handle to release the driver's escape hatch latching mechanism shall be 50 $\pm$ 10 pounds (lb) pull at a point 1/2 inch from the end of the handle. The driver's escape hatch shall drop free of the hull when the latching mechanism is released (see 4.6.13.2).

3.4.12.3 Loader's hatch. The helper springs on outside of vehicle shall be set so when the loader's hatch is unlatched, it shall spring open 30 degrees from horizontal. The force required to close the hatch from the open 30 degree position shall not exceed 45 lb. With the hatch fully closed, the force required to lock or unlock the hatch shall not exceed 20 lb (see 4.6.13.3).

3.4.12.4 Cupola hatch. With the cupola hatch closed, the force required to lock or unlock the hatch shall not exceed 46 pounds. With the hatch unlocked, the force required to push hatch to its extreme open-latched position shall not exceed 30 lb. The force required to release the hatch open-lock plunger shall not exceed 50 lb (see 4.6.13.4).

3.4.13 Seats.

3.4.13.1 Driver's seat. With the driver in a seated position, the force required to actuate the fore and aft seat adjustment lever shall not exceed 12 lb at the end of the lever. With the driver's seat vacated, the force required to actuate the seat vertical adjustment lever shall not exceed 14 lb at the end of the lever. The force required to trip the seat dumping lever shall not exceed 14 lb at the end of the lever. The driver's seat shall move forward, backward and vertically when the appropriate levers are actuated (see 4.6.14.1).

3.4.13.2 Gunner's seat. With no load, the gunner's seat shall be free of binding and interference throughout the operating range (see 4.6.14.2).

3.4.13.3 Commander's platform seat. With no load on the commander's seat and platform assembly, the platform seat shall be free of binding and interference throughout the operating range. The platform latch shall lock securely in the "up" position. The backrest shall be retained in a vertical position when not used in its functional mode. The seat shall be retained in a vertical position when not being used (see 4.6.14.3).

3.4.13.4 Loader's seat. When the loader's seat assembly is properly installed and is not in use, the lifting spring shall be capable of raising and retaining the seat base in a vertical position (see 4.6.14.4).

3.4.14 Crew compartment system.

3.4.14.1 Radio and intercommunication installation. Provision shall be available (signal, control and power circuits) for installation of an AN/VRC-12 radio at the commander's station for external communications. Provision for installation of an AN/VIC-1(V) intercom at each crew station and the rear fender phone box for internal and external communications shall also be provided (see 4.6.15.1).

3.4.15 Electrical system.

3.4.15.1 Vehicle electrical.

3.4.15.1.1 Interior lighting. Each crew position shall contain a domelight to provide general illumination to assist with tasks at night or during closed-hatch operation. The domelight shall contain provisions for adjusting light intensity and red filter for night vision adaptation. The lights shall operate as specified through all vehicle operating conditions. All electrical contacts and connections shall maintain positive contact under all vehicle operation conditions (see 4.6.16.1.1).

3.4.15.1.2 Hull-to-turret slipring. The hull to turret slipring shall provide power and signal circuits capable of maintaining positive electrical contact between the hull and turret electrical subsystems under all vehicle environments (see 4.6.16.1.2).

3.4.15.1.3 Auxiliary outlet. Two outlets [24 volts (V) direct current (dc) nominal], one each in the turret and hull, shall be provided for use with the BII trouble light assemblies. Each auxiliary outlet circuit shall be protected with a 15 ampere (A) automatic reset circuit breaker (see 4.6.16.1.3).

3.4.15.1.4 Personnel heater. The heater shall be capable of starting with the switch in either Hi or Lo position. The blower motor shall operate at reduced speed when the heater is turned on. The burner shall ignite within four minutes of heater turn-on. Subsequent to ignition, the heater shall be capable of generating high or low heat and the blower motor shall run at full speed. Turning the heater OFF shall cause both the burner to extinguish and the blower motor to shut off within 3.5 minutes (see 4.6.16.1.4).

3.4.15.1.5 Engine smoke generator. The vehicle shall provide smoke in the left and right exhaust pipes when the engine is running and the smoke generator switch is in the ON position (see 4.6.16.1.5).

3.4.15.2 Hull electrical.

2.4.15.2.1 Power plant electrical. The power plant electrical equipment shall consist of the following (see 4.6.16.2.1):

a. Engine and transmission sending units necessary to provide pressure and temperature signals to the driver's instrument panel.
b. An electrical disconnect to facilitate power pack removal and replacement.
c. An electrical starter motor capable of starting the engine.
d. Generator for supplying electrical energy.

3.4.15.2.2 Exterior lights. The external lights shall operate as specified on applicable drawings through all vehicle operating conditions. All electrical contacts and connections shall maintain positive contact under all vehicle operating conditions (see 4.6.16.2.2).

3.4.15.2.3 Generator voltage. With the engine operating at not less than 1000 rpm, the vehicle generator shall deliver between 25.8 and 30.2 V at the battery, except when the turret hydraulic power pack is energized, the voltage shall not be less than 18.5 V (see 4.6.16.2.3).

3.4.15.2.4 Driver's infrared power pack high voltage supply. With the generator supplying specified voltage, the infrared power pack output voltage at the driver's periscope connector shall be not less than 14 000 V, without any evidence of high voltage arcing (see 4.6.16.2.4).

3.4.15.2.5 Air cleaner blower motors. Each air cleaner blower motor shall provide a flow of air through each blower outlet. The air cleaner blower motors shall be wired so they do not operate unless the engine is running (see 4.6.16.2.5).

3.4.15.2.5.1 Air cleaner outlet system. The air cleaner outlet system (air cleaner to turbocharger) shall be air tight to the extent that when a vacuum of 25 to 30 inches of water is applied, the loss of vacuum shall not be more than three inches of water during a three minute period (see 4.6.16.2.5.1).

3.4.15.2.6 Engine manifold heater. The vehicle wiring for the engine manifold heater shall provide a switch-actuated vehicle battery circuit to the engine. Operation of the pushbutton switch on the purge pump handle with the starter switch depressed, shall provide vehicular battery voltage to pin “a” of the multiple connector at the engine electrical quick disconnect (see 4.6.16.2.6).

3.4.15.3 Turret electrical.

3.4.15.3.1 Main gun firing circuits. The main gun firing circuits shall be capable of providing the energy necessary [1.25 A for 100 milliseconds (ms)] to ignite the main round. The firing circuit shall also provide the following (see 4.6.16.3.1):

a. The probe shall be grounded at all times, except during application of the firing voltage.
b. The firing control circuits shall include the "dead man" switching feature which prevents subsequently loaded rounds from detonating until the firing switch “trigger” has been released after the previous round.
c. Interconnections shall be provided to allow firing circuit activation from the alternate emergency switch on the manual elevation pump handle, and provide emergency mode firing per 3.4.15.3.2.

3.4.15.3.2 Emergency mode firing. In the event of a firing circuit failure, the blasting machine shall be capable of firing the round (see 4.6.16.3.2).

3.4.15.3.3 Coaxial machine gun firing circuit. The machine gun firing circuit shall be capable of providing the energy necessary (13 A) to operate the machine gun solenoid (see 4.6.16.3.3).

3.4.15.3.4 Main gun and machine gun circuit controls. The firing circuit controls will be arranged and interlocked to allow the commander to fire the main gun and the coaxial machine gun, and the gunner to fire the main gun and the coaxial machine gun. A safety switch, manually operated from the loader's station, shall open the firing circuits to the main gun from the commander's and gunner's station with the switch in the SAFE position. These circuits shall be closed with the switch in the FIRE position (see 4.6.16.3.4).

3.4.15.3.5 Searchlight power circuits. The searchlight power circuits shall be capable of providing vehicle power for operating and controlling the searchlight (for 2.2 KW AN/VSS-1 searchlight only) (see 4.6.16.3.5).

3.4.15.3.6 Smoke grenade discharger circuits.

3.4.15.3.6.1 Arming. The power-on (ready) lamp in the grenade power box shall illuminate when the master battery switch, the turret power switch, and the grenade system power switch are all ON (see 4.6.16.3.6.1).

3.4.15.3.6.2 Circuit voltage. Voltage at the smoke grenade discharger firing pins, shown in figure 2, shall be as indicated in table III when the power-on (ready) lamp in the grenade power box is illuminated and the appropriate firing pushbutton is actuated (see 4.6.16.3.6.2 and 4.6.16.3.6.3).

TABLE III. Grenade discharger circuit voltage.

Firing push button	Left discharger firing pins	Right discharger firing pins	Voltage
RIGHT	1, 2, 5	3, 4, 6	Vehicle (see 3.5.15.2.3)
RIGHT	3, 4, 6	1, 2, 5	0 ± 0.5 V dc
LEFT	3, 4, 6	1, 2, 5	Vehicle (see 3.5.15.2.3)
LEFT	1, 2, 5	3, 4, 6	0 ± 0.5 V dc

3.5 Performance. A complete vehicle combat loaded or with a simulated load of equal weight (see 3.4.8), and serviced, shall perform herein after a break-in run. The vehicle, serviced (see 3.3.2a) and equipped for existing climatic conditions, shall operate as specified without special equipment (see 4.6.17).

3.5.1 Durability. The vehicle shall meet the operational durability requirements when operated for 4000 miles, combat loaded or with a simulated load of equal weight, at an average speed not exceeding 30 mph over terrain apportioned as follows (see 4.6.17.1):

a. 25 percent on paved roads, either concrete or asphalt, or any combination of the two.
b. 25 percent on gravel and dirt roads with at least 10 percent of this distance under mud conditions.
c. 25 percent on level, cross country.
d. 25 percent on hilly, cross country.

3.5.2 Power plant and power train. The power plant (engine and transmission) shall function throughout all gear and speed ranges without loss of lubricants or damage that may cause failure of vehicle to perform any of the mobility requirements. The power train (power plant, final drive and track) and associated controls shall be capable of operation throughout all speed and steering

ranges when controls are applied to steer, stop, or hold vehicle. Each power plant shall be checked prior to installation in the vehicle and the necessary engine and transmission adjustments made to assure conformity to vehicle mobility and related engine requirements (see 4.6.17.2).

3.5.2.1 Speeds.

3.5.2.1.1 Level road speeds. The vehicle shall operate at sustained speeds of 30 mph and at 2.5 mph on level ground without damage to power plant and power train. When traveling between 25 and 30 mph in a straight line, without manual steer correction, the vehicle drift shall not exceed three feet in 100 feet (see 4.6.17.2.1.1).

3.5.2.1.2 Grade speeds. The vehicle shall operate at a sustained speed of 10 mph while ascending a 10 percent grade, and at 20 mph while ascending a 3 percent grade (see 4.6.17.2.1.2).

3.5.2.2 Acceleration. The vehicle shall accelerate from a standing start on level ground through a distance of 200 feet within a time period of 13 seconds (see 4.6.17.2.2).

3.5.2.3 Climbing. The vehicle shall ascend longitudinal grades of 60 percent in forward and reverse gear without stalling or damage to the power plant and power train. The vehicle shall operate on right and left side slopes of 30 percent (see 4.6.17.2.3).

3.5.2.4 Engine start on grades and slopes. When standing on a 60 percent grade for not less than two minutes, with engine idling under no load between 700 and 750 rpm, the engine shall be stopped for not less than two minutes. The engine shall restart in not more than one minute when headed either up or down grade. A similar engine stopping and starting test shall be accomplished on 30 percent right and left side slopes (see 4.6.17.2.4).

3.5.2.5 Braking and drift. The vehicle traveling at 20 mph shall stop within 60 feet from the point of brake application, drift shall no exceed four feet when stopping (see 4.6.17.2.5).

3.5.2.5.1 Holding. With the vehicle standing on a 60 percent grade with the service brakes applied, the vehicle shall be held stationary when headed either up or down grade. With the parking brake engaged and all other holding devices inoperative, the vehicle shall be held stationary when headed either up or down grade (see 4.6.17.2.5.1).

3.5.2.6 Turning. The vehicle shall turn 360 degrees to the right and left in pivot, in neutral steer, within a circle 35 feet in diameter (see 4.6.17.2.6).

3.5.2.7 Fording.

3.5.2.7.1 Shallow water. The vehicle shall ford a level, hard-bottom body of water 48 inches in depth, including wave, without special equipment. With the vehicle standing in water 48 inches in depth for 30 minutes, the accumulation of water shall be not more than two inches on the crew compartment hull floor measured in the center of the "V" (see 4.6.17.2.7.1).

3.5.2.7.2 Drain valves. After unlocking the lever, the force required to operate the front drain valve lever shall not exceed 17 lb. This force measured at the end of the hand grip shall cause the valve to travel at least 3/8 of an inch. After unlocking the lever, the force required to operate the rear drain valve lever shall not exceed 25 lb measured at a point just below the knob. This force shall actuate the valve and travel shall be not less than 11/16 of an inch (see 4.6.17.2.7.2).

3.5.2.7.3 Turret inflatable seal and pump. The turret seal pump shall be capable of inflating the seal to 25 psi. The force required to operate the pump plunger shall not exceed 50 lb (see 4.6.17.2.7.3).

3.5.2.7.4 Engine start - shallow water. With the vehicle standing for 30 minutes in water up to 48 inches in depth, and the engine operating at 1000 rpm for 15 minutes, then stopped for 15 minutes, the engine shall restart in not more than 3 minutes. All accessories shall function satisfactorily during and after fording operations. After fording operations, the water contamination content of the transmission, engine, final drives, and suspension system lubricants shall be not more than 2 percent by volume (see 4.6.17.2.7.4).

3.5.2.7.5 Deep water. When the vehicle is specified with an installed fording kit (see 3.3.3) the vehicle with fording kit installed shall ford a level, hard-bottom, body of water 96 inches in depth. With the vehicle standing in water 96 inches in depth for 30 minutes, the accumulation of water shall be not more than 2 inches on the crew compartment hull floor in the center of the "V" (see 4.6.17.2.7.5).

3.5.2.8 Trench crossing. The vehicle shall cross trenches 36 inches in depth and 102 inches in width without stalling or damage to suspensions, gun tube, and other vehicle equipment (see 4.6.17.2.8).

3.5.2.9 Verticle obstacles. The vehicle shall cross over vertical obstacles 36 inches in height while moving forward without stalling or damage to suspension and hull floor (see 4.6.17.2.9).

3.5.3 Turret and cupola.

3.5.3.1 Main armament balance. With the vehicle combat loaded, the main gun level, an M457 dummy round in the main gun breech, without searchlight or searchlight bracket, the main armament shall balance muzzle heavy within the range of 56 to 70 pounds foot (lb-ft) (see 4.6.17.3.1).

3.5.3.2 Nylon ballistic shield. The gun mount with coaxial machine gun mount, machine gun, spent brass and link ejection bag, sighting system and the nylon ballistic shield installed, shall elevate to a minimum of 19 degrees and a minimum of 8 degrees depression. No binding shall exist between the machine gun, the sighting system and the nylon ballistic shield, to cause the coaxial machine gun to deflect by more than 0.5 mil and the telescope to deflect more than 0.1 mil (see 4.6.17.3.2).

3.5.3.3 System backlash. With the elevation and traverse power switch on or off, the control system backlash shall not exceed 1 mil in traverse and 1 mil in elevation when a perpendicular force of 70 lb is applied in the plane of rotation at a point approximately 20 inches from the muzzle end of the gun. (The backlash shall be that angular movement of the gun in traverse and elevation when the force at the end of the gun is reversed and applied in an opposite direction.) (See 4.6.17.3.3).

3.5.3.4 Turret and gun control system. Except as otherwise specified, the turret and gun control system shall operate and meet all requirements specified herein for the following operating conditions (see 4.6.17.3.4):

a. The turret shall be level within one degree.
b. The vehicle electrical system shall supply at least 25.8 V dc to the turret and gun control system with the engine operating and the generating system ON.
c. The main armament shall be balanced as specified in 3.5.3.1.

NOTE: The system shall be capable of operating at l8 to 30 V dc.

3.5.3.4.1 Traverse and elevation rates.

3.5.3.4.1.1 Gun elevation speeds. The gun shall be controllable in elevation and depression over a speed range of at least 0.5 mil per second to 71 mils per second (4 degrees per second). The steady speed (after acceleration) shall continuously increase with increasing handle displacement; these requirements apply to both gunner and commander power controls (see 4.6.17.3.4.1.1).

3.5.3.4.1.2 Turret traversing speeds. The turret shall be controllable in traverse at all speeds between 0.5 mil per second, and 400 mils per second. The tracking speed shall range as a minimum from 0.5 mil per second to 65.2 mils per second. At speeds above 65.2 mils per second the turret speed shall increase with increased control handle displacement until maximum velocity of not less than 400 mils per second is reached. The system shall remain stable at all times. These requirements are applicable to both the gunner and commander power controls (see 4.6.17.3.4.1.2).

3.5.3.4.2 Main gun laying and tracking.

3.5.3.4.2.1 Gun laying (stationary target, and vehicle). The average time required to position the periscope reticle within the borders of a .25 mil square target shall not exceed the times listed and the conditions as specified in table IV. The time requirement shall be met for the trials of right and left traverse or elevation and depression. For combined traverse, elevation, and depression layoffs, the time requirements apply to number of trials from each of four directions form target. These

requirements shall be met by the gunner's and commander's controls and by the manual controls as specified in table IV (see 4.6.17.3.4.2.1).

3.5.3.4.2.2 Gun laying on moving target and tracking accuracy. With the tank in a stationary position, the time required to lay the gun sight reticle within the borders of a moving target from an established lead angle shall not exceed 3.5 seconds in any instance as specified in table V. The target shall be as specified in the table and shall be moved over a horizontal crossing course. The lead angle shall be established with the line of sight aimed behind the moving target at which time the line of sight may be stationary or moving at a speed equal to or less than the target speed. After the reticle has been positioned within the borders for the length of the course in accordance with percentage of time on target specified in the table. This requirement shall be met with the gunner and commander power controls (see 4.6.17.3.4.2.2).

TABLE IV. Gun laying on stationary target.

	Layoff – mils		Average time seconds	
Position	Azimuth	Elevation	Manual operation	Power operation
1	0	10	2.0	2
2	25	10	5.0	5
3	25	10	5.0	5
4	100	0	4.5	4
5	400	0	13.5	5
6	800	0		6
7	1600	0		8
8	3200	0		13

TABLE V. Gun laying on moving target and tracking accuracy.

Percent of time on target	Traverse rate mils/sec (ref)	Established lead mils	Target size mils (square)	Target size centi-meters (square)	Target range meters	Target velocity mph	Length of course meters
90	0.5	1.0	0.25	45.72	1828.8	2.0	45.72
100	1.0	2.0	1.25	228.50	1828.8	4.0	91.44
100	3.3	7.5	1.25	228.50	1828.8	13.5	182.88
100	9.8	20.0	1.25	228.50	1828.8	40.0	182.88
100	19.8	7.5	1.25	34.29	274.32	12.0	365.76
100	32.6	10.0	1.25	34.29	274.32	20.0	365.76
100	65.2	20.0	5.0	137.16	274.32	40.0	365.76

3.5.3.4.3 Operation on slopes. When the vehicle is canted or pitched on slopes up to and including 15 degree turret attitude, the control system shall be capable of gun laying on a 0.25 mil stationary target as specified in 3.5.3.4.2.1, except time limitation need not be met. Turret chatter shall be allowed only when turret unbalance tends to cause turret rotation in the same direction of manual traverse. The gun control system performance on level terrain shall not be affected in any manner as a result of vehicle operation on slopes. A combat load of simulated equipment may be employed if desired (see 4.6.17.3.4.3).

3.5.3.4.4 Stability of operation. With the vehicle level or on slopes up to a 15 degree turret attitude, and turret power activated or deactivated, the gun shall not move more than 0.5 mil in azimuth or elevation during a one hour period (see 4.6.17.3.4.4 and 4.6.17.3.4.4.1).

3.5.3.4.5 Traverse and elevation limits. The angular main gun movement from the horizontal position shall be in accordance with the following requirements (see 4.6.17.3.4.5):

a. 19 degree minimum elevation for 360 degrees of turret traverse by power and manual controls.
b. 8 degree minimum depression each side of vehicle front centerline to 95 degrees maximum of rear vehicle centerline by power and manual controls.
c. 5 degree minimum depression from 95 degrees each side of vehicle rear centerline to 28 degrees each side of vehicle rear centerline by manual control with elevation and traverse power switch off.
d. 0 degree minimum depression 28 degrees each side of vehicle rear centerline by manual control with elevation and traverse power switch off.
e. 0 degree minimum depression 95 degrees each side of vehicle rear centerline by power and manual controls with elevation and traverse power switch on.

3.5.3.4.6 Override control. The commander’s control shall take over instaneously the power control of the turret and gun and the firing circuits from the gunner's control when the override switch in the commander’s control handle is actuated. Override of the system control by the commander’s control shall be obtainable at the neutral position regardless of the handle position of the gunner's control. With the commander’s control and gunner’s control 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. With the gunner’s control in the neutral position, the gunner’s control shall regain system control instantaneously when the commander’s control handle is released (see 4.6.17.3.4.6).

3.5.3.4.7 Hydraulic pressure limit switch. When power traversing the turret at a rate not to exceed 65 mils per second, the hydraulic pressure switch shall activate the hydraulic control power pack motor at a control system pressure gage reading of 880 to 1010 psi. With the gunner’s and commander’s power and manual controls in neutral position, the hydraulic pressure

switch shall deactivate the hydraulic power pack motor at a control system pressure as indicated on the gage between 1150 and 1500 psi (see 4.6.17.3.4.7).

3.5.3.4.8 Turret traverse brake. With the elevation and traverse power switch on and with the turret stationary, there shall be no traverse movement of the turret when the gunner's power control handle is turned to it stop in either traverse direction without actuating the palm switch in the gunner's power control handle (see 4.6.17.3.4.8).

3.5.3.4.9 Travel locks. With the gun external travel lock and the turret azimuth lock disengaged, the turret and gun control system shall act as a holding device for the gun and turret when the vehicle is in motion. With the vehicle moving at a rate of 5 mph in low gear on a horizontal hard surface road and with the elevation and traverse power switch off, the turret slippage shall not exceed 10 mils in traverse when subjecting the vehicle to a full steer 90 degrees turn in either direction and coming to a sudden stop. With the vehicle moving at a rate of 20 mph on a horizontal hard surface road and with the elevation and traverse power switch on or off, the gun slippage shall not exceed 5 mils in elevation on brake application. With the hand traverse crank out of detent there shall be no more than 360 degree movement of the hand traverse crank without engaging, the detent nor shall the hand elevation crank show any movement by either turret induced reaction when the vehicle is in motion as specified herein or by power operation of the turret and gun control system. With the gun in external travel lock, the turret azimuth lock shall be capable of being placed in the locked position. Engagement of the turret azimuth lock shall prevent traversing of the turret in any direction (see 4.6.17.3.4.9).

3.5.3.4.10 Control system deadspot. The turret and gun control system deadspot, as measured at the gunner's and commander's power controls, shall not exceed 7 degrees handle movement from the neutral center position in any direction to initiate gun and turret movement. The neutral center position shall be as defined as that handle position which divides the initial free handle movement (backlash of linkage) in half. The deadspot angles on each side of the neutral center in the traverse axis shall be equal within 2 degrees, and the deadspot angles in the elevation axis shall be equal within 2 degrees (see 4.6.17.3.5.10).

3.5.3.4.11 Main gun manual control.

3.5.3.4.11.1 Traverse effort. The mean force applied tangentially to the hand traverse crank at a uniform rate to maintain turret movement shall not exceed 17 lb. No individual reading shall be more than 20 lb (see 4.6.17.3.4.11.1).

3.5.3.4.11.2 Elevation effort. The mean torque required to rotate the hand crank at a uniform rate to maintain gun movement shall not exceed 46 inch pounds (in-lb). No individual reading shall be more than 55 in-lb (see 4.6.17.3.4.11.2).

3.5.3.4.11.3 Elevation response rate. The gun at the horizontal position within plus or minus 1 degree, shall move at a minimum rate of 10 mils per revolution of the handcrank in elevation and depression. The hand crank shall be turned at a rate not less than 10 rpm and not more than 20 rpm to measure the response rate (see 4.6.17.3.4.11.3).

3.5.3.4.12 Power and manual control. The manual traverse and power elevation controls shall be capable of simultaneous use. The same requirement applies to the power traverse and the manual elevation controls. There shall be no movement of the gun or turret caused by turning the elevation and traverse power switch on or off. The gun firing switches shall function individually with elevation and traverse power switch on or off and with either the main gun or the coaxial machine gun selector switches turned on (see 4.6.17.3.4.12).

3.5.3.4.13 Superelevation actuator. The superelevation actuator shall maintain the gunner's periscope reticle on target within 2 mils after ranging has been accomplished (see 4.6.17.3.4.13).

3.5.3.4.14 Hydraulic fluid.

3.5.3.4.14.1 Hydraulic fluid cleanliness. When all the requirements of the turret and gun control systems have been met, and with hydraulic fluid discharged from the 2 gallon accumulator, the hydraulic fluid in the control power pack reservoir shall contain no more than 0.1 percent water. This fluid shall have a contamination level not greater than that shown below (see 4.6.17.3.4.14.1).

TABLE VI. Maximum contamination limit [100 milliliter (mL) sample].

Particle size range (microns)	Number of particles
5 to 15	128,000
15 to 25	22,800
25 to 50	4,050
50 to 100	720
over 100	128

3.5.3.4.14.2 Hydraulic fluid leakage. Turret and gun control system hydraulic fluid leakage shall be permissible in the form of a weep or seep. There shall be no evidence of fluid leakage in the form of a drop or drip other than that specified herein. There shall be no drip from the deck clearance valve assembly. Fluid leakage (drip) from the control power pack at the override linkage control box shall not exceed 1 drop (see 6.5.1) in two minutes (see 4.6.17.3.4.14.2).

3.5.3.4.15 Elevation shut-off valve. With the elevation and traverse power switch on, the movement of the main gun shall not exceed 2 mils in the elevation axis when the gunner's power control handle is tilted forward and backward to its stop in either direction without actuating the palm switch in the gunner's power control handle (see 4.6.17.3.4.15).

3.5.3.5 Cupola control.

3.5.3.5.1 Traverse effort. The required starting torque, for right or left traverse, shall be not more than 40 in-lb to start motion from any position within 360 degrees rotation (see 4.6.17.3.5.1).

3.5.3.6 Gun fire control system. The gun fire control system shall operate and meet all requirements specified herein (see 4.6.17.3.6).

3.5.3.6.1 Main gun sighting system.

3.5.3.6.1.1 Synchronization. The line of sight of the telescope and the gunner's periscope, (daylight system only) and the left line of sight of the rangefinder, shall move in synchronization with the centerline of the gun tube bore within plus or minus 0.3 mil in both elevation and deflection in all positions from horizontal to 15 degrees elevation. The gun tube bore centerline at 15 degrees elevation shall be within 0.5 mil of a plane which is perpendicular to the plane of traverse and coincident with the line of the gun when the gun is at zero elevation (see 4.6.17.3.6.1.1).

3.5.3.6.1.2 Elevation backlash. The elevation backlash in the sighting system shall not exceed 0.3 mil for any gun elevation throughout the entire range of elevation and depression (see 4.6.17.3.6.1.2).

3.5.3.6.1.3 Boresight knob travel. The boresight knobs on the gunner’s periscope, the rangefinder and the telescope mount shall be adjustable, to a minimum of 5 mils down, 2 mils up, 4 mils left, and 4 mils right as measured from the boresight position (see 4.6.17.3.6.1.3).

3.5.3.6.1.4 Unity sight knob travel. The rotation of the gunner’s utility sight knobs in elevation and deflection from stop to stop shall cause the reticle to travel 20 mils (see 4.6.17.3.6.1.4).

3.5.3.6.1.5 Boresight retention. The gunner's periscope, commander’s rangefinder, and the telescope shall maintain previously established boresight within the values in table VII (see 4.6.17.3.6.1.5).

TABLE VII. Boresight retention.

Periscope		Rangefinder		Telescope	
Elevation	Deflection	Elevation	Deflection	Elevation	Deflection
0.25 mil	0.25 mil	0.25 mil	0.25 mil	0.25 mil	0.25 mil

3.5.3.6.2 Rangefinder calibration.

3.5.3.6.2.1 Rangefinder settings. Each rangefinder shall be checked within 72 hours prior to installation in the turret. With the range scale set to 1200 meters, the calibration reticles positioned in accordance with figure 3, the 1200 meter target image in coincidence, and the rangefinder temperature stabilized at 80°F, plus or minus 20°F, the following requirements shall be met (see 4.6.17.3.6.2.1).

NOTE: Rangefinder temperature shall be considered stabilized after four hours at any given temperature plus or minus 5°F within the 60 to l00°F range.

a. Horizontal calibration knob. The setting of the horizontal calibration knob shall be within 40 units of error (UOE) of the midpoint of total travel.
b. Vertical calibration knob. The setting of the vertical calibration knob shall be within 180 degrees of midpoint of total travel.
c. Internal correction scale knob. The setting of the internal correction scale (ICS) knob shall be within 13 UOE of the mid-position "(25)".

3.5.3.6.2.2 Final rangefinder calibration settings. With the rangefinder installed in turret and turret installed on vehicle, the rangefinder settings shall be checked to a maximum range target of 1000 to 2000 meters (see 4.6.17.3.6.2.2).

a. Horizontal calibration knob. The setting of the horizontal calibration knob shall be within 80 UOE (graduations) of the midpoint of total travel.
b. Vertical calibration knob. The setting of the vertical calibration knob shall be within 360 degrees of midpoint of total travel.
c. ICS knob. The setting of the ICS knob shall be within 20 UOE by the midpositions "(25)".

3.5.3.6.3 Superelevation. The superelevation as measured at the gun shall meet the requirements of table VIII with the tolerances specified in table IX when data is transmitted automatically by positioning the rangefinder range scale at any specific range. The mil output as a result of the rotation of the ballistic output shaft shall be as specified in table IX (see 4.6.17.3.6.3).

3.5.3.6.4 Indirect fire control.

3.5.3.6.4.1 Elevation quadrant. 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. The reading on the elevation quadrant shall correspond to the position of the gun within plus or minus 1 mil at all angles of elevation and depression (see 4.6.17.3.6.4.1).

3.5.3.6.4.2 Azimuth indicator backlash. The backlash of the azimuth indicator shall not exceed 1.0 mil at any position of the turret (see 4.6.17.3.6.4.2).

3.5.3.6.4.3 Leveling devices. The levels on the rangefinder and ballistic drive shall be level within 15 minutes (three graduations) when the gun is at the boresight position and the ballistic drive superelevation input shaft is at the position specified on the ballistic drive input shaft qualification plate (see 4.6.17.3.6.4.3).

TABLE VIII. Superelevation (mils).

Ammunition	Cam	Meters 500	Meters 1000	Meters 1200	Meters 2000	Meters 3000	Meters 3600	Meters 4000
APDS-T, M392	D8619776	1.14	2.37	2.88	5.00	7.84	9.71	11.08
HEP-T, M393	D8620062	6.68	13.18	16.20	31.41	59.29	81.83	. . .
HEAT-T, M456	D8620987	1.97	4.34	5.42	10.77	21.22	31.06	40.11
APERS-T, M494	B11727369	9.4	12.7	14.1	19.9	30.2	37.8	43.6

TABLE IX. Superelevation tolerances.

Mil output	Tolerance plus or minus
0 to 6	0.25
6 to 11	0.30
11 to 26	0.35
26 to 31	0.40
31 to 36	0.50
36 to 41	0.60
41 to 61	0.70
61 to 86	0.80
86 to 98.5	0.90

3.6 Fire extinguisher. The fixed fire extinguisher system, when installed in accordance with applicable drawings shall be readily accessible for operation internally and externally. Actuating the internal controls shall simultaneously stop the supply of fuel to the engine. The effort required to discharge the system either internally or externally, shall be not more than 55 lb. A time delay of more than six seconds but less than 11 seconds shall occur on the first shot between actuating of the release mechanism and entrance of carbon dioxide (CO_2) into the engine compartment (see 4.7).

3.7 Electromagnetic interference and compatibility.

3.7.1 Electromagnetic characteristics. The complete vehicle, equipped with the AN/VRC-12 radio set, AN/VSS-1, 2.2 kw searchlight, AN/VIC-l intercommunications set, and the M13A4 ballistic computer shall meet the requirements of MIL-STD-461 to the extent specified herein (see 4.8.1).

3.7.1.1 Radiated emissions. Radiated emissions shall not exceed the limits specified herein at a six meter distance from the vehicle (see 4.8.1).

3.7.1.1.1 Narrowband emissions. Narrowband radiated emissions shall not exceed the limits of requirement RE02.1, MIL-STD-461A (see 4.8.1).

3.7.1.1.2 Broadband emissions. Broadband radiated emissions should not exceed the limits specified in table X over the frequency range of 1.5 to 1000 megahertz (MHz) (see 4.8.1).

TABLE X. Broadband radiated emission limits.

Subsystem and equipment operating	Mode of operation	Limits
Hydraulic powerpack	Cycling	figure 4
Ballistic computer	Ranging and selecting ammo	figure 5
Main weapon and machine guns	Firing	Manual mode switching RE02, MIL-STD-461 A, notice 4
Searchlight AN/VSS-1	Off and on	Exempt
Conditions other than specified above		RE02, MIL-STD-416A, notice 4

3.7.1.2 Radiated susceptibility. No equipment or subsystem, as installed in the complete tank system, shall experience any undesirable response, malfunction, or degraded performance when the complete tank system is subjected to the radiated susceptibility requirement RS03 for sheltered systems in the frequency range of 10 kilohertz (kHz) to 400 MHz (see 4.8.1).

3.7.1.3 Electromagnetic compatibility. No equipment or subsystem as installed in the complete vehicle system shall experience any malfunction or degradation of performance which would impair mission success when other equipment or subsystems are individually or collectively operated. Rotation of the image of the night vision device shall not be considered degrading to mission success (see 4.8.1).

3.8 Environment. The vehicle shall operate in ambient air temperature of plus 115 to minus 25°F, and with special equipment installed, temperatures to minus 65°F. The complete vehicle, when prepared for storage, shall withstand temperature extremes of plus 160 to minus 65°F without deterioration of any component that may cause failure of the systems and/or subsystems (see 4.9.1 and 4.9.2).

3.9 Continuous noise level. The continuous noise level experience audibly by the helmeted crew, during vehicle and equipment operation, shall not exceed the maximum noise level specified in table XI (see 4.10).

3.9.1 Noise hazard caution signs. Noise hazard caution signs shall be posted in all crew stations. The signs shall be clearly visible to all personnel (see 4.10.1).

TABLE XI. Maximum acceptable level for continuous noise.

Octave band center frequency Hertz (Hz)	Maximum acceptable noise level (db ref. 0.0002 micorbar)
63	121
125	111
250	103
500	102
1000	100
2000	100
4000	100
8000	100

3.10 Painting, marking and data plates.

3.10.1 Painting. Unless otherwise specified, the exterior and interior of the vehicle and all components, assemblies, subassemblies, and parts that require painting shall be prepared and painted in accordance with MIL-STD-193. Vehicle exterior paint shall be Forest Green Camouflage, lusterless, enamel, alkyd per MIL-E-52798. The vehicle interior paint shall match color chip 17875 of FED-STD-595. All sliding parts and operating contact surfaces shall be free of paint (see 4.11).

3.10.2 Marking. Marking and marking paint shall conform to TT-E-527, lusterless black color chip 37038 of FED-STD-595 as specified on Drawing 8736758 (see 4.11).

3.10.3 Identification data plates. All plates shall be in accordance with the applicable drawings (see 4.11).

3.11 Workmanship. Workmanship shall be of a quality to assure the vehicle and components are free from defects resulting from improper manufacturing or assembly practices (see 4.12).

3.11.1 Welding repairs. Welding repairs of any kind shall be made only when specifically authorized by the acquisition activity (see 4.12.1 and 6.2).

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order (see 6.2), the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor 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 or witness 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 Inspection equipment. Unless otherwise specified in the contract (see 6.2), the contractor is responsible for the provision and maintenance of all inspection equipment necessary to assure that supplies and services conform to contract requirements. Inspection equipment must be capable of repetitive measurements to an accuracy of 10 percent of the measurement tolerance. Calibration of inspection equipment shall be in accordance with MIL-STD-45662.

4.2 Classification of inspection:

a. First article inspection (see 4.4).
   1. Preproduction inspection (see 4.4.1).
   2. Initial production inspection (see 4.4.2).
   3. Production sample inspection (see 4.4.3).

b. Quality conformance inspections (see 4.5).
   1. Examination (see 4.5.2).
   2. Acceptance tests (see 4.5.3.1).
   3. Control tests (see 4.5.3.2).
   4. Comparison tests (see 4.5.3.3).

4.3 Inspection conditions. Unless otherwise specified (see 6.2), all inspections shall be conducted under the conditions of temperature, barometric pressure, and humidity prevailing at the site of the test or place of manufacture.

4.4 First article inspection. First article inspections shall be performed on preproduction, initial production, or production sample vehicles as specified herein. Approval of the first article sample by the Government shall not relieve the contractor of the obligation to supply vehicles that are fully representative of those inspected as a first article sample. Any changes or deviation of the production units from the first article sample shall be subject to the approval of the contracting officer.

4.4.1 Preproduction inspection. When specified (see 6.2), preproduction vehicle (see 3.1) shall be inspected at a location approved by the Government, to determine conformance to requirements of this specification. Inspection shall consist of examination as specified in 4.5.2 and all tests specified in table XIII.

4.4.2 Initial production inspection. When specified (see 6.2) and initial production inspection shall be performed on no less than two vehicles, selected at random after the contractor considers the vehicles produced are representative of production parameters. Inspection shall consist of examination as specified in 4.5.2 and tests as specified in table XIII. The vehicle shall be road tested for 4000 miles as specified in table XII.

TABLE XII. Four thousand mile test combat loaded (Government proving ground).

Course	Mileage and speeds
Hard-surface roads	1000 miles at varying speeds up to maximum
Gravel or dirt roads	1000 miles at varying speeds up to maximum
Level, cross-country terrain	1000 miles at varying speeds up to maximum
Hilly, cross-country terrain	1000 miles at varying speeds up to maximum

4.4.3 Production sample inspection. A vehicle produced from production tooling and assembled using production methods shall be selected at random from the first month production or the first twenty built, and subjected to the production sample inspection.

4.4.3.1 In-process examination. During fabrication of the initial production vehicle, an in-process examination be conducted by representatives of TACOM product assurance directorate to evaluate conformance of materials and workmanship to specified requirements. Examination will be made at the contractor or subcontractor facility prior to application of primer and paint. Processing and welding procedures, quality system, and inspection records will be evaluated during this examination.

4.4.3.2 Completed production sample contractor inspection. The production sample vehicle shall be road tested and inspected by the contractor as specified in 4.5.3.1, to determine conformance to contract and specifications. After inspection, the contractor shall submit the vehicle (and all inspection records and certifications) to the responsible Government representative at contractor plant for preliminary examination.

4.4.3.3 Preliminary examination. The responsible Government representative shall conduct a preliminary examination as specified in 4.5.2.2, of the production sample vehicle.

TABLE XIII. Classification and location of inspections.

Title	Requirement	Test	First article			Quality conformance		
			Preprod vehicle GPG	Initial prod GPG	Prod sample contr	Accept contr	Control contr	Cmprsn GPG
Materials, design and construction	3.2 thru 3.3.1	4.6.1	X	X			X	
Break-in run	3.3.2	4.6.1	X	X		X		
Operation and distance	3.3.2.1	4.6.1	X	X		X		
Reverse operation	3.3.2.2	4.6.1	X	X		X		
Conditions after run	3.3.2.3	4.6.1	X	X		X		
Fording kit	3.3.3	4.6.1	X	X			X	X
Sealing	3.4.1	4.6.2.1	X	X		X		X
Hatch seals	3.4.1.1	4.6.2.1.1	X	X		X		X
Vision device and receptacle seals	3.4.1.2	4.6.2.1.1 and 4.6.2.1.2	X	X		X		X
Hydraulic lines	3.4.2	4.6.3	X	X	X	X		X
Vent blower	3.4.3.1	4.6.4.1	X	X		X		
Carbon monoxide	3.4.3.2	4.6.4.2						X
Controls	3.4.4	4.6.5	X	X		X		
Adjustment mechanisms	3.4.5	4.6.6	X	X		X		X
Vision device and recepticales	3.4.6	4.6.7		X			X	X
Airflow	3.4.7.1	4.6.8.1	X	X		X		X
Stowed equipment	3.4.8	4.6.9		X	X		X	
Engine shroud	3.4.9	4.6.10	X	X		X		X
Cooling system	3.4.10	4.6.11 and 4.9.1	X	X		X		X
Fuel tank and lines	3.4.11.1	4.6.12.1	X	X	X	X		X
Intank fuel pumps	3.4.11.2	4.6.12.2	X	X			X	X
Fuel return system	3.4.11.3	4.6.12.3	X	X		X		X
Fuel shutoff valve	3.4.11.4	4.6.12.4	X	X		X		X
Throttle linkage	3.4.11.5	4.6.12.5	X	X		X		X
Fuel system, grades and slopes	3.4.11.6	4.6.12.6	X	X		X		X
Driver's hatch	3.4.12.1	4.6.13.1	X	X		X		X
Driver's escape hatch	3.4.12.2	4.6.13.2	X	X		X		X
Loader's hatch	3.4.12.3	4.6.13.3	X	X		X		X
Cupola hatch	3.4.12.4	4.6.13.4	X	X		X		X
Driver's seat	3.4.13.1	4.6.14.1	X	X		X		X
Gunner's seat	3.4.13.2	4.6.14.2	X	X		X		X
Commander's platform seat	3.4.13.3	4.6.14.3	X	X		X		X

TABLE XIII. Classification and location of inspections - Continued.

Title	Requirement	Test	First article			Quality conformance		
			Preprod vehicle GPG	Initial prod GPG	Prod sample contr	Accept contr	Control contr	Cmprsn GPG
Loader's seat	3.4.13.4	4.6.14.4	X	X		X		X
Radio and intercommunication installation	3.4.1 .1	4.6.15.1	X	X		X		X
Interior lighting	3.4.1 .1.1	4.6.16.1.1	X	X		X		X
Hull-to-turret slipring	3.4.1 .1.2	4.6.16.1.2	X	X		X		X
Auxiliary outlet	3.4.1 .1.3	4.6.16.1.3	X	X		X		X
Personnel heater	3.4.1 .1.4	4.6.16.1.4	X	X	X	X		X
Engine smoke generator	3.4.1 .1.5	4.6.16.1.5	X	X			X	X
Power plant electrical	3.4.1 .2.1	4.6.16.2.1	X	X		X		X
Exterior lights	3.4.1 .2.2	4.6.16.2.2	X	X		X		X
Generator voltage	3.4.1 .2.3	4.6.16.2.3	X	X		X		X
Driver's infrared power pack high voltage supply	3.4.15.2.4	4.6.16.2.4	X	X		X		X
Air cleaner blower motors	3.4.15.2.5	4.6.16.2.5	X	X		X		X
Air cleaner outlet system	3.4.15.2.5.1	4.6.16.2.5.1	X	X		X		X
Engine manifold heater	3.4.15.2.6	4.6.16.2.6	X	X		X		X
Main gun firing circuits	3.4.15.3.1	4.6.16.3.1	X	X		X		X
Emergency mode firing	3.4.15.3.2	4.6.16.3.2	X	X		X		X
Co-axial machine gun firing circuit	3.4.15.3.3	4.6.16.3.3	X	X		X		X
Main gun and machine gun circuit controls	3.4.15.3.4	4.6.16 3.4	X	X		X		X
Searchlight power circuits	3.4.15.3.5	4.6.16 3.5	X	X		X		X
Arming	3.4.15.3.6.1	4.6.16 3.6.1	X	X		X		X
Circuit voltage	3.4.15.3.6.2	4.6.16 3.6.2 & 4.6.16 3.6.3	X	X		X		X
Durability	3.5.1	4.6.17 .1	X	X				X
Power plant and power train	3.5.2	4.6.17.2	X	X		X		X
Level road speeds	3.5.2.1.1	4.6.17.2.1.1	X	X		X		X
Grade speeds	3.5.2.1.2	4.6.17.2.1.2	X	X		X		X
Acceleration	3.5.2.2	4.6.17.2.2	X	X		X		X
Climbing	3.5.2.3	4.6.17.2.3	X	X		X		X
Engine start on grade and slopes	3.5.2.4	4.6.17.2.4	X	X		X		X

TABLE XIII. Classification and location of inspections - Continued.

Title	Requirement	Test	First article			Quality conformance		
			Preprod vehicle GPG	Initial prod GPG	Prod sample contr	Accept contr	Control contr	Cmprsn GPG
Braking and drift	3.5.2.5	4.6.17.2.5	X	X		X		X
Holding	3.5.2.5.1	4.6.17.2.5.1	X	X	X	X		X
Turning	3.5.2.6	4.6.17.2.6	X	X	X	X		X
Shallow water	3.5.2.7.1	4.6.17.2.7.1	X	X		X		X
Drain valves	3.5.2.7.2	4.6.17.2.7.2	X	X			X	X
Turret inflatable seal and pump	3.5.2.7.3	4.6.17.2.7.3	X	X		X		X
Engine start - shallow water	3.5.2.7.4	4.6.17.2.7.4	X	X			X	X
Deep water	3.5.2.7.5	4.6.17.2.7.5	X	X		X		X
Trench crossing	3.5.2.8	4.6.17.2.8	X	X				X
Vertical obstacles	3.5.2.9	4.6.17.2.9	X	X				X
Main armament balance	3.5.3.1	4.6.17.3.1	X	X			X	X
Nylon ballistic shield	3.5.3.2	4.6.17.3.2	X	X		X		X
System backlash	3.5.3.3	4.6.17.3.3	X	X			X	X
Gun elevation speeds	3.5.3.4.1.1	4.6.17.3.4.1.1	X	X		X		X
Turret traversing speeds	3.5.3.4.1.2	4.6.17.3.4.1.2	X	X		X		X
Gun laying (stationary target and vehicle)	3.5.3.4.2.1	4.6.17.3.4.2.1	X	X	X	X		X
Gun laying on moving target and tracking accuracy	3.5.3.4.2.2	4.6.17.3.4.2.2	X	X		X		X
Operation on slopes	3.5.3.4.3	4.6.17.3.4.3	X	X		X		X
Stabilitiy of operation	3.5.3.4.4	4.6.17.3.4.4 & 4.6.17.3.4.4.1	X	X			X	X
Traverse and elevation limits	3.5.3.4.5	4.6.17.3.4.5	X	X	X	X		X
Override control	3.5.3.4.6	4.6.17.3.4.6	X	X		X		X
Hydraulic pressure limit switch	3.5.3.4.7	4.6.17.3.4.7	X	X		X		X
Turret traverse brake	3.5.3.4.8	4.6.17.3.4.8	X	X		X		X
Travel locks	3.5.3.4.9	4.6.17.3.4.9	X	X		X		X
Control system deadspot	3.5.3.4.10	4.6.17.3.4.10	X	X		X		X
Traverse effort	3.5.3.4.11.1	4.6.17.3.4.11.1	X	X		X		X
Elevation effort	3.5.3.4.11.2	4.6.17.3.4.11.2	X	X		X		X
Elevation response rate	3.5.3.4.11.3	4.6.17.3.4.11.3	X	X		X		X
Power and manual control	3.5.3.4.12	4.6.17.3.4.12	X	X		X		X
Superelevation actuator	3.5.3.4.13	4.6.17.3.4.13	X	X		X		X

TABLE XIII. Classification and location of inspections - Continued.

Title	Requirement	Test	First article: Preprod vehicle GPG	First article: Initial prod GPG	First article: Prod sample contr	Quality conformance: Accept contr	Quality conformance: Control contr	Quality conformance: Cmprsn GPG
Hydraulic fluid cleanliness	3.5.3.4.14.1	4.6.17.3.4.14.1	X	X			X	
Hydraulic fluid leakage	3.5.3.4.14.2	4.6.17.3.4.14.2	X	X		X		X
Elevation shut off valve	3.5.3.4.15	4.6.17.3.4.15	X	X		X		X
Traverse effort	3.5.3.5.1	4.6.17.3.5.1	X	X		X		X
Gun fire control system	3.5.3.6	4.6.17.3.6	X	X		X		X
Synchronization	3.5.3.6.1.1	4.6.17.3.6.1.1	X	X		X		X
Elevation backlash	3.5.3.6.1.2	4.6.17.3.6.1.2	X	X		X		X
Boresight knob travel	3.5.3.6.1.3	4.6.17.3.6.1.3	X	X		X		X
Unity sight knob travel	3.5.3.6.1.4	4.6.17.3.6.1.4	X	X			X	X
Boresight retention	3.5.3.6.1.5	4.6.17.3.6.1.5	X	X			X	X
Rangefinder settings	3.5.3.6.2.1	4.6.17.3.6.2.1	X	X		X		X
Final rangefinder calibration setting	3.5.3.6.2.2	4.6.17.3.6.2.2	X	X		X		X
Superelevation	3.5.3.6.3	4.6.17.3.6.3	X	X		X		X
Elevation quadrant	3.5.3.6.4.1	4.6.17.3.6.4.1	X	X			X	X
Azimuth indicator backlash	3.5.3.6.4.2	4.6.17.3.6.4.2	X	X		X		X
Leveling devices	3.5.3.6.4.3	4.6.17.3.6.4.3	X	X		X		X
Fire extinguisher	3.6	4.7	X	X			X	X
Electromagnetic characteristics	3.7.1	4.8.1	X	X				X
Radiated emissions	3.7.1.1	4.8.1	X	X				X
Narrowband emissions	3.7.1.1.1	4.8.1	X	X				X
Broadband emissions	3.7.1.1.2	4.8.1	X	X				X
Radiated susceptibility	3.7.1.2	4.8.1	X	X				X
Electromagnetic compatibility	3.7.1.3	4.8.1	X	X				X
Environment	3.8	4.9.1 & 4.9.2	X	X			X	X
Continuous noise level	3.9	4.10	X	X			X	X
Noise hazard caution sign	3.9.1	4.10.1	X	X		X		X
Painting	3.10.1	4.11	X	X		X		X
Marking	3.10.2	4.11	X	X		X		X
Identification data plates	3.10.3	4.11	X	X		X		X
Workmanship	3.11	4.12	X	X		X		X
Welding repairs	3.11.1	4.12.1	X	X		X		X
Preservation, packaging and vehicle processing	Section 5	4.13	X	X		X		X

4.4.3.4 Provisional inspection. Provisional inspection of the production sample vehicle shall be conducted jointly by representatives of TACOM product assurance directorate and the responsible Government representative. The contractor shall provide any required assistance. Testing will be as specified in 4.5.3.1. Contractor shall make available his inspection plant records and certifications pertinent to the vehicle and components.

4.4.3.5 Repair of defects. Defects found as a result of the foregoing inspections shall be corrected by the contractor. Failure of the contractor to correct defects promptly shall be cause for suspension of acceptance of vehicles until corrective action has been approved by the Government.

4.4.3.6 Vehicle disposition. On completion of the sample production vehicle inspection, the vehicle shall remain at the manufacturing facility as a production sample and shall be released at the discretion of the Government. The contractor shall service and maintain the vehicle during this period.

4.4.3.7 Final approval and acceptance. Final approval and acceptance of the initial production vehicle(s) shall be withheld until the production sample vehicle is accepted (see 4.4.3).

4.4.4 First article inspection failure. Test item deficiencies during, or as a result of, the first article test, shall be cause for rejection of the items until evidence has been provided by the contractor that corrective action has been taken to eliminate the deficiency. Any deficiency found during, or as a result of the first article test, shall be prime facie evidence that all items already produced prior to completion of the first article 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 items shall be corrected by the contractor at no cost to the Government. The Government shall not final accept products until first article testing is completed to the satisfaction of the Government.

4.5 Quality conformance inspection.

4.5.1 Sampling.

4.5.1.1 Lot formation. An inspection lot shall consist of all the vehicles of one type and part number, from an identifiable production period, from one manufacturer, submitted at one time for acceptance.

4.5.1.2 Sampling for examination. Samples for quality conformance examination shall be selected in accordance with general inspection level II of MIL-STD-105. Before sampling may be initiated, the contractor shall establish by examination of at least 20 consecutively produced vehicles that the process average percent defective, as defined in MIL-STD-105, is not greater than the specified AQLs.

4.5.2 Quality conformance examinations.

4.5.2.1 Acceptable quality level. Each sample selected in accordance with 4.5.1.2 shall be examined to determine conformance to the following acceptable quality levels (AQL) on the basis of percent defective (see 6.4).

Classification	AQL
Major	25
Minor	150

4.5.2.2 Classification of defects. For examination purposes, defects shall be classified as listed in table XIV.

TABLE XIV. Classification of defects.

Category	Defect	Method of examination
Major	AQL 25 Defects/100 Units	
101	Seal leakage, improper (see 3.4.1).	Visual and functional
102	Hydraulic lines damage, leakage (see 3.4.2).	Visual and functional
103	Controls malfunction, improper clearance (see 3.4.4).	Visual and functional
104	Adjustment mechanisms malfunction, damage (see 3.4.5).	Visual and functional
105	Vision devise defective fitting, leakage (see 3.4.6).	Visual and functional
106	Gas particulate system malfunction, damage (see 3.4.7).	Visual and functional
107	Stowed equipment malfunction, damage (see 3.4.8).	Visual and functional
108	Cooling system malfunction, damage, leaks (see 3.4.10).	Visual and functional
109	Fuel system malfunction, leaks, damage 1/ (see 3.4.11).	Visual and functional
110	Hatches malfunction, damage, improper clearance (see 3.4.12).	Visual and functional
111	Seats malfunction, damage (see 3.4.13).	Visual and functional
112	Radio and intercom system malfunction (see 3.4.14).	Visual and functional
113	Electrical system malfunction, damage, items not clearly marked or missing (see 3.4.15).	Visual and functional
114	Suspension lack of lubricant fitting damaged (see 3.5.1).	Visual
115	Power plant and power train malfunction, improper mounting, damage leaks (see 3.5.2).	Visual and functional
116	Ballistic shield malfunction, damage (see 3.5.3.2).	Visual and functional
117	Turret and gun control malfunction, damage, missing component, leaks (see 3.5.3.4).	Visual and functional

TABLE XIV. Classification of defects – Continued.

Category	Defect	Method of examination
118	Cupola malfunction damage (see 3.5.3.5).	Visual and functional
119	Fire control malfunction damage (see 3.5.3.6).	Visual and functional
120	Fire extinguisher seals missing, defective (see 3.6).	Visual and functional
121	Caution signs missing (see 3.9.1).	Visual
122	Marking and plates missing, damaged or defective (see 3.10.2 and 3.10.3).	Visual
123	Workmanship malfunction, damage, structural defects, welding defects, weld repairs without authorization or beyond scope of authorization (see 3.11 and 3.11.1).	Visual and functional
Minor	AQL 150 Defects/100 units	
201	Seals improper installation or assembly (see 3.4.1).	Visual and functional
202	Hydraulic lines improper installation or assembly (see 3.4.2).	Visual and functional
203	Controls improper installation or assembly (see 3.4.4).	Visual and functional
204	Adjustment mechanisms improper installation or assembly (see 3.4.5).	Visual and functional
205	Vision devices improper installation or assembly (see 3.4.6).	Visual and functional
206	Gas particulate system improper installation or assembly (see 3.4.7).	Visual and functional
207	Stowed equipment improper installation, assembly or clearance (see 3.4.8).	Visual and functional
208	Cooling system improper installation or assembly (see 3.4.10).	Visual and functional
209	Fuel system improper installation, assembly or clearance (see 3.4.11).	Visual and functional
210	Hatches improper installation or assembly (see 3.4.12).	Visual and functional
211	Seals improper installation or assembly (see 3.4.13).	Visual and functional
212	Radio and intercom system improper installation and circuit identification (see 3.4.14).	Visual and functional
213	Electrical system improper installation, assembly, circuit identification or protection (see 3.4.15).	Visual and functional
214	Suspension improper lubrication, fittings, missing or defective (see 3.5.1).	Visual and functional
215	Power plant and power train improper component, assembly or installation (see 3.5.3.2).	Visual and functional
216	Ballistic shield improper installation, component assembly, or adjustment (see 3.5.3).	Visual and functional

TABLE XIV. Classification of defects – Continued.

Category	Defect	Method of examination
217	Turret and gun control improper installation, component assembly, fluid, or fluid level (see 3.5.3.4).	Visual and functional
218	Cupola improper installation or assembly (see 3.5.3.5).	Visual and functional
219	Fire control improper installation or assembly (see 3.5.3.6)	Visual and functional
220	Fire extinguisher improper installation or assembly (see 3.6).	Visual and functional
221	Caution signs improper installation, size or location (see 3.9.1)	Visual
222	Marking and plates improper, size, location, incomplete or illegible (see 3.10.2 and 3.10.3).	Visual
223	Workmanship Improper fit, appearance, installation, adhesion, adjustment, assembly or weldment (see 3.11 and 3.11.1).	Visual and functional

1/ Any fuel leakage constitute a special defect and shall result in 100 percent inspection of the lot for this deficiency.

4.5.3 Quality conformance tests.

4.5.3.1 Acceptance tests (100 percent). After the break-in run (see 3.3.2), each vehicle shall be examined as specified in 4.5.2, operated a distance of eight miles or more by the contractor, and subjected to acceptance tests specified in table XIII. Except for equipment and component installation, and servicing performed by the contractor as a final processing of vehicles for acceptance, vehicles shall be completely assembled and serviced with fuel, lubricants, and fluids as specified. Vehicles need not be loaded with rated payload, except for holding test as specified in 4.7.17.2.5.1. After the tests, the vehicle shall be examined for evidence of fuel or lubricant leakage, or other defects.

4.5.3.2 Control tests. One of the first 10 vehicles produced, and thereafter one per month, shall be selected for control testing after a break-in run.

4.5.3.3 Comparison tests. The Government may select vehicles at any time during the contract production period and subject them to Government proving ground testing. Vehicles selected shall be examined for the defects listed in table XIV and tested in accordance with table XIII, including a 2000 mile test for reliability, maintainability, and durability in accordance with table XV. Vehicles shall be combat loaded with all BII stowed in their allotted space to conform to 3.4.8. Samples shall not include any vehicles previously tested.

TABLE XV. Two thousand mile test combat loaded. (Government proving ground).

Course	Mileage and speeds
Hard surface roads	200 miles at varying speeds
Gravel and dirt roads	500 miles at varying speeds
Level, cross-country terrain	650 miles at varying speeds
Hilly, cross-country terrain	650 miles at varying speeds

4.5.3.4 Failure. Failure of any vehicle to pass any of the specified inspections shall be cause for the Government to refuse acceptance of the production quantity represented, until action taken by the contractor to correct defects and prevent recurrence has been approved by the Government.

4.5.3.5 Special tests and examinations. Special tests and examinations (see 6.2 and 6.2.1) when required by the contract (see 6.2), shall be performed in accordance with tables XII and XIII.

4.6 Methods of inspection.

4.6.1 Materials and construction. Conformance to 3.2 through 3.3.3 shall be determined by inspection of contractor records providing proof or certification that design, construction, processing, and materials conform to requirements. Applicable records shall include drawings, specifications, design data, receiving inspection records, processing and quality control standards, vendor catalogs and certifications, industry standards, test reports, and rating data.

4.6.2 Physical characteristics.

4.6.2.1 Sealing. To determine conformance to 3.4.1, there shall be no evidence of bearing contamination by foreign matter nor leakage of bearing lubricant from leak proof seals. Examination shall be performed prior to and after road testing (see 6.5.1), fording and amphibious operations or operations in mud, sand, or snow.

4.6.2.1.1 Hatch seals. To determine conformance to 3.4.1.1, all entry hatches shall be closed and locked and 3 gallons of water sprayed on each hatch over a three minute period. All entry hatches shall be checked for leakage.

4.6.2.1.2 Vision device and receptacle seals. To determine conformance to 3.4.12, the driver's, gunner's and commander's periscopes shall be checked for leakage in conjunction with 4.6.2.1.1.

4.6.3 Hydraulic lines. To determine conformance to 3.4.2, hydraulic lines and connections shall be examined to assure internal cleanliness prior to and during installation. Brake hydraulic lines shall be examined for leakage after road testing. Detected leakage shall not exceed amount specified.

4.6.4 Ventilation system.

4.6.4.1 Vent blower. To determine conformance to 3.4.3.1, the operation of the vent blower shall be observed during road tests and when the vehicle is idling.

4.6.4.2 Carbon monoxide. To determine conformance to 3.4.3.2, tests shall be performed in accordance with procedures specified in the USATECOM material test procedure 2-2-614, dated 18 June 1968, except as follows:

a. Firing tests shall be conducted with the ventilation system and engine operating, and all hatches closed.

b. Main gun firing contamination levels shall be determined for one three round salvo for each type of ammunition designated for the main weapon.

c. Secondary weapon contamination levels shall be determined for one 200 round burst fired from each vehicle machine gun simultaneously.

CAUTION: When conducting these tests, safety precautions shall be exercised (see 6.3).

4.6.5 Controls. To determine conformance to 3.4.4, all controls shall be operated, adjusted, and checked for functional requirements. The full requirement cannot be met until the vehicle has been subjected to all specified environments and all control functions as specified.

4.6.6 Adjustment mechanisms. To determine conformance to 3.4.5, all adjustment mechanisms requiring adjustment shall be checked for proper adjustment, function and proper installation in accordance with applicable drawings.

4.6.7 Vision devices and receptacles. To determine conformance to 3.4.6, the vision device receptacles shall be checked for the ability to receive and hold vision devices without binding or interference; the gunner's periscope shall be checked for ability to maintain sighting capabilities as specified.

4.6.8 Gas particulate system.

4.6.8.1 Air flow. To determine conformance to 3.4.7.1, the air flow at each crew position shall be checked for 3.0 to 4.5 cfm flow with the gas particulate system operating and other crew position outlets capped with a gas mask type air flow restricter.

4.6.9 Stowed equipment. To determine conformance to 3.4.8, all BII except ammunition shall be stowed (combat loaded) on the vehicle. Ammunition shall be simulated in size and weight. All items shall fit and function in the space provided and all fastening devices shall be secured. All BII used shall be of the latest production available to the contractor. The contractor will be permitted to unpackage, install, and repackage BII used for this test.

4.6.10 Engine shroud. To determine conformance to 3.4.9, a dimensional check shall be made at the right and left front corners of the engine shroud to assure sealing between top deck frame and the tadpole seal around the engine.

4.6.11 Cooling system. To determine conformance to 3.4.10, with the vehicle operating at ambient temperature, verify that the engine and oil temperature indicators on the driver's panel remain in the green area during all stages of vehicle operation.

4.6.12 Fuel system.

4.6.12.1 Fuel tanks and lines. To determine conformance to 3.4.11.1, the fuel tanks and lines shall be examined for cleanliness at various stages of fabrication. The fuel system shall be pressurized with fuel filtered air at a pressure of 3 to 4 psi, a fluid, soapy water or equivalent, applied to the fittings and fuel tank seals to test for leakage. All lines, connections, and tanks shall be as specified. Upon completion of the leakage test, all lines, tanks, and connections shall be wiped dry of test fluid. The fuel tanks shall be filled at a rate of not less than 50 gpm, and observed for leaks before and after vehicle operation on smooth, level, and hard-surfaced roads.

4.6.12.2 Intank fuel pumps. To determine conformance to 3.4.11.2, a plug with pressure gage shall be attached to the engine end of the fuel line disconnect. The pump shall be electrically actuated and the pressure shall be as specified for each pump.

4.6.12.3 Fuel return system. To determine conformance to 3.4.11.3, air pressure of 3 to 5 psi shall be applied to the inlet line and the return selector valve checked in the "left" and then "right" positions to verify that the fuel is diverted into the correct tank as indicated by the pointer. After the test, the selector valve shall be placed in the "both" position and lockwired in that position.

4.6.12.4 Fuel shutoff valve. To determine conformance to 3.4.11.4, with the engine operating at 2000 to 2200 rpm, the fuel shutoff handle shall be actuated to the "OFF" position; the engine shall stop operating within the time specified.

4.6.12.5 Throttle linkage. To determine conformance to 3.4.11.5, the throttle pedal shall be depressed to within a range of 0.12 to 0.62 inch of the pedal stop, and the engine throttle rod checked to assure that full rack position has been reached. The throttle pedal shall then be depressed to the pedal stop and verification made that a clearance of 0.01 inch minimum is at the engine throttle stop.

4.6.12.6 Fuel system, grades and slopes. To determine conformance to 3.4.11.6, the fuel system on grades and slopes shall be observed during climbing tests (see 4.6.17.2.3 and 4.6.17.2.4).

4.6.13 Hatches.

4.6.13.1 Driver's hatch. To determine conformance to 3.4.12.1, a force gage shall be attached to the driver's hatch when it is in the closed position and the hatch shall be pulled to the open position and back to closed position. The force shall be as specified. With the hatch in a closed position, the force required to lock the driver's hatch cover shall be measured with a force gage attached to the end of the locking lever and shall be as specified.

4.6.l3.2 Driver's escape hatch. To determine conformance to 3.4.l2.2, the driver's escape hatch shall be checked by attaching a force gage to the handle at the point specified, releasing the latch, and noting that the force required is as specified. After the latching mechanism is released, the escape hatch shall drop free from the hull. Caution shall be exercised in unlatching the escape hatch by assuring that the area under the hatch is free of personnel and equipment before releasing the handle. After performing this test, the shallow water fording test shall be performed and the hatch checked for sealing ability as specified in 3.4.l.l.

4.6.13.3 Loader's hatch. To determine conformance to 3.4.12.3, using a force gage the various forces for hatch operation shall be measured as specified.

4.6.13.4 Cupola hatch. To determine conformance to 3.4.12.4, using a force gage the breakaway forces shall be verified for the directions specified. All characteristics shall be within the limits specified.

4.6.14 Seats.

4.6.14.1 Driver's seat. To determine conformance to 3.4.13.1, each driver's seat lever shall be actuated and the seat shall move forward, backward and vertically as appropriate. A force gage shall be attached to each lever as specified and the force required to actuate shall be measured. All sliding parts and operating contact surfaces shall be examined for absence of paint.

4.6.14.2 Gunner's seat. To determine conformance to 3.4.13.2, the gunner's seat (no load) shall be slid through its full range, locked and unlocked, and checked for binding and interference.

4.6.14.3 Commander's platform seat. To determine conformance to 3.4.13.3, the platform (no load) shall be slid through its full range, locked and unlocked, and checked for binding and interference. The seat, also with no load, shall be checked for operability through its range.

4.6.14.4 Loader's seat. To determine conformance to 3.4.13.4, the loader's seat shall be pulled to the seated position and then released to see if it returns to the vertical position.

4.6.15 Crew communication.

4.6.15.1 Radio and intercommunication installation. To determine conformance to 3.4.14.1, the radio, intercom, and external phone circuits shall be checked for function at each applicable crew and operating position.

4.6.16 Electrical system.

4.6.16.1 Vehicle electrical.

4.6.16.1.1 Interior lighting. To determine conformance to 3.4.15.1.1, the hatches shall be closed and each crew position domelight shall be turned on and the intensity of each raised and lowered. Each light shall perform as specified.

4.6.16.1.2 Hull-to-turret slipring. To determine conformance to 3.4.15.1.2, the slipring shall be checked for positive electrical contact for 360 degrees of turret rotation.

4.6.16.1.3 Auxiliary outlet. To determine conformance to 3.4.15.1.3, the BII trouble light or its equivalent shall be attached to the auxiliary outlets and checked for operation. The light shall be removed and each circuit overloaded to check circuit breaker operation.

4.6.16.1.4 Personnel heater. To determine conformance to 3.4.15.1.4, actuate the Hi/Lo switch to either position and verify reduced speed blower motor operation. Verify that the indicator lamp on the control panel lights within four minutes of turn-on as an indication of burner ignition. Subsequent to ignition, verify that the blower motor is operating at full speed in both the Hi/Lo switch positions and that the high heat is generated when the Hi/Lo switch is in the Hi position and low heat is generated when in the Lo position. When the Hi/Lo switch is turned to the OFF position, verify that both the indicator lamp goes out and the blower motor shuts off within three an a half minutes.

4.6.16.1.5 Engine smoke generator. To determine conformance to 3.4.15.1.5, when the engine is equipped with an engine smoke generator, activate the smoke generator switch when the engine is warm and operating 1600 rpm. Verify that both right and left exhaust ducts emit white smoke.

NOTE: Do not test the engine smoke generator for more than 15 seconds nor within a building nor with personnel exposed to the gas plume.

4.6.16.2 Hull electrical.

4.6.16.2.1 Power plant electrical. To determine conformance to 3.4.15.2.1, the engine shall be started and the generator output verified by the voltmeter on the driver's instrument panel. During operation of the vehicle, the driver's instrument panel shall be observed for proper display of engine temperature and pressure and of transmission temperature and pressure. It shall also be verified that an electrical disconnect is available at each electrical connection for ease of power pack removal and replacement.

4.6.16.2.2 Exterior lights. To determine conformance to 3.4.15.2.2, the external lights shall be tested for operation as specified during and after the eight mile road test.

4.6.16.2.3 Generator voltage. To determine conformance to 3.4.15.2.3, the generator voltage shall be checked as specified.

4.6.16.2.4 Driver's infrared power pack high voltage supply. To determine conformance to 3.4.15.2.4, with the master battery control and infrared power switches turned on and generator supplying specified voltage, the voltage shall be measured at the driver's I.R. periscope loose harness plug using an 80 megohm load to simulate the I.R. periscope.

4.6.16.2.5 Air cleaner blower motors. To determine conformance to 3.4.15.2.5, the air cleaner blower outlets shall be checked for proper air flow during engine operation, and no flow when the engine is not operating.

4.6.16.2.5.1 Air cleaner outlet system. To determine conformance to 3.4.15.2.5.1, the filter shall be removed, the hose clamp at the turbocharger inlet shall be loosened, and the outlet system shall be sealed off at both ends and pressurized to a vacuum pressure between 25 and 30 inches of water. Maintain turbocharger inlet cleanliness during test and when re-attaching the hose clamp.

4.6.16.2.6 Engine manifold heater. To determine conformance to 3.4.15.2.6, the pushbutton switch on the purge pump handle and the starter switch shall be actuated and pin "a" of the engine electrical disconnect shall be checked for proper voltage.

4.6.16.3 Turret electrical.

4.6.16.3.1 Main gun firing circuits. To determine conformance to 3.4.15.3.1, the following tests shall be conducted:

a. With a 1.25 A load connected at the circuit output, the voltage across the load shall be tested with a voltmeter for presence of vehicle voltage as each firing trigger is actuated and the voltage is recorded.

b. Tests shall be conducted for proper probe grounding as specified, the dead man switching feature, and proper interconnection of 1) the emergency switch on the manual elevation pump handle and 2) emergency mode firing with the blasting machine.

4.6.16.3.2 Emergency mode firing. To determine conformance to 3.4.15.3.2, the blasting machine circuits shall be checked for sufficient power to fire the main gun.

4.6.16.3.3 Co-axial machine gun firing circuit. To determine conformance to 3.4.15.3.3, a 13 A load shall be connected at the output of the machine gun firing circuit and the voltage across the load shall be tested for the presence of vehicle voltage as each respective firing trigger is actuated.

4.6.16.3.4 Main gun and machine gun circuit controls. To determine conformance to 3.4.15.3.4, the commander's controls and the gunner's controls shall be checked for ability to fire the weapons specified. Verify that the firing circuits from the commander's and gunner's stations to the main gun are open when the loader's safety switch is in the SAFE position and closed when in the FIRE position.

4.6.16.3.5 Searchlight power circuits. To determine conformance to 3.4.15.3.5, the searchlight control circuits at the external connector shall be checked by inserting appropriate switching leads at the internal control point.

4.6.16.3.6 Smoke grenade discharge circuits.

4.6.16.3.6.1 Arming. To determine conformance 3.4.15.3.6.1, operate the master battery switch to ON, the turret power switch to ON, and the grenade system power switch to ON, and verify the power-on (ready) lamp in the grenade power box illuminates. Operate the grenade system power switch to OFF and verify the power-on (ready) lamp is extinguished.

4.6.16.3.6.2 Circuit voltage (complete installation). To determine conformance to 3.4.15.3.6.2, arm the circuit as specified in 4.6.16.3.6.1 and verify that the power-on (ready) lamp is illuminated. Activate the RIGHT firing pushbutton and verify the voltage on the smoke grenade discharger pins shown in figure 10 is as specified in 3.4.15.3.6.2. Activate the LEFT firing pushbutton and verify that the voltage on the smoke grenade discharger pins is as specified. Return the power-on (ready) switch to OFF and verify that voltage is not present on any of the firing pins.

4.6.16.3.6.3 Circuit voltage (incomplete installation). When the smoke grenade dischargers and pushbutton unit are not installed on the vehicle, the external firing circuits at the external connector shall be checked on each vehicle by inserting appropriate switching leads at the internal control point (see 3.4.15.3.6.2).

4.6.17 Performance. To determine conformance to 3.5, except as otherwise specified herein, testing shall be performed on a hard flat level surface.

4.6.17.1 Durability. To determine conformance to 3.5.1, durability shall be demonstrated when the vehicle is performing the 4000 mile operation as specified.

4.6.17.2 Power plant and power train. To determine conformance to 3.5.2, the vehicle power plant and power train shall be operated throughout all gears and speed ranges as specified herein and checked for functional requirements. The power train, final drives, tracks, suspension system, and controls shall be checked throughout all speed and steering ranges, and shall perform as specified. Prior to installation in the vehicle, with the power plant mounted on a test stand, check engine function, transmission settings, and generator. Assure proper oil is being used for subsequent testing.

4.6.17.2.1 Speeds.

4.6.17.2.1.1 Level road speeds. To determine conformity to 3.5.2.1.1, the vehicle shall be operated at a minimum 30 mph speed for not less than 10 minutes and at 2.5 $\pm$ 0.5 mph for not less than 12 minutes and checked for function of power plant and power train. The vehicle drift when travelling between 25 and 30 mph shall be checked to verify performance as specified.

NOTE: When test facilities preclude safe operation at a sustained 30 mph speed, tests for that speed shall consist of achieving and maintaining 30 mph ten consecutive times at distances of at least 100 yards.

4.6.17.2.1.2 Grade speeds. To determine conformance to 3.5.2.1.2, the vehicle shall be operated at a sustained speed of 10 mph while ascending a 10 percent grade and at 20 mph speed while ascending a 3 percent grade.

4.6.17.2.2 Acceleration. To determine conformance to 3.5.2.2, the vehicle shall be accelerated from a standing start through a distance of 200 feet and the time checked for performance as specified.

4.6.17.2.3 Climbing. To determine conformance to 3.5.2.3, each vehicle shall be driven in forward and reverse gear up an approved 60 percent grade and on a 30 percent side slopes, engine stopped and restarted and observed for functional fuel system and climbing requirements.

4.6.17.2.4 Engine start on grades and slopes. To determine conformance to 3.5.2.4, the engine shall start and oil pressure and temperature shall be maintained when operating on specified grades and slopes with the fuel tanks filled to no more than 50 percent of capacity.

4.6.17.2.5 Braking and drift. To determine conformance to 3.5.2.5, the vehicles shall be operated at 20 mph on dry, level, hard-surfaced roads without loose material, and stopped as specified. The results of three consecutive stopping distances shall be averaged to make this determination. To establish drift, the vehicle shall follow a set line of travel on approaching the braking point, applying the vehicle brakes at a given point on the line, and without manual steer correction, bringing the vehicle to a complete stop. The vehicle shall stop within 60 ft of the braking point. Sidewise departure from a continuation of the line of travel shall not exceed 6.7 percent of the stopping distance.

4.6.17.2.5.1 Holding. To determine conformance to 3.5.2.5.1, a load of 6000 lb shall be placed on the vehicle in a position that will not restrict the flow of engine air (intake or exhaust). The vehicle shall be driven up a 60 percent dry, hard grade and the service brakes checked, and then the parking brakes checked for conformance. Checks shall be made with the vehicle headed up and down grade.

4.6.17.2.6 Turning. To determine conformance to 3.5.2.6, the vehicle shall be operated and turned to right and to the left in full 360 degree pivot turn in neutral steer and checked for functional requirements. During this test, the vehicle shall be brought to a full stop before reversing the turning direction. The full turns shall be accomplished within a 35 ft diameter circle.

4.6.17.2.7 Fording.

4.6.17.2.7.1 Shallow water. To determine conformance to 3.5.2.7.1, the chassis shall be driven into water of specified depth with engine the compartment drain valve open and without special equipment. During and after this period, water accumulation in the crew compartment hull floor shall not be more than specified depth.

4.6.17.2.7.2 Drain valves. To determine conformance to 3.5.2.7.2, a force gage shall be attached to the end of the handgrip of the front valve lever and actuated as specified. The rear valve lever shall also have the gage attached and actuated as specified. The front and rear drain valve levers shall operate at the force specified and the valves checked for functional and dimensional requirements.

4.6.17.2.7.3 Turret inflatable seal and pump. To determine conformance to 3.5.2.7.3, a force gage shall be attached to the pump plunger and pump actuated to arrive at the specified pressure as indicated on the inflatable seal pressure gage. The maximum force shall be not more than that specified. The indicated pressure loss during a 30 minute period shall not exceed 5 psi.

CAUTION: The pressure shall be relieved at the conclusion of this test.

4.6.17.2.7.4 Engine start - shallow water. To determine conformance to 3.5.2.7.4, the engine starting capability shall be checked during shallow water operation. The engine shall be idled at 1000 rpm for 15 minutes, stopped and restarted in not more than 3 minutes with all accessories functioning satisfactorily during and after test.

4.6.17.2.7.5 Deep water. To determine conformance to 3.5.2.7.5, when a fording kit is specified, the vehicle with kit installed shall be driven into a hard bottom body of water 96 inches in depth and remain at that depth for 30 minutes. The accumulation of water shall be checked and shall be not more than 2 inches on the crew compartment hull floor in the center of the “V”.

4.6.17.2.8 Trench crossing. To determine conformance to 3.5.2.8, the vehicle shall be driven at a speed not to exceed 5 mph without stalling over trenches as specified. The main gun shall be in the forward, fully elevated position. After the test, the vehicle shall be examined for damage.

4.6.17.2.9 Vertical obstacles. To determine conformance to 3.5.2.9, the vehicle selected shall be driven forward at a speed not to exceed 5 mph without stalling over vertical obstacles as specified. The main gun shall be in the forward, fully elevated position. After the test, the vehicle shall be examined for damage.

4.6.17.3 Turret and cupola.

4.6.17.3.1 Main armament balance. To determine conformance to 3.5.3.1, verify that the main gun has been balanced in accordance with Drawing 12270442. The compensating weight is to remain attached to the gunner's guard when performing any gun control test without a coaxial machine gun and M457 dummy round. No simulated weights of any kind shall be used.

4.6.17.3.2 Nylon ballistic shield. To determine conformance to 3.5.3.2, the following tests shall be performed as follows:

a. Coaxial machine gun deflection. With the main gun on its zero aiming point, a simulated machine gun containing a centering aperture shall be installed in the machine gun mount. The mount shall be adjusted to boresight position while viewing the coaxial machine gun target through the centering hole in the simulated machine gun. A deflection measuring device shall be mounted to the gun shield and coaxial machine gun deflection shall be checked while elevating the main gun 19 degrees and depressing 8 degrees.

b. Gunner's telescope sighting system deflection. With the gunner's telescope set in its boresight position, deflection shall be tested by observing the gunner's telescope targets located at plus 15 degrees and minus 5 degrees on the target stand, as the main muzzle telescope reticle is superimposed on its appropriate targets.

4.6.17.3.3 System backlash. To determine conformance to 3.5.3.3, backlash tests shall be conducted as specified using the gunner's telescope to measure the amount of backlash.

4.6.17.3.4 Turret and gun control system. To determine conformance to 3.5.5.4, the vehicles shall be completely assembled, serviced with applicable fluids and lubricants, but need not be combat loaded. After tests, the vehicle shall be examined for leaks and workmanship deficiencies possibly caused by operation. The turret and electrical system shall be as specified during these tests.

4.6.17.3.4.1 Traverse and elevation rates.

4.6.17.3.4.1.1 Gun elevation speeds. To determine conformance to 3.5.3.4.1.1, tests shall be conducted to determine the elevation and depression controllability over the speed ranges specified. Tests shall be conducted with both the gunner's and commander's power handles.

4.6.17.3.4.1.2 Turret traverse speeds. To determine conformance to 3.5.3.4.1.2, the turret shall be tested for controllability over speed ranges specified. Tests shall be conducted with gunner's and commander's power controls, and in both directions of turret rotation. The accumulator shall be fully charged prior to maximum traverse speed tests. Maximum speeds shall be checked by allowing the turret to accelerate approximately 400 mils from stop and observing the time required to complete the next 3200 mils (1/2 revolution) of traverse. Tests for gunner's handle displacement shall be conducted in both directions of rotation.

4.6.17.3.4.2 Main gun laying tracking.

4.6.17.3.4.2.1 Gun laying (stationary target and vehicle). To determine conformance to 3.5.3.4.2.1, tests shall be performed in accordance with the following:

a. Tests shall be conducted with the gunner's controls and repeated with the commander's controls. Tests with the manual controls shall be conducted from the gunner's position only.

b. For testing, the sighting on the specification target shall be performed for positions 3, 5 and 7 of table IV. Two trials shall be made and the average time shall be used for determination of compliance.

4.6.17.3.4.2.2 Gun laying on moving target and tracking accuracy. To determine conformance to 3.5.4.2.2, tests shall be conducted in accordance with the following:

a. Tests with the gunner's and commander's controls shall be conducted with the vehicle operating in the power mode. A suitable turret tracking instrument with timer, recorder and calibrating device shall be used for performing tests. Tests shall be conducted in both clockwise and counterclockwise directions.

b. For testing, the traverse rates of 0.5, 3.3, 32.6 and 65.2 mils per second as shown in table V shall be used.

4.6.17.3.4.3 Operation on slopes. To determine conformance to 3.5.3.4.3, tests shall be conducted in accordance with the following:

a. The vehicle shall be located on a 15 $\pm$ 2 degrees slope for laying on target as specified in table IV. Tests shall be conducted in power mode with gunner's controls and repeated with the commander's controls. Manual control tests shall be performed at gunner's station.

b. For testing, the sighting on the specified target shall be accomplished for positions 3, 5 and 7 for power mode and for 3 and 5 for manual mode of table V. One determination shall be made for each of the positions specified.

4.6.17.3.4.4 Stability of operation. To determine conformance to 3.5.3.4.4, for the elevation axis, the following test shall be performed with the turret level, turret electrical power OFF and engine inoperative:

a. Using the gunner's telescope and manual elevation handle, align the main gun on a target within degree of horizontal.

b. Install a magnetic base dial indicator with a minimum one inch range on the turret roof and set it at a predetermined point on the gun breech.

c. Again, using the telescope and manual elevation handle, depress the gun at least 15 mils (without overloading the indicator) and then elevate the gun to the original target (a) without overshoot.

d. Make an indicator reading within six seconds after arriving on target and again after a one hour period.

e. Verify that the breech has not been moved more than 0.5 mil in the elevation axis.

4.6.17.3.4.4.1 Gun stability (105mm). To determine conformance to 3.5.3.4.4, the following test shall be performed with the vehicle nose down on a 15 degree slope, the main gun horizontal and 90 degrees to the vehicle front to rear axis, turret power switch ON and engine inoperative:

a. Using the gunner's telescope and manual elevation handle, align the main gun on a target within 1 degree of horizontal.

b. Install a magnetic base dial indicator with a minimum one inch range on the turret roof and set it at a predetermined point on the gun breech.

c. Install a similar indicator on the race ring and set it at a predetermined point on the race ring gear.

d. Using the telescope and power control handle, depress and traverse the gun at least 15 mils off-target (without overloading either indicator) and then return the gun to the original target (a) without overshoot.

e. Read both indicators within eight seconds after arriving on target and again after a one hour period.

f. Verify that the gun has not moved more than 0.5 mil in elevation or traverse.

4.6.17.3.4.5 Traverse and elevation limits. To determine conformance to 3.5.3.4.5, the elevation and depression limits of the main gun shall be measured for 360 degrees of traverse using power and manual controls as follows:

a. Power and manual controls, elevation/traverse switch on:

1. Elevate the gun to 19 degrees, first with manual and then with power controls. With the gun at 19 degree elevation, power traverse the turret for 360 degrees.

2. Depress the gun to 8 degrees and slowly power traverse the turret from the front of the vehicle to the rear and observe for gun beginning to jump to nominal zero after passing a traverse angle 95 degrees from the vehicle rear centerline.

3. Return the turret to face forward and, using maximum power, traverse the turret to the rear and observe for gun jump to nominal zero without striking the vehicle while holding the control handle in full depression position.

4. Continue rapid traverse over the rear portion of the vehicle. The gun shall not, strike any portion of the vehicle even though the control handles are at full depression. Observe for gun return to 8 degrees full depression as follows:

   a. At an approximate angle of 95 degrees from the vehicle rear centerline.
   b. Without striking the vehicle.

5. Repeat 2, 3, and 4 with power traversing from the opposite direction.

6. Perform a similar test by hand traversing the turret and depressing the gun with the manual hand pump.

7. The forward 85 degree traverse angle at 8 degree gun depression on each side of the vehicle front centerline shall be maintained. The gun shall pass over the rear deck without striking any portion of the vehicle.

b. Manual controls, elevation switch off:

1. Depress the gun to 5 degrees and traverse the turret from an angle 95 degrees forward of the vehicle rear centerline to an angle 28 degrees from the vehicle rear centerline. Approach the 28 degree limiting angle slowly.

2. At 28 degrees, raise the gun to zero degrees and continue traversing over the rear deck to the opposite 28 degree angle. Depress the gun to 5 degrees and continue traversing in the same direction to an angle 95 degrees forward of the vehicle rear centerline.

3. The gun shall depress 5 degrees manually on each side of the vehicle in the areas forward of the rear 28 degree lines to an angle 95 degrees forward of the vehicle rear centerline without striking any portion of the vehicle.

4.6.17.3.4.6 Override control. To determine conformance to 3.5.3.4.6, the commander's override control shall be operated and the control and movement of the gun shall be observed for performance as specified. With the commander's and gunner's controls in the neutral position, testing for no gun movement while depressing or releasing the override switch in the commander's control shall be accomplished by observing no apparent movement of the gunner's telescope reticle superimposed on a clearly defined target.

4.6.17.3.4.7 Hydraulic pressure limit switch. To determine conformance to 3.5.3.4.7, the turret shall be traversed as specified and the system pressure gage observed for specific pressure as the power pack motor comes on. With the power pack motor running and the controls in their neutral position, the power pack shall cut out at the specified system pressure.

4.6.17.3.4.8 Turret traverse brake. To determine conformance to 3.5.3.4.8, the turret shall be placed in a level position and the turret azimuth noted on the azimuth indicator. With the gunner's power switch on, the gunner's control handle shall be turned to its stop in a clockwise direction without actuating the palm switch. The azimuth indicator shall be observed for turret movement. The procedure shall be repeated in the counterclockwise direction. The turret shall then be power traversed in at least 10 degrees to the left with the gunner's controls, stopped, the position observed on the azimuth indicator and the gunner's control handle again turned to its right and then left stops without depressing the palm switch. The procedure shall be repeated after power traverse to the right. The azimuth indicator shall show no movement of the turret during any of these checks.

4.6.17.3.4.9 Travel locks. To determine conformance to 3.5.3.4.9, tests shall be conducted as follows:

a. Turret slippage tests shall be conducted with the turret lock disengaged and with the main gun in a forward position. The vehicle shall then be operated on a smooth, hard-surfaced road in low gear at a speed of 5 mph and given a full-left, 90 degree steer. Turret slippage shall be measured with the azimuth indicator. The pivot steer tests shall be repeated in full-right, 90 degree steer.

b. For elevation or depression slippage tests, the main gun shall be elevated three to eight degrees in a forward position. The vehicle shall be driven on a straight course, hard-surfaced road at 20 mph, stopped as specified, and the gun slippage measured with the M1A1 gunner's quadrant.

c. The hand traverse crank and the hand elevation crank shall be checked during road tests and during power operation of the turret for movement as specified.

d. The main gun shall be clamped into the external travel lock and the internal turret lock shall be tested for capability of being placed in the locked position. Upon locking, the turret traverse controls shall be actuated and the turret shall remain locked.

4.6.17.3.4.10 Control system deadspot. To determine conformance to 3.5.3.4.10, the gunner's and the commander's controls shall be operated as specified and the deflection of the control handles to initiate continuous movement of the gun in the test direction shall be measured with appropriate inspection equipment. When measuring the deadspot angle, the controls shall not be moved toward the neutral center once the gun or turret has begun to move.

4.6.17.3.4.11 Main gun manual control.

4.6.17.3.4.11.1 Traverse effort. To determine conformance to 3.5.3.4.11.1, a force gage shall be attached to the hand traverse crank and the turret traversed with the hand crank, observing the effort required to maintain turret movement. The force shall be measured in each direction of rotation at four points throughout 360 degrees of rotation (one in each quadrant); the mean force required shall not exceed 17 lb with no individual reading exceeding 20 lb.

4.6.17.3.4.11.2 Elevation effort. To determine conformance to 3.5.3.4.11.2, a torque gage shall be attached to the hand elevation crank and the torque required to maintain uniform movement shall be measured. The torque reading shall not exceed 46 in-lb mean torque with no individual reading exceeding 55 in-lb.

4.6.17.3.4.11.3 Elevation response rate. To determine conformance to 3.5.3.4.11.3, the main gun hand elevation crank shall be rotated at the rate of 10 to 20 rpm while observing a mil-scale target through the gunner's periscope, the measured response rate shall be not less than 10 mils per revolution of the handle.

4.6.17.3.4.12 Power and manual control. To determine conformance to 3.5.3.4.12, the following tests shall be conducted: The gun shall be elevated and depressed with the gunner's power control while traversing the turret with the manual controls. The gun shall be elevated and depressed by manual control while traversing the turret with the gunner's power control. The elevation and traverse power switch shall be turned on and off not less than 3 times and the gun observed for movement. Gun movement shall not exceed the specified amount. The gun firing switches shall be tested and shall operate as specified.

4.6.17.3.4.13 Superelevation actuator. To determine conformance to 3.5.3.4.13, the gunner's periscope reticle shall be laid on a convenient target with the computer set at zero superelevation and the servo switch off. HEP-T, M393 ammunition shall be selected on the computer, and the range scale rotated to 3000 meters. With the servo switch on, and after automatic transmission of superelevation has been accomplished, the gunner's reticle shall be on target within the limits specified.

4.6.17.3.4.14 Hydraulic fluid.

4.6.17.3.4.14.1 Hydraulic fluid cleanliness. To determine conformance to 3.5.3.4.14.1, the hydraulic oil in the control power pack shall be tested for water contamination and cleanliness requirements

4.6.17.3.4.14.2 Hydraulic fluid leakage. To determine conformance to 3.5.4.3.14.2, during and after road tests, the vehicle shall be examined for leakage in the turret and gun control hydraulic system not to exceed the amount specified.

4.6.17.3.4.15 Elevation shut off valve. To determine conformance to 3.5.3.4.15, with the gunner's power switch on, without actuating the palm switch, the gunner's control handle shall be tilted forward and backward to its stops and the gun observed for movement of not more than 2 mils.

4.6.17.3.5 Cupola control.

4.6.17.3.5.1 Traverse effort. To determine conformance to 3.5.3.5.1, a torque gage shall be attached to the cupola traverse mechanism and the torque measured to start cupola motion. Breakaway torque to start motion shall be as specified.

4.6.17.3.6 Fire control system. To determine conformance to gun fire control system requirements of 3.5.3.6.1.1 through 3.5.3.6.1.5, tests shall be performed as specified. With the exception of sighting system boresight retention and rangefinder calibration, these tests may be conducted on an indoor turret stand using equipement indicated herein. The portion of the vehicle tested using this method shall be the turret and other installation as assembled just prior to marriage to the hull and tracked portion of the vehicle. Turret voltage shall be a nominal 26 V dc.

4.6.17.3.6.1 Main gun sighting system.

4.6.17.3.6.1.1 Synchronization. To determine conformance to 3.6.3.6.1.1, testing shall be conducted in accordance with the following procedure: (See figures 6 through 10 for fire control location positions and target aiming points.)

a. The turret shall be mounted on a stand so that the turret datum surface is level within 0.2 mil.

b. Target or aiming points, as shown in figure 8, shall be mounted on a target stand. Details of targets shall be as shown in figure 9. Targets shall be in a common plane within 1/16 inch. This plane shall be vertical within 0.5 mil and shall be located 523.5 inches plus or minus .125 inch from the centerline of the turret mounting diameter. A vertical plane perpendicular to the target plane and intersecting the zero gun aiming point shall intersect the centerline of the turret mounting diameter of the turret stand within 1/4 inch.

c. The gun tube shall be leveled from low to high.

d. The telescope sighting equipment shall be inserted in the gun tube and the turret shall be rotated as required to align the borescope reticle with the vertical line of the gun centerline of the target board.

e. The target shall be positioned with respect to the gun trunnions as follows:

1. When the gun is leveled, in (c), the target horizontal aiming point shall be in line with the crosshair reticle as viewed through the telescopic sighting system within 1/8 inch. The target shall be raised or lowered to thus position the aiming point.

2. The gun shall be elevated to the 15 degree aiming point and the target rotated, if necessary, to superimpose the reticle on the 15 degree aiming point. When the target is thus positioned, so that elevation or depression of the gun results in the reticle traveling exactly through the zero elevation and 15 degree aiming points, the target shall be within 0.5 mil clockwise or counterclockwise of a plumb line position.

3. Laying from low to high borescope reticle shall be superimposed on the zero elevation aiming point.

f. The ballistic computer superelevation counter shall be positioned at zero by rotating the handcrank.

g. The rangefinder shall be set at 1200 meters, and the left and right side aiming points superimposed by means of the horizontal and vertical knobs.

h. Aperture stops shall be placed on the gunner's periscope, the rangefinder and the gunner's telescope, either at the objective or the exit end, as feasible.

i. The gunner's periscope (daylight), the rangefinder and the gunner’s telescope reticle shall be superimposed on their zero aiming points by adjustment of boresight knobs.

j. The borescope reticle shall be superimposed on each of its aiming points laying from low to high without overtravel. The turret shall be traversed if necessary. Reticles described in (i) shall fall within their respective tolerance bands at each aiming point. A reticle line shall be considered within the tolerance bands if half or more of the reticle line is within the white area.

4.6.17.3.6.1.2 Elevation backlash. To determine conformance to 3.5.3.6.1.2, backlash tests shall be made in accordance with the following procedure:

a. Main gun shall be aligned with its horizontal aiming point by laying from low to high without overtravel.

b. The line of sight through the gunner's periscope (daylight) and the rangefinder shall be adjusted to superimpose their reticles on their aiming points.

c. The main gun shall be realigned with its aiming point laying from high to low.

d. The backlash or amount that each line of sight lags shall be measured by noting the new position of each reticle on its aiming point. Backlash for the periscope and the rangefinder shall not exceed the amount specified.

e. Backlash shall be checked at main gun positions of zero, plus 5,10, and 15 degrees.

4.6.17.3.6.1.3 Boresight knob travel. To determine conformance to 3.5.3.6.1.3, the boresight knob travel shall be tested after synchronization requirements have been met. The knob travel shall be measured from a position established with the gun line of sight on its horizontal aiming point laying from low to high and each reticle on its horizontal aiming point. Boresight knob travel shall be as specified.

4.6.17.3.6.1.4 Unity sight knob travel. To determine conformance to 3.5.3.6.1.4, place the unity reticle on its horizontal aiming point using the boresight knobs in conjunction with 4.6.17.3.6.1.3. From this position, rotate the elevation and deflection boresight knobs from stop to stop and verify that the total travel is as specified.

4.6.17.3.6.1.5 Boresight retention. To determine conformance to 3.5.3.6.1.5, testing shall be conducted in accordance with the following procedure:

a. Prior to the eight mile road test, the vehicle shall be positioned at least 1200 meters from a clearly defined target.

b. With the computer set for 1200 meters, boresight mode of operation, the main gun shall be aligned on target laying from low to high.

c. The gunner's periscope reticle, the gunner's telescope reticle, and the rangefinder reticle shall be aligned on target. Boresight knob positions of the sighting instruments shall be recorded.

d. The eight mile road test shall be performed.

e. The vehicle shall be returned to position established in "a".

f. The main gun shall be aligned on original aiming point, laying from low to high.

g. The boresight knob (excluding boresight knob backlash) of each sighting instrument shall be used, if necessary, to reposition their reticles on the original aiming point. Any loss of boresight retention shall be noted by the new boresight knob position and shall not exceed the limits specified.

4.6.17.3.6.2 Rangefinder calibration.

4.6.17.3.6.2.1 Rangefinder settings. To determine conformance to 3.5.3.6.2.1, the rangefinder shall be mounted on a Government approved final inspection fixture and checked prior to installation in the turret.

4.6.17.3.6.2.2 Final rangefinder calibration settings. To determine conformance to 3.5.3.6.2.2, the rangefinder mounted in the turret and the turret installed on the vehicle, rangefinder calibration shall be checked in accordance with the following procedure:

a. A clearly defined target shall be provided between 1000 and 2000 meters located within an accuracy of 1/3 of 1 percent and the range scale set to agree with the range chosen.

b. Set the occluder knob to its midposition.

c. With the eyepiece in proper focus for the observer, coincidence shall be established with the target by means of the horizontal and vertical calibrating knob.

d. The calibrating reticle shall be illuminated. The calibrating reticle lamp shall not be left on for more than one minute at any one time. If it is necessary to turn on the reticle lamps again, allow at least two minutes off after the third check. Alignment of the coincidence reticle shall be established (see figure 3) using the cover protected ICS and halving knobs.

e. The horizontal, vertical, and ICS knob setting shall be that specified.

4.6.17.3.6.3 Superelevation. To determine conformance to 3.5.3.6.3, the superelevation of the gun sighting system shall be checked in accordance with the following procedures and observed for accuracy of sighting:

a. With the ballistic computer switch at the rangefinder turned off, the computer range correction knob and superelevation counter shall be set at zero.

b. If a mil scale on a target is to be used to read gun superelevation, the gun shall be aligned with the horizontal gun aiming point by laying low to high. The mil scale shall be fixed to the target with the zero index at the horizontal gun aiming point. If the gunner's quadrant M1Al is to be used to measure gun superelevation, the gun shall be leveled by means of a M1Al gunner's quadrant positioned on the breech ring pads.

c. The gunner's periscope daylight system shall be aligned with its aiming point to rotating the boresight knobs. The knobs shall be locked.

d. The rangefinder scale light shall be switched on.

e. The range finder scale shall be positioned at 500 meters without overtraveling.

f. The ballistic computer switch at the rangefinder shall be turned on.

g. The gunner's periscope shall be lowered as a result of superelevation input from the ballistic computer. The gunner's periscope reticle shall be realigned with its aiming point by elevating the gun. Alignment shall be accomplished from low to high.

h. Superelevation of the gun shall be noted by the position of the gun tube telescope on the mil target or by reading the gunner's quadrant M1Al on the gun breech ring pads. Superelevation reading shall conform to table VIII with tolerances as specified in table IX. The ballistic computer power switch at the rangefinder shall be turned off.

i. The inspection procedure in "a" through "h" above shall be repeated for each ammunition at the ranges in table VIII.

4.6.17.3.6.4 Indirect fire control.

4.6.17.3.6.4.1 Elevation quadrant. To determine conformance to 3.5.3.6.4.1, with the turret in a level position, using a calibrated gunner's quadrant on the breech pad, the gun shall be elevated to 337.78 mils. The reading on the elevation quadrant shall agree with the calibrated quadrant within 1 mil. The procedure shall be repeated with the gun at a depression of 142.22 mils.

4.6.17.3.6.4.2 Azimuth indicator backlash. To determine conformance to 3.5.3.6.4.2, the turret shall be traversed in a clockwise direction without overtravel and the zero of the outer movable dial positioned in line with the one mil pointer. A fixed vertical reference line shall be observed through the gunner's telescope and the corresponding boresight knob position noted. The turret shall then be traversed clockwise approximately 50 mils and returned to its zero azimuth indicator position without overtravel. The movement of the gunner's telescope boresight deflection knob required to realign the vertical line of sight with its original reference line is backlash error and shall not exceed 1.0 mil.

4.6.17.3.6.4.3 Leveling devices. To determine conformance to 3.5.3.6.4.3, the main gun shall be leveled at zero elevation as indicated by a bore leveling gage positioned in the chamber. The leveling devices on the rangefinder and ballistic drive shall be observed for accuracy.

4.7 Fire extinguisher. To determine conformance to 3.6, the fire extinguisher shall be tested for operation. With the engine idling at 700 to 800 rpm the internal control shall be pulled with a maximum effort of 55 lb using a force gage. The first shot shall actuate one bottle. Upon actuation of the first shot release mechanism, the engine shall shut down. Actuation of the release mechanism shall result in a time delay of more than 6 seconds but less than 11 seconds before the system begins discharging CO_2 into the engine compartment and into the center of the "V". After returning the handle to its original position, a second actuation shall discharge the remaining two bottles of CO_2. Removal and weighting of each CO_2 bottle after test shall show a minimum of 9 lb of CO_2 discharged during test.

CAUTION: When conducting these tests, safety precautions shall be exercised (see 6.3).

4.8 Electromagnetic interference and compatibility.

4.8.1 Electromagnetic characteristics. To determine conformance to 3.7.1 through 3.7.1.3, the vehicle shall be subjected to electromagnetic interference tests in accordance with MIL-STD-462. When testing the radio for susceptibility RS03, care must be taken to assure that any apparent susceptibility is not being caused by unwanted harmonics generated in the test source. As an aid to intra-system compatibility, broadband conducted emissions on the + 28 V dc bus shall be compared to the limits of CE07. Test plans shall be approved by the Government (see 6.2.1).

4.9 Environment.

4.9.1 High temperature. To determine conformance to 3.8 and 3.4.10 (cooling system), the completed vehicle properly serviced and equipped, shall be subjected to the high temperatures specified herein and observed for performance, heating conditions, and cooling system operation. With the vehicle operating in ambient air temperature of 115°F and a cooling air intake grille restriction not exceeding 2 inch H_2O measured between cylinders and with a cooling air exhaust restriction not exceeding 4 inches H_2O measured above the cooling fans, for all transmission gear ranges above 0.3 maximum speed ratio point, the vehicle shall meet the performance requirements. Storage tests in accordance with MIL-STD-810 shall be performed.

4.9.2 Low temperature. To determine conformance to 3.8, the vehicle properly serviced and equipped, shall be subjected to the low temperature operational tests at temperatures specified herein. Storage tests in accordance with MIL-STD-810 shall be performed.

4.10 Continuous noise level. To determine conformance to 3.9, the average of three noise level readings at each octave band shall be determined at each operator's head position under normal operating procedures. The sound level meter, microphone related equipment and techniques employed shall be in accordance with MIL-STD-1474.

4.10.1 Noise hazard caution sign. To determine conformance to 3.9.1, verify that the noise hazard signs are clearly visible to personnel in all crew stations.

4.11 Painting, marking and data plates. To determine conformance to 3.10.1, 3.10.2 and 3.10.3, the vehicle shall be visually examined to verify the painting, marking and data plate requirements.

4.12 Workmanship. The vehicle shall be examined to determine conformance to 3.11.

4.12.1 Welding repairs. To determine conformance to 3.11.1, welding repairs shall be checked for authorization to repair and conformance to approved procedures.

4.13 Preservation, packaging, and vehicle processing inspection. Material and equipment shall be inspected prior to shipment, to determine conformance to Section 5 of this specification.

5. PACKAGING

5.1 Preparation for delivery. Preparation for delivery and storage shall be as specified in MIL-T-62050.

6. NOTES

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

6.2 Ordering data. Acquisition documents should specify the following:

a. Title, number, and date of this specification.
b. If first article samples are required (see 3.1).
c. If special kit equipment is required (see 3.3.3).
d. If special paint requirements are specified (see 3.10.1).
e. If welding repairs are authorized (see 3.11.1).
f. If the contractor is responsible for provisions and maintenance of test equipment (see 4.1.1).
g. If inspection conditions shall be the other than as specified (see 4.3).
h. If preproduction inspection is required (see 4.4.1).
i. If initial production inspection is required (see 4.4.2).
j. If special tests and examinations are required (see 4.5.3.5).
k. Selection of applicable level and packaging standard or packaging data sheet (see 5.1).

6.2.1 Government approval for special test methods. Special test methods, procedures, and test plans used to establish electromagnetic characteristics (see 4.8.1) are to be approved by the acquisition agency.

6.3 Safety precautions.

6.3.1 Carbon monoxide. Carbon monoxide is a colorless, odorless, deadly poisonous gas which, when breathed, deprives the body of oxygen and causes suffocation. Exposure to air contaminated with carbon monoxide produces symptoms of flushed complexion, headache, dizziness, dimness of vision, nausea, apparent drowsiness, loss of muscular control. If exposure symptoms are evident, remove affected personnel from the area and treat as follows: expose to fresh air; keep warm; do not permit physical; if necessary, administer artificial respiration (see 4.6.4.2).

6.3.2 Fire extinguisher. Caution should be exercised in handling carbon dioxide fire extinguisher cylinders. They should not be dropped, permitted to strike each other, or be handled roughly. Extreme care should be exercised during reinstallation to avoid tripping fire extinguisher control system since physica1 injury is highly probable (see 4.7).

6.4 Process average. Sampling may be initiated if the process average value for the first twenty vehicles inspected is less than the AQL specified in the classification of defects for major and minor defects. If the computed process average exceeds the specified AQL, 100 percent inspection shall be performed and continued until such time that the process average for twenty consecutive vehicles is less than the specified AQL.

6.5 Definitions.

6.5.1 Leaks. The following definitions shall be used with the classification of defects (see 3.4.1, 3.4.2, 3.5.3.14.2, 4.6.4 and 4.6.17.3.4):

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 the formation of a droplet.
c. Droplet - Any recurring evidence of fluid beyond the seal that results in the formation of a non-falling drop.
d. Drop - A drop is defined as a volume of .05 cubic centimeters.
e. Drip - Any recurring evidence of fluid beyond the seal where a droplet forms and falls.

6.6 Recycled materials. The use of recycled materials which meet the requirements of the applicable material specifications without jeopardizing the intended use of the item shall be encouraged (see 3.3).

6.7 Supersession data. This military specification supersedes M60PD-T-62222A(AT), dated 31 July 1981.

Custodian:
Army - AT

Preparing activity:
Army - AT

(Project No. 2350-A308)

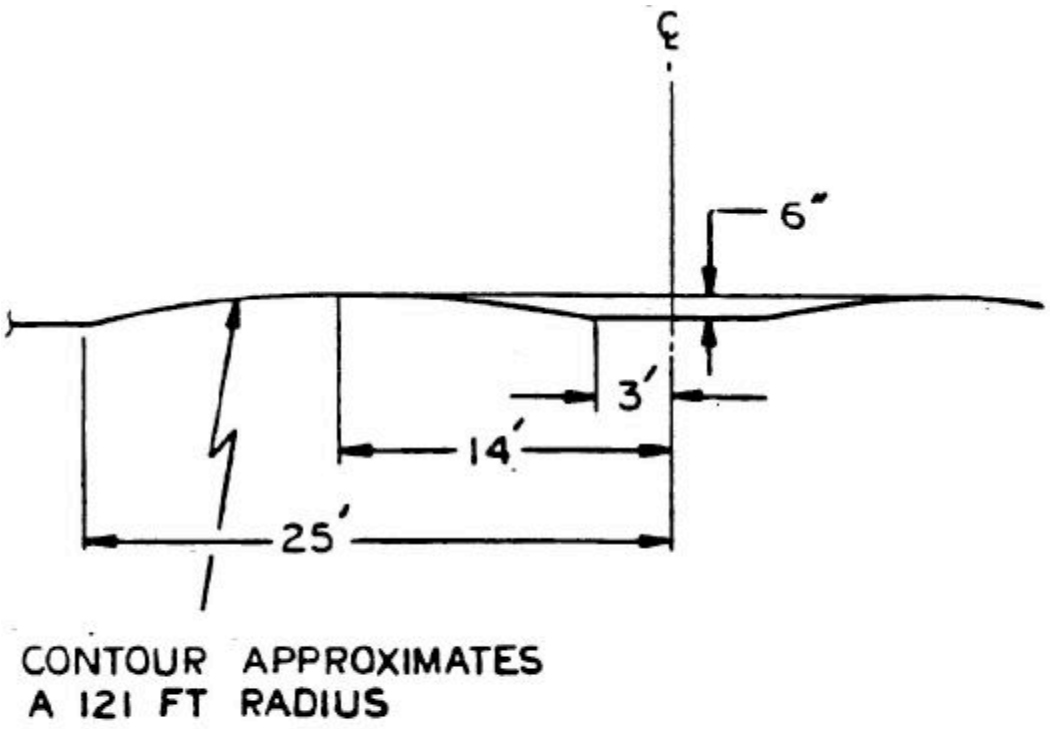


FIGURE 1. Profile of test track (artificial bump).

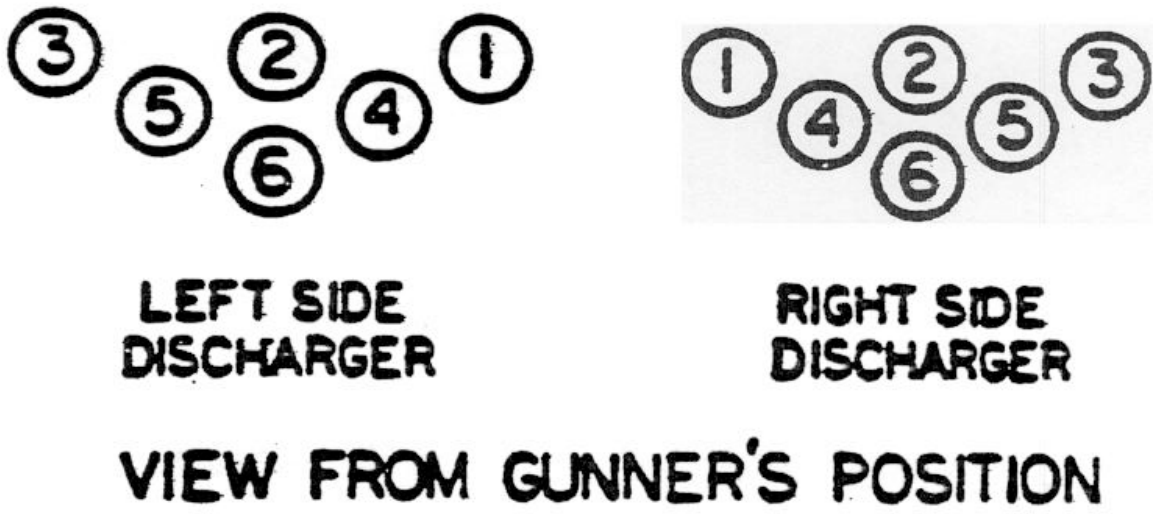
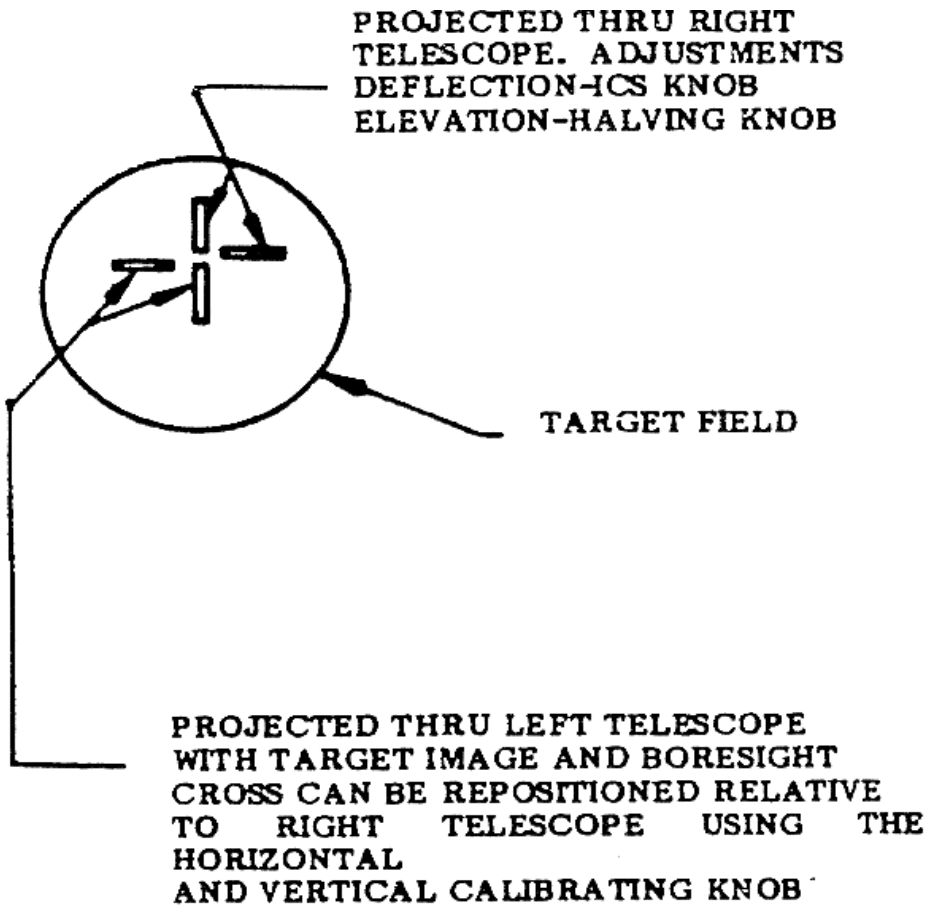


FIGURE 2. Grenade discharge barrel numbering.



NOTE - THE COVER PROTECTED HALVING KNOB SHALL BE UTILIZED ONLY FOR THE VERTICAL ADJUSTMENT OF THE CALIBRATING RETICLE TO ESTABLISH A MINIMUM RECOGNIZABLE SEPARATION BETWEEN THE UPPER AND LOWER VERTICAL RETICLE BARS.

FIGURE 3. Illuminated calibrating reticle.

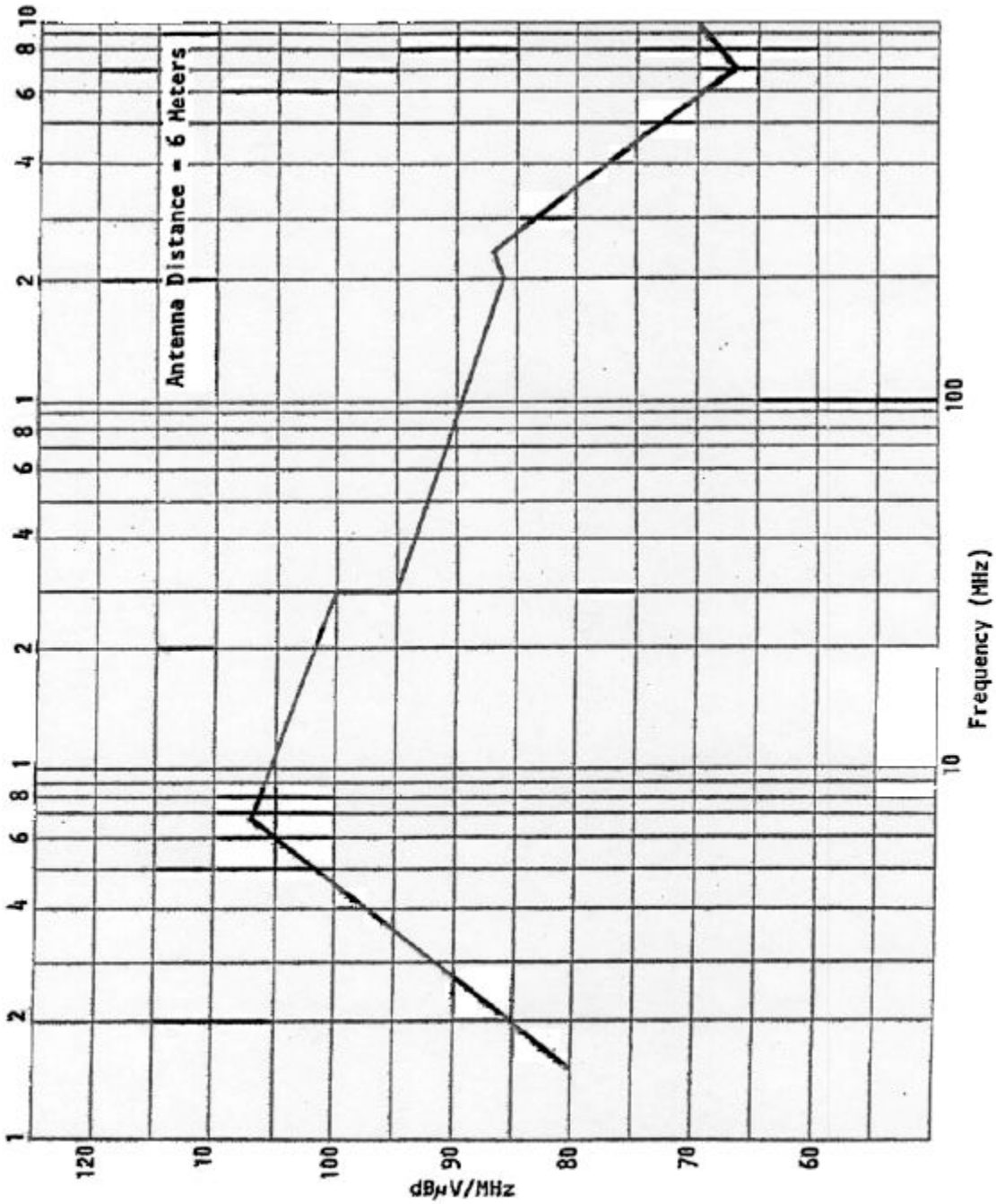


FIGURE 4. Broadband radiated emissions hydraulic powerpack cycling.

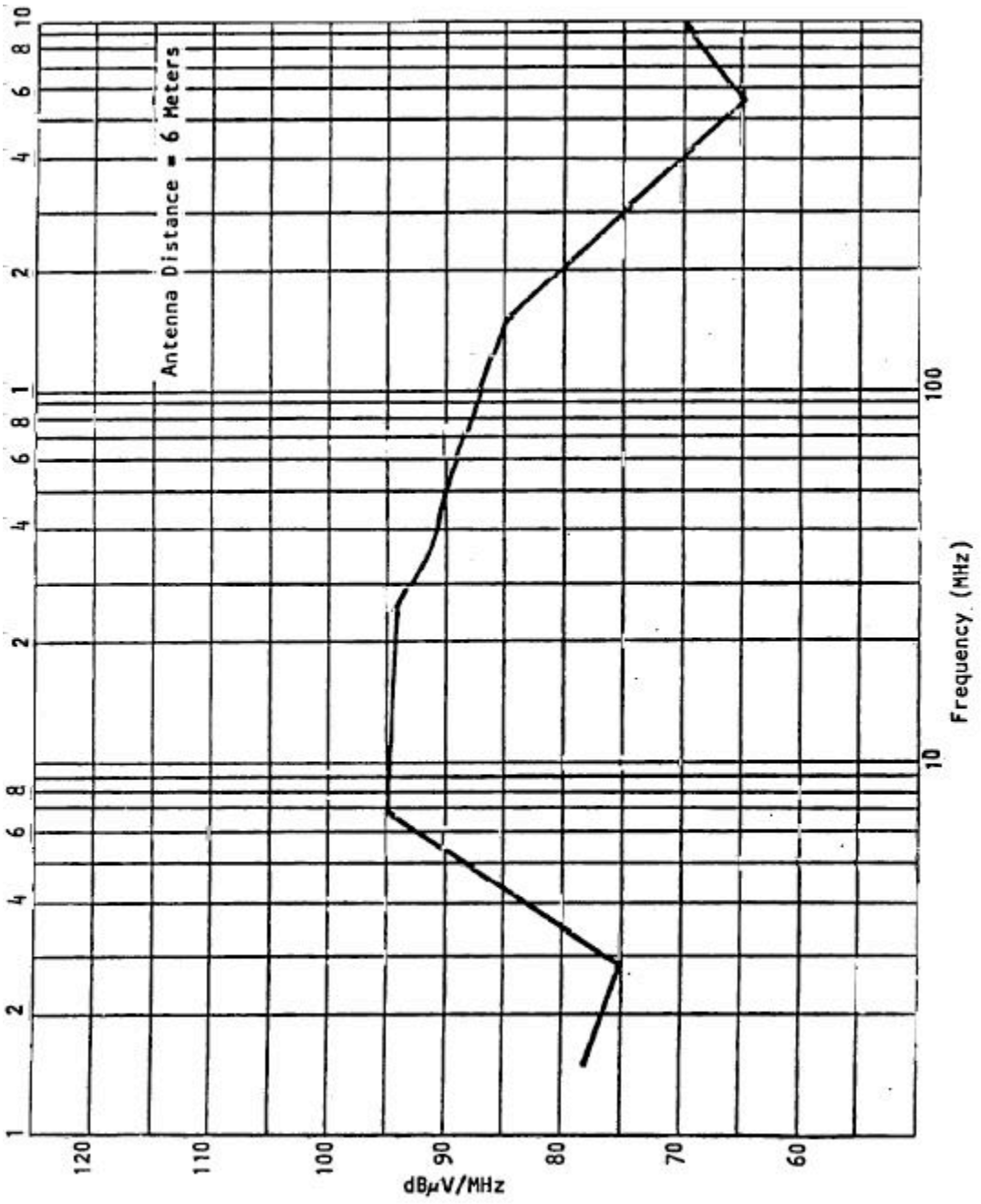


FIGURE 5. Broadband radiated emissions ballistic computer, ammo select.

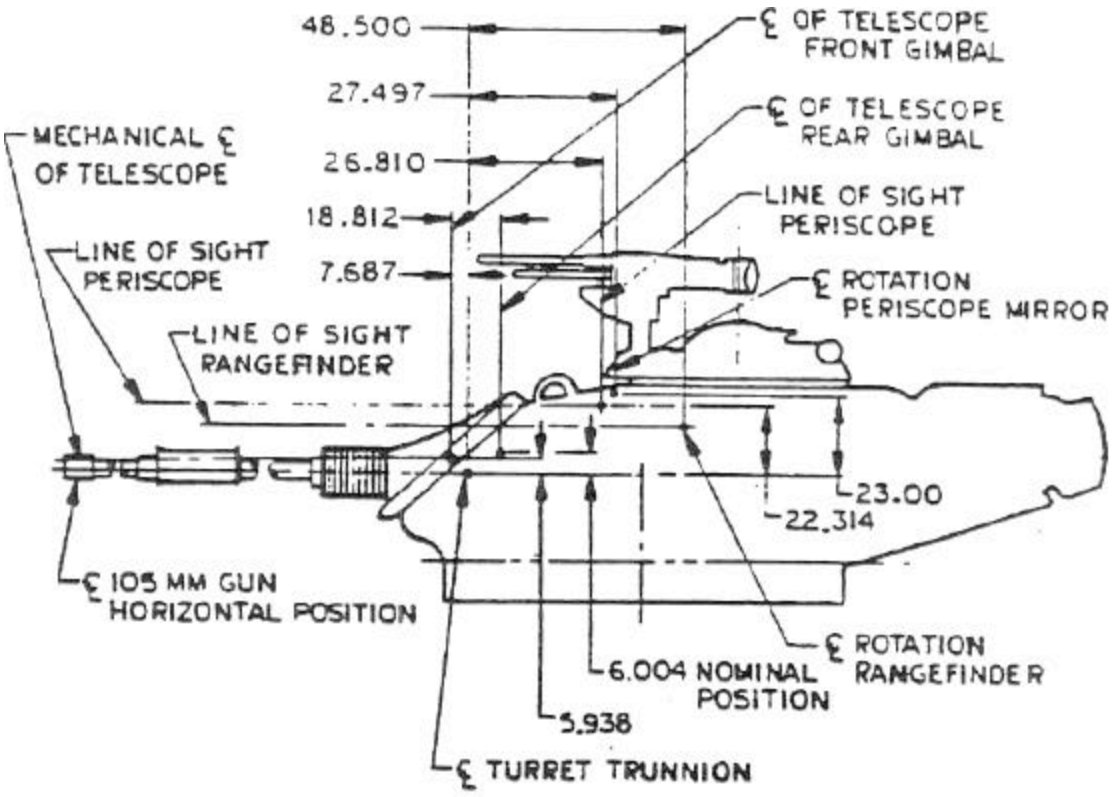


FIGURE 6. Side elevation.

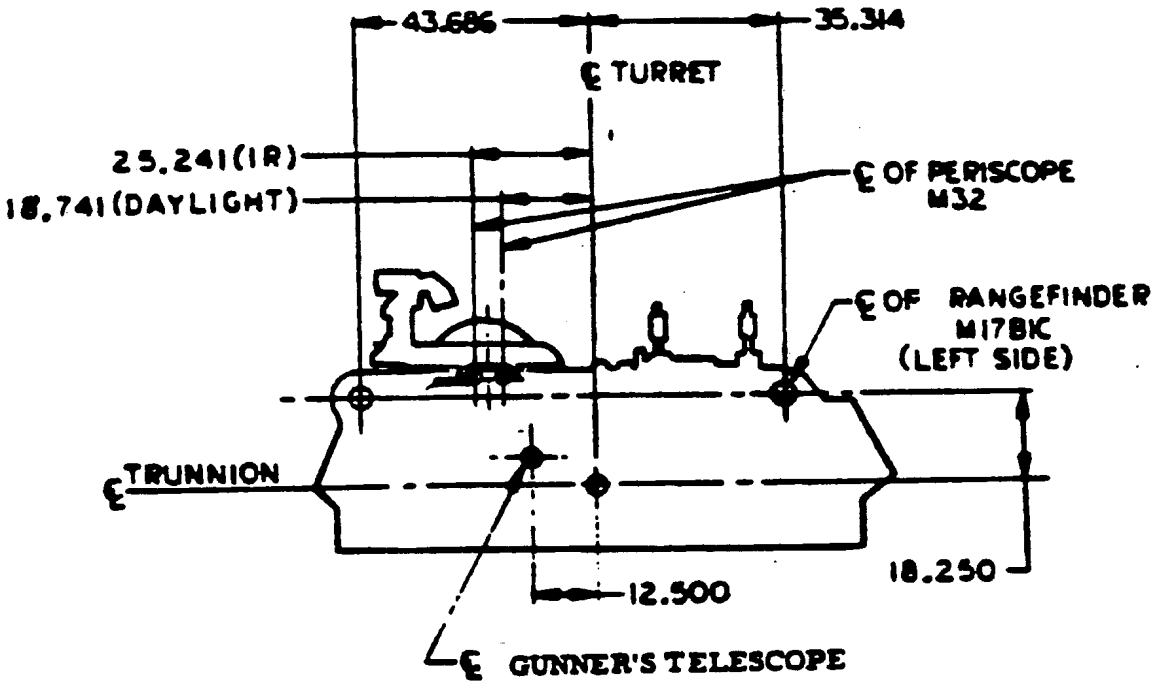


FIGURE 7. Front elevation.

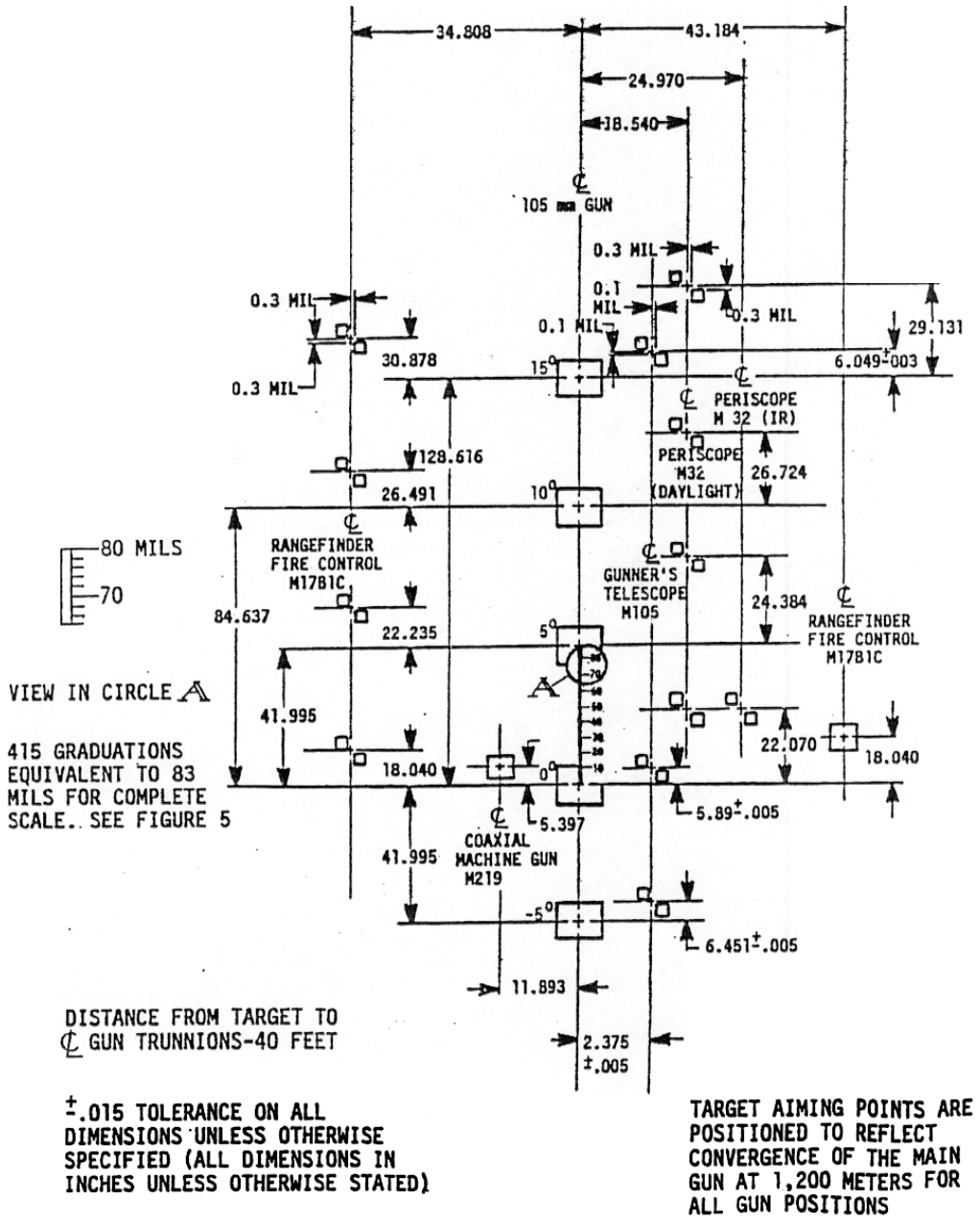
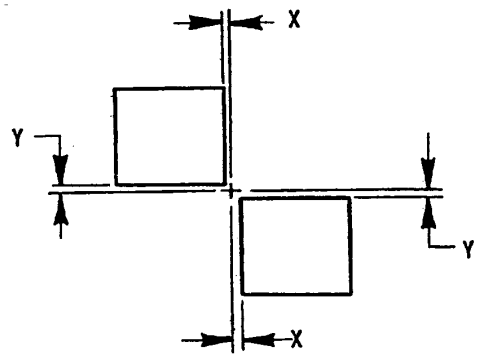


FIGURE 8. Boresight and synchronization target.

OPEN AIMING POINTS



		TOLERANCE BANDS OF TARGETS AT 40 FEET BASED ON 1,200 METER BORESIGHT									
		GUN ELEVATION, DEGREES									
		-5		0		+5		+10		+15	
		MIL	INCHES	MIL	INCHES	MIL	INCHES	MIL	INCHES	MIL	INCHES
RANGEFINDER M17B1C											
	X					03	156	03	158	03	161
	Y					03	157	03	161	03	167
PERISCOPE M32											
	X					03	150	03	152	03	155
	Y					03	151	03	154	03	160
TELESCOPE M105											
	X	01	048							01	049
	Y	01	048							01	051

FIGURE 9. Target details.

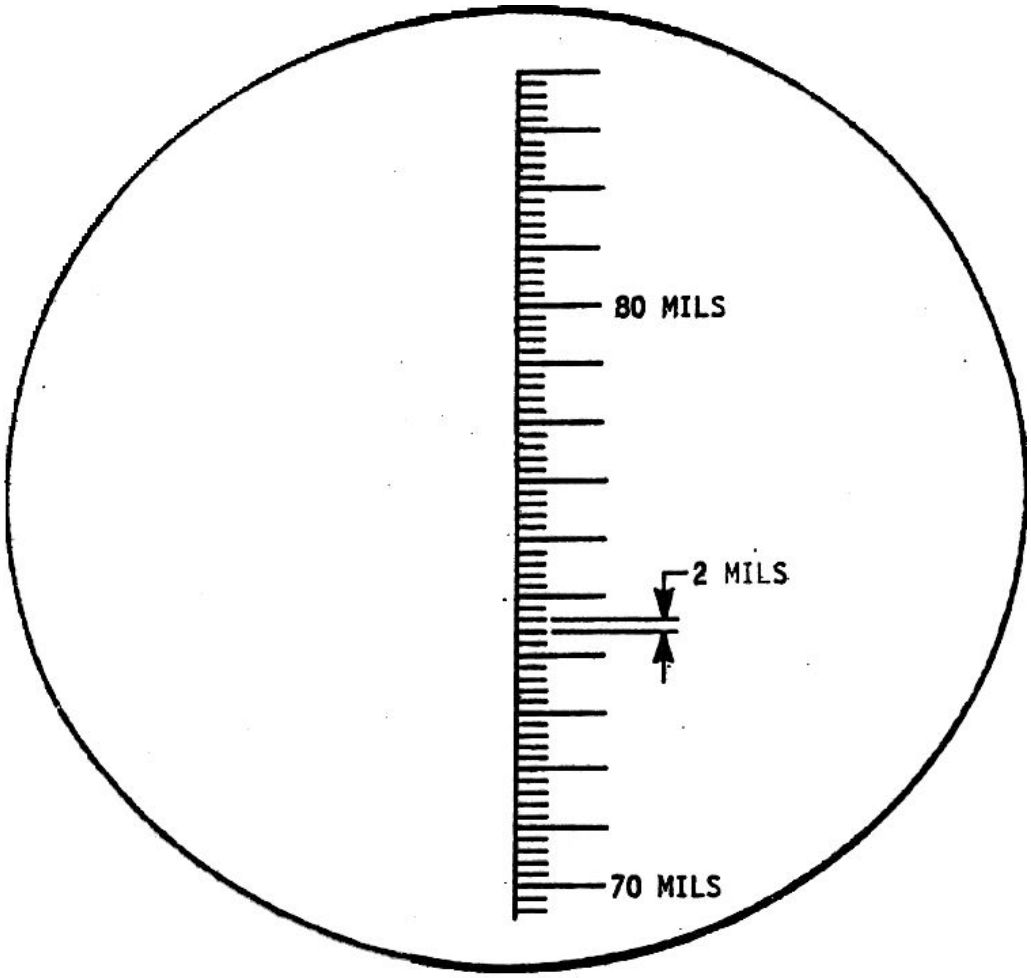


FIGURE 10. Enlarge view of detail A of figure 8.