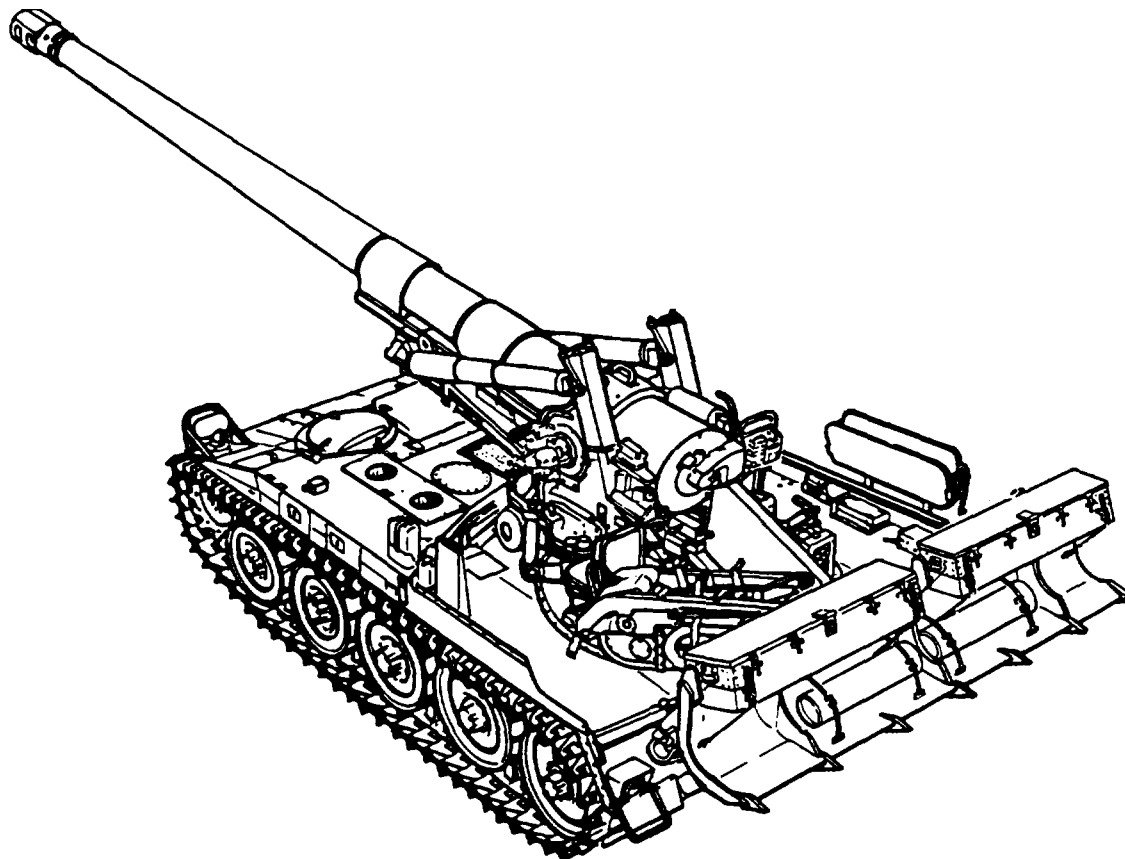


TECHNICAL MANUAL

**UNIT MAINTENANCE
MANUAL**

**HULL AND
RELATED COMPONENTS
HOWITZER, HEAVY,
SELF-PROPELLED:
8-INCH, M110A2
(2350-01-041-4590)
(EIC:3E320-1)
(EIC:3E3)**

UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES AND LUBRICATION INSTRUCTIONS	PAGE 2-12
UNIT TROUBLESHOOTING	PAGE 2-43
UNIT MAINTENANCE INSTRUCTIONS	PAGE 2-373
MAINTENANCE ALLOCATION CHART	PAGE B-1



Distribution: Statement A: Approved for public release; distribution is unlimited

**This Manual supersedes hull and related components portions of
TM 9-2350-304-20, dated 23 November 1979**

HEADQUARTERS, DEPARTMENT OF THE ARMY

MARCH 1994

**UNIT MAINTENANCE MANUAL
HULL AND RELATED COMPONENTS
HOWITZER, HEAVY,
SELF-PROPELLED: 8-INCH, M110A2
(2350-01-041-4590) (EIC:3E3)**

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

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to Commander, US Army Tank-Automotive Command, Attn: AMSTA-MB, Warren, MI 48397-5000. A reply will be furnished to you.

Table of Contents

	Page
HOW TO USE THIS MANUAL	ii
CHAPTER 1. INTRODUCTION	
Section I. General Information.....	1-1
Section II. Equipment Description and Data.....	1-5
Section III. Principles of Operation	1-19
CHAPTER 2. UNIT MAINTENANCE INSTRUCTIONS	
Section I. Repair Parts, Special Tools, TMDE, and Support Equipment.....	2-6
Section II. Service Upon Receipt.....	2-7
Section III. Unit Preventive Maintenance Checks and Services.....	2-12
Section IV. Unit Troubleshooting	2-43
Section V. Wiring Harness and Cable Repair.....	2-364
Section VI. Maintenance of Hydraulic Lines and Fittings.....	2-371
Section VII. Unit Maintenance Instructions	2-373
Section VIII. Preparation for Storage or Shipment.....	2-1133
APPENDIX A. REFERENCES	A-1
APPENDIX B. MAINTENANCE ALLOCATION CHART	B-1

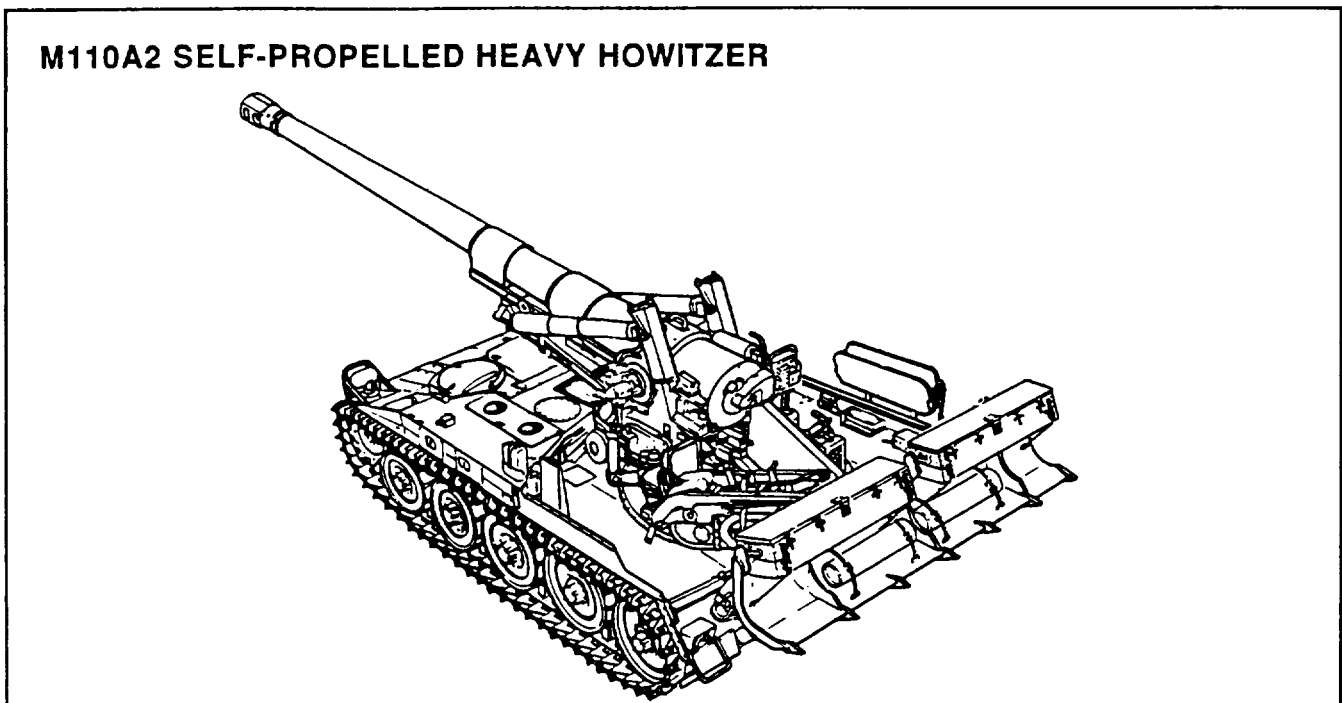
*This manual supersedes hull and related components portions of TM 9-2350-304-20, 23 November 1979, including all changes.

Table of Contents (Cont)

	Page
APPENDIX C. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST.....	C-1
APPENDIX D. ILLUSTRATED LIST OF MANUFACTURED ITEMS.....	D-1
APPENDIX E. TORQUE VALUES.....	E-1
APPENDIX F. HYDRAULIC SYSTEM DESCRIPTION AND SCHEMATIC DIAGRAMS.....	F-1
APPENDIX G. SPECIAL TOOLS AND EQUIPMENT.....	G-1
ALPHABETICAL INDEX.....	Index-1
 HOW TO USE THIS MANUAL	

This manual (TM 9-2350-304-20-1) contains unit level maintenance procedures for the hull and related components of the M11 OA2 Self-Propelled Heavy Howitzer. This manual is to be used in conjunction with TM 9-2350-304-10 and TM 9-2350-304-24P-1. Chapter 1 contains general information; equipment description and data; and principles of operation. Chapter 2 contains information concerning repair parts, special tools, TMDE, and support equipment; and unit level troubleshooting and maintenance procedures.

Be sure to read and understand maintenance instructions before beginning any maintenance task. Also, read and understand information in Chapter 1 and general maintenance procedures on page



**CHAPTER 1
INTRODUCTION**

CHAPTER INDEX

	Page
Corrosion Prevention and Control (CPC).....	1-4
Destruction of Army Materiel to Prevent Enemy Use.....	1-1
Equipment Characteristics, Capabilities, and Features.....	1-5
Equipment Data.....	1-17
Location and Description of Major Components	1-5
Maintenance Forms, Records, and Reports	1-1
Official Nomenclature, Names, and Designations.....	1-2
Preparation for Storage or Shipment.....	1-2
Reporting Equipment Improvement Recommendations (EIR)	1-4
Scope	1-1

Section I. GENERAL INFORMATION

1-1. SCOPE.

- a. *Type of Manual.* Unit level maintenance.
- b. *Model Number and Equipment Name.* M110A2, 8-inch, heavy, self-propelled howitzer.
- c. *Purpose of Equipment.* Transports a long-barrel howitzer and its crew. Travels at convoy speed for artillery support in offensive and defensive combat operations.

1-2. MAINTENANCE FORMS, RECORDS, AND REPORTS. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, The Army Maintenance Management System (TAMMS).

1-3. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE.

a. *Tactical Situations.* Situations may arise in which it is necessary to abandon equipment in the combat zone. All abandoned equipment must be destroyed to prevent its use by the enemy. The destruction of equipment subject to capture or abandonment in the combat zone will be undertaken only upon authority delegated by a division or higher commander.

b. *Plans.*

- (1) Plans for destruction of equipment must be adequate, uniform, and easily carried out in the field.

1-3. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE (CONT).

(2) Destruction must be as complete as the available time, equipment, and personnel will permit. Since complete destruction requires considerable time, priorities must be established so the more essential parts are destroyed first.

(3) The same essential parts must be destroyed on all like units to prevent the enemy from constructing a complete unit from undamaged parts.

(4) Spare parts and accessories must be given the same priority as parts installed on the equipment.

c. *Methods.* To destroy equipment adequately and uniformly, all personnel of the unit must know the plan and priority of destruction and be trained in the methods of destruction.

d. *References.* Read TM 750-244-6 for information on destruction of mechanical equipment. Read TM 750-244-5-1 for information on destruction of ammunition.

1-4. PREPARATION FOR STORAGE OR SHIPMENT. Administrative storage is restricted to 90 days and must not be extended. Refer to page 2-1133 for detailed instructions on administrative storage.

1-5. OFFICIAL NOMENCLATURE, NAMES, AND DESIGNATIONS.

<i>Common Name</i>	<i>Official Nomenclature</i>
Access cover	Radiator drain access cover
Arctic traction kit	Track parts kit
Battery/generator voltmeter	Battery/generator special scale meter
Bearing cone	Hub bearing inner cone and rollers
Bearing unit drive shaft	Mag clutch to bearing unit propeller shaft
Bellcrank	Throttle linkage bellcrank
Brake lever shaft	Straight control shaft
Cable	Wire rope assembly
Diode assembly	Master light switch lead and diode assembly
Drain valve handle	Engine compartment drain valve door handle
Engine oil dipstick	Liquid level
Flame detector switch	Thermostatic switch
Fluid filter hose assembly	Fuel pump to driver's heater hose assembly

<i>Common Name</i>	<i>Official Nomenclature</i>
Fuel filler latch pin	Fuel filler cover latch radiator filler pin
Fuel level transmitter	Fuel sending unit liquid quantity transmitter
Fuel pump connecting hose assembly	Fuel pump to driver's heater hose assembly
Governor control lever	Transmission throttle control lever
Ground strap	Electrical lead
Insulation sleeving	Sleeve insulation or sleeving insulation
Left discharge tube	Elbow to cylinder metal tube assembly
Lever	Throttle pedal lever
Lockout isolation manifold	Shutoff valve manifold
Lockout control valve to spade control metal tube assembly	Metal tube assembly
Manual control lever	Manual control engine shutdown lever
Nonmetallic hose assembly	Surge tank-to-engine manifold nonmetallic hose assembly
Nut lockwasher	Lock bearing nut
Overheat switch	Thermostatic switch
Power plant lifting sling	Beam type sling
Power takeoff drive shaft	To P.T.O. propeller shaft
Pressure equalizing tube	Radiator pressure equalizing metallic tube
Radiator	Engine coolant radiator tank
Reducer to tee lockout system pressure line metal tube assembly	Metal tube assembly
Remover and replacer handle	Hexagon head capscrew
Retainer	Shouldered washer
Right discharge tube	Right cylinder metal tube assembly

1-5. OFFICIAL NOMENCLATURE, NAMES, AND DESIGNATIONS (CONT).

<i>Common Name</i>	<i>Official Nomenclature</i>
Right front fender extension	Right headlamp mud guard front plate assembly
Ring spacer	Vehicular light switch ring spacer
Road wheel	Solid rubber tire and wheel
Stud	Bolt, ribbed neck
Surge tank tube	Radiator-to-surge tank tube assembly
Tee to union lockout system pressure line metal tube assembly	Metal tube assembly
Throttle rod	Rigid connecting link, bellcrank-to-governor throttle
Track shoe link pin	Threaded-end rod
Tube	Nonmetallic hose
Tube	Bent metallic tube
Union to union lockout system pressure line metal tube assembly	Metal tube assembly
Washer	Ring spacer
Warning light	Engine and transmission warning light
Warning light	Generator charge indicator light

1-6. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR). If your M110A2 Howitzer needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF Form 368 (Product Quality Deficiency Report). Mail it to us at Commander, US Army Tank-Automotive Command, ATTN: AMSTA-Q, Warren, MI 48397-5000. We will send you a reply.

1-7. CORROSION PREVENTION AND CONTROL (CPC).

a. Corrosion Prevention and Control (CPC) of Army materiel is a continuing concern. It is important that any corrosion problems with this item be reported so that the problem can be corrected and improvements can be made to prevent the problem in the future.

b. While corrosion is typically associated with rusting of metals, it can also include deterioration of other materials such as rubber and plastic. Unusual cracking, softening, swelling, or breaking of these materials may be a corrosion problem.

c. If a corrosion problem is identified, it can be reported using SF Form 368, Product Quality Deficiency Report. Use of key words such as "corrosion," "rust," "deterioration," or "cracking" will assure that the information is identified as a CPC problem.

d. The form should be submitted to: Commander, US Army Tank-Automotive Command, ATTN: AMSTA-Q/Customer Feedback Center, Warren, MI 48397-5000.

Section II. EQUIPMENT DESCRIPTION AND DATA

1-8. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.

a. *Purpose.* The M110A2 Howitzer is a weapon that defends against close-in or long-range ground targets.

b. *Capabilities and Features.*



Do not ford water which exceeds 42.0 in. (106.7 cm) in depth. Check for soft mud or sandy bottoms.

(1) The M110A2 Howitzer is an unarmored, full-tracked, heavy, self-propelled, 8-in. (203-mm) howitzer. This diesel-powered artillery piece is highly mobile, maneuverable, and may be air transported. The vehicle is capable of long-range, high-speed operation on improved roads. It can traverse rough terrain, muddy or marshy ground, sand, and snow or ice. The M11 0A2 Howitzer can ford streams up to 42.0 in. (106.7 cm) deep.

(2) A hydraulic suspension lockout system and spade assembly help provide a stable platform for firing the cannon. The cannon elevating and traversing mechanisms and the projectile loader and rammer are also hydraulically powered. However, they may be manually operated in case of a power failure.

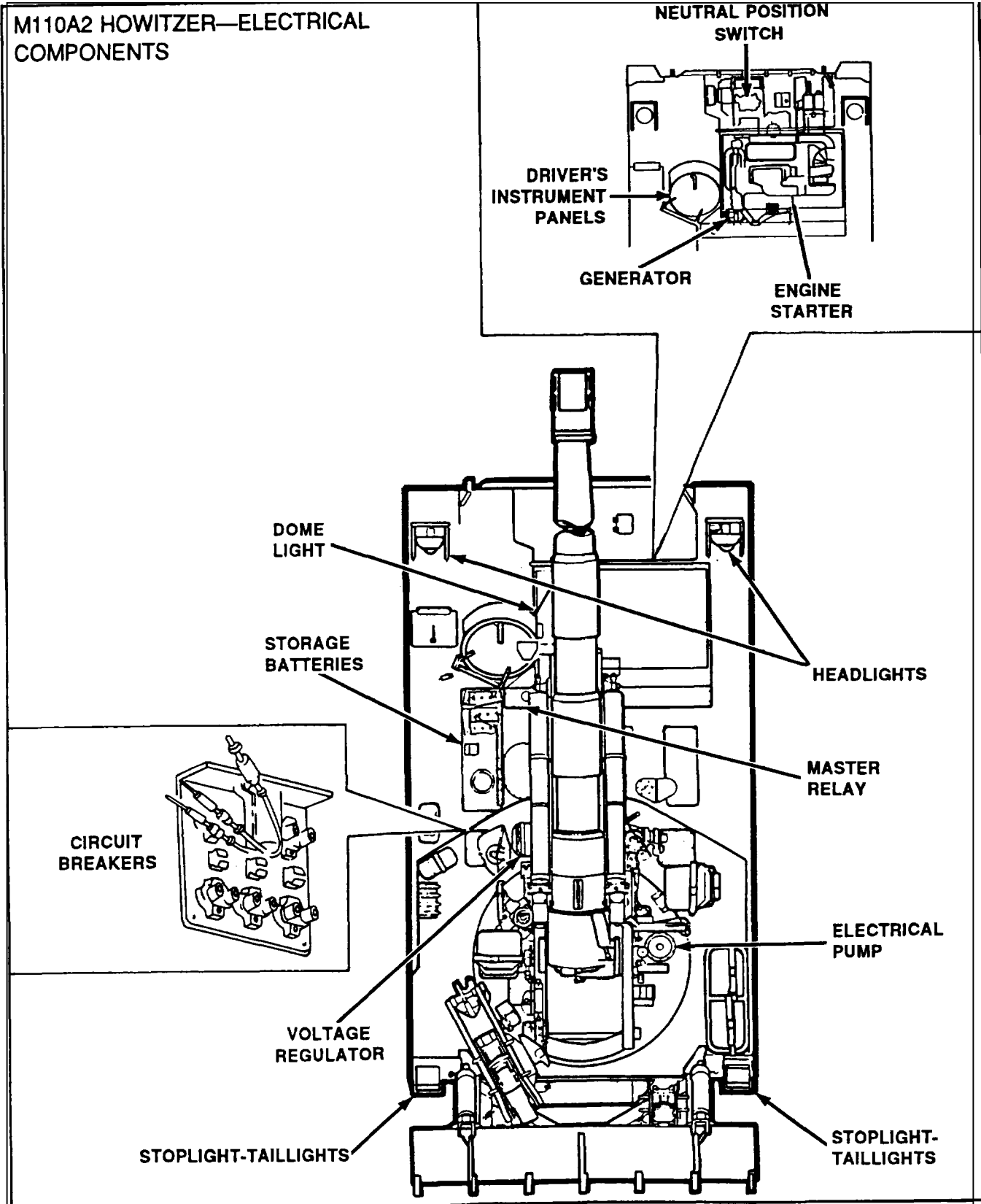
(3) The turret can traverse 30 degrees (533 mils) right or left of vehicle centerline and the cannon can elevate to 65 degrees (1156 mils) above horizontal position.

1-9. **LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.** Refer to TM 9-2350-304-10 or TM 9-2350-304-20-2 for location and description of major components not listed below.

ELECTRICAL COMPONENTS

Electrical power is provided by a 24-volt, 300-ampere generator and four storage batteries. Output of the generator is controlled by a solid state voltage regulator. A master relay regulates battery power. An electric pump powers the hydraulic system. Electrical components are controlled by switches located in the driver's compartment. Leads and wiring harnesses distribute current to all electrical components. A slave receptacle allows connection of the vehicle electrical system to another power source. Electrical components are connected by wiring harnesses, electrical leads, and circuit breakers.

1-9. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (CONT).



- a. *Generator.* The 300-ampere, 24-volt dc generator operates whenever the engine is running. It provides electrical power to recharge the batteries and operate the vehicle.
- b. *Batteries.* Four 12-volt batteries are connected in series-parallel to produce 24 volts, and to provide electrical power to start and operate the vehicle.
- c. *Master relay.* The batteries transmit power through contacts in the master relay. When the master switch is on, the master relay is energized and power is available to all circuits in the vehicle.
- d. *Voltage regulator.* The voltage regulator controls the output voltage and current of the generator. It is a solid state unit and is not adjustable. Circuit breakers protect the generator from electrical overload.
- e. *Electric pump.* Hydraulic pressure is provided by an electric pump.
- f. *Starter and solenoid.* The starter is a direct cranking, nonreversible, 24-volt unit. It is actuated by a two-coil starter motor solenoid mounted on the starter.
- g. *Neutral position switch and starter control relay.* The neutral position switch closes when the transmission shift lever is in neutral position. This completes the circuit for the starter control relay to supply battery power to the two starter windings when the start switch is pressed.
- h. *Driver's instrument and switch panels.* The instrument and switch panels contain the switches, indicator lights, and gages required for operation of the vehicle. Refer to TM 9-2350-304-10 for description of the separate items on each panel.
- i. *Vehicle lighting.* The service and infrared headlights are set for high or low beam by the dimmer switch. The two headlights are combination units. Each headlight consists of an incandescent driving lamp, infrared driving lamp, blackout driving lamp, and blackout marker lamp. The taillights are combination units. The right taillight consists of a blackout stoplight and marker light. The left taillight consists of a service taillight, service stoplight, and blackout marker light. The dome light is a standard combination blackout and service light.
- j. *Warning switches and transmitters.* When the brake foot pedal is depressed, the brake warning sensitive switch roller guide is released, causing the switch contacts to close. Closing the switch contacts causes the service stoplight or blackout stoplight to light.
- (1) The engine low oil pressure warning switch opens at 9 to 13 psi (62 to 90 kPa) on increasing pressure. When the switch is closed, a circuit is completed to light the warning light and cause the warning horn to sound.
- (2) The engine oil pressure transmitter is a variable resistance unit. It gives a reading on the engine oil pressure indicator.
- (3) The engine oil temperature warning switch closes at 300 °F to 310 °F (149 °C to 155 °C) on increasing temperature. When the switch is closed, a circuit is completed that causes the warning light to light and the warning horn to sound.
- (4) The transmission oil temperature transmitter is a variable resistance unit. It gives a reading on the transmission oil temperature indicator.

1-9. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (CONT).

(5) The transmission oil pressure transmitter is a variable resistance unit. It gives a reading on the transmission oil pressure indicator.

(6) The fuel level transmitter is a sparkproof, float-operated variable resistance unit. It gives a reading on the fuel level indicator.

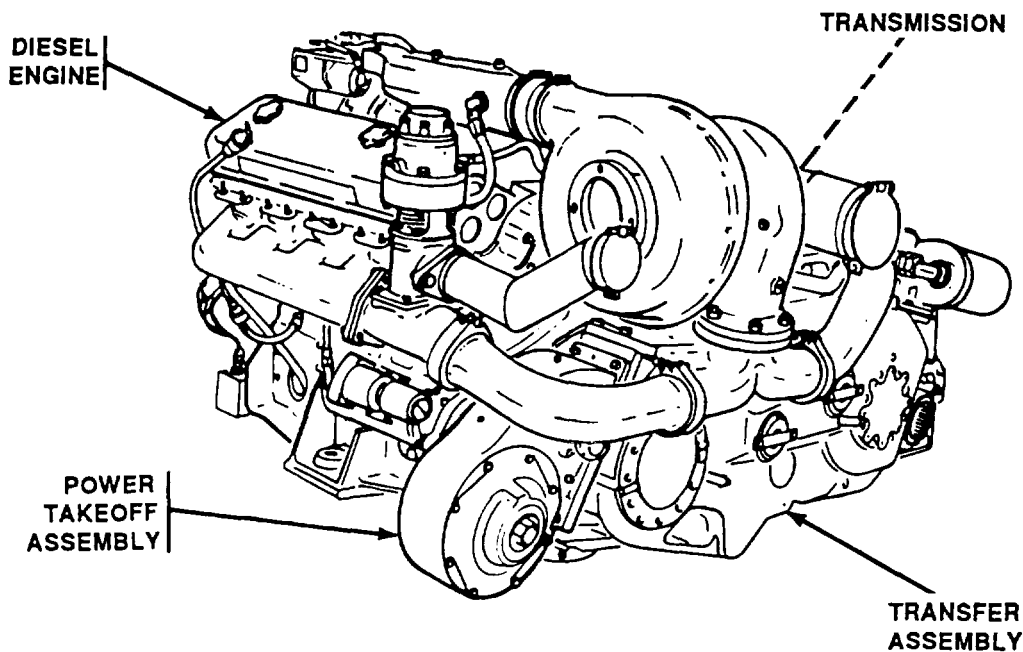
NOTE

This illustration cannot show all wiring, electrical leads, and circuit breakers on the M110A2 Howitzer. For complete vehicle schematic diagrams, refer to FO-1 and FO-2.

k. *Wiring.* Vehicle components are connected with single wire leads or multiple lead wiring harnesses. All wiring is standard ordnance waterproof cable. Connections are made by waterproof, rubber, single wire quick-disconnect connectors, plug-receptacle connectors, or solderless waterproof terminals.

l. *Leads.* All leads are identified by a marker band attached to the wire and stamped with a circuit number. The socket and pin contacts of the connectors are identified by upper case letters of the alphabet, stamped on the connector insert.

m. *Circuit breakers.* Thermal break, automatic reset, 15A and 20A circuit breakers protect the vehicle components and circuits.

EXHAUST SYSTEM

a. *Engine Model 7083-7395.* Engine exhaust gas is routed through two exhaust manifolds and two exhaust ducts to the turbocharger. The exhaust gas passes through the turbocharger (driving it) and out through the exhaust elbow.

b. *Engine Model 7083-7398.* Exhaust gases are discharged through two exhaust manifolds and ducts to the turbocharger. Gases from the right manifold discharge into the turbocharger turbine. Gases from the left manifold discharge through the turbocharger regulator in the turbocharger.

(1) Turbocharger regulator. The regulator is controlled by the pressure difference between intake and outlet air of the turbocharger blower section. When the outlet pressure is greater than the inlet pressure, the regulator vents part of the exhaust gases through its exhaust pipe to bypass the turbocharger. This reduces the turbocharger speed and output of air, thus preventing turbocharger overspeed.

(2) Exhaust elbow. Exhaust gases are expelled from the turbocharger through an exhaust elbow.

FIRE EXTINGUISHER SYSTEM

The fixed fire extinguisher system is a carbon dioxide gas system with two release handles. When either release handle is pulled, two cylinders discharge carbon dioxide gas through nozzles over the engine and into the powerplant compartment.

FUEL SYSTEM

The engine takes fuel from the cell to the low-pressure fuel filter on the engine. Fuel flows from the low-pressure fuel filter to the engine fuel pump. The fuel pump delivers fuel through a high-pressure fuel filter to the injectors at high pressure. Excess fuel is used to cool the injectors and is returned to the fuel cell through a return line. Fuel that leaks past moving parts in the engine is collected in the powerplant reservoir.

a. *Fuel cells.* A steel fuel cell is part of the hull. It is lined with a two-piece fabric fuel cell filled with foam filler blocks. The fabric fuel cell prevents fuel leakage. The foam filler blocks prevent sloshing of fuel in the cell.

b. *Air box pump and fuel prime solenoid.* The air box pump and fuel prime solenoid valve, when energized, allows the pump to draw fuel from the low-pressure filter and force it through the high-pressure filter to the injectors. This prime and purge system forces out any air trapped in the high-pressure fuel filter and lines.