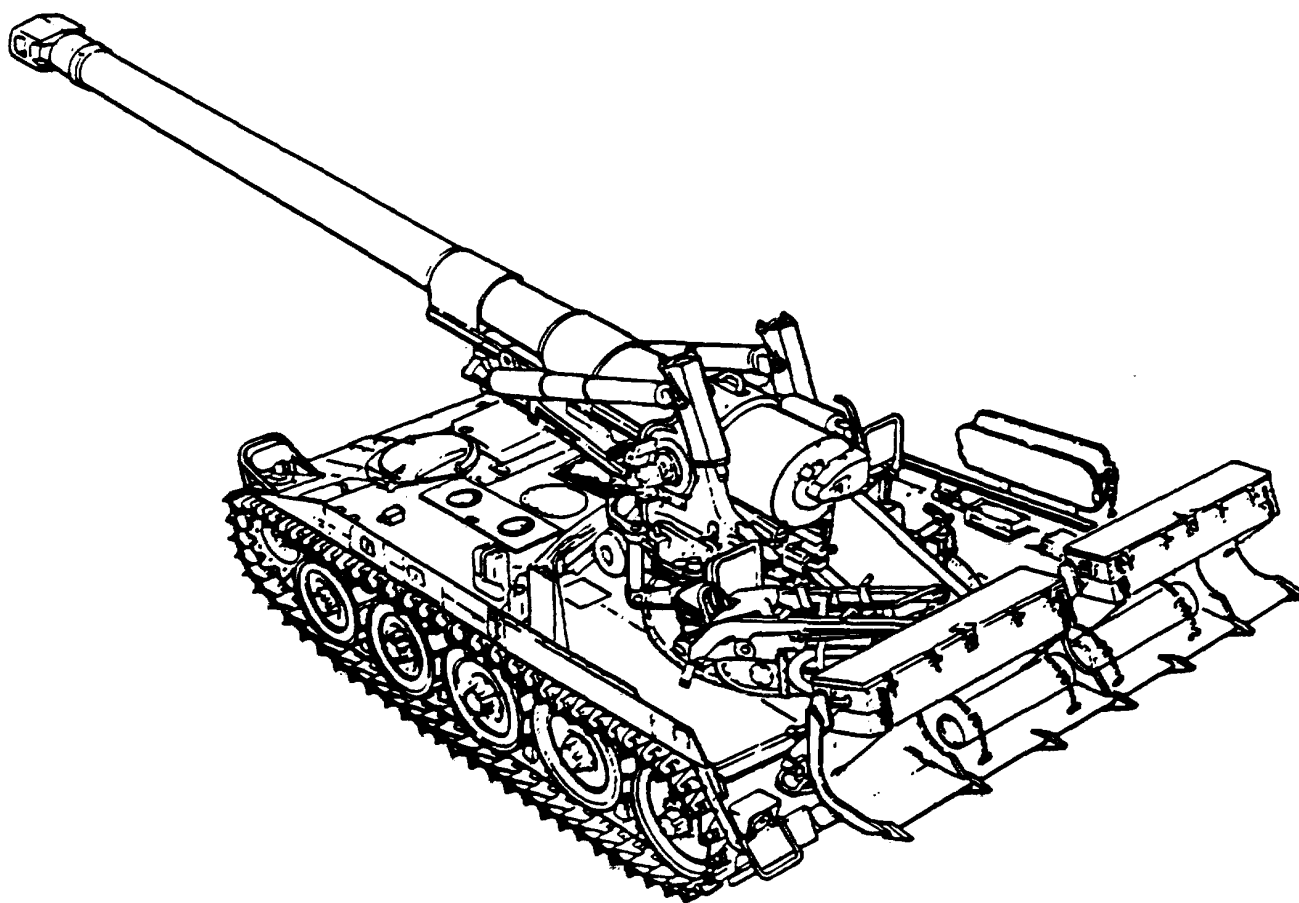


**TECHNICAL MANUAL
DIRECT SUPPORT AND GENERAL
SUPPORT MAINTENANCE MANUAL**

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

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GENERAL SUPPORT MAINTENANCE PROCEDURES	PAGE 3-5	



*This manual supersedes TM9-2350-304-34-1 dated 20 June 1980.

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

TECHNICAL MANUAL

No. 9-2350-304-34-1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington D.C., 24 May 1994

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

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

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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 48597-5000. A reply will be furnished to you.

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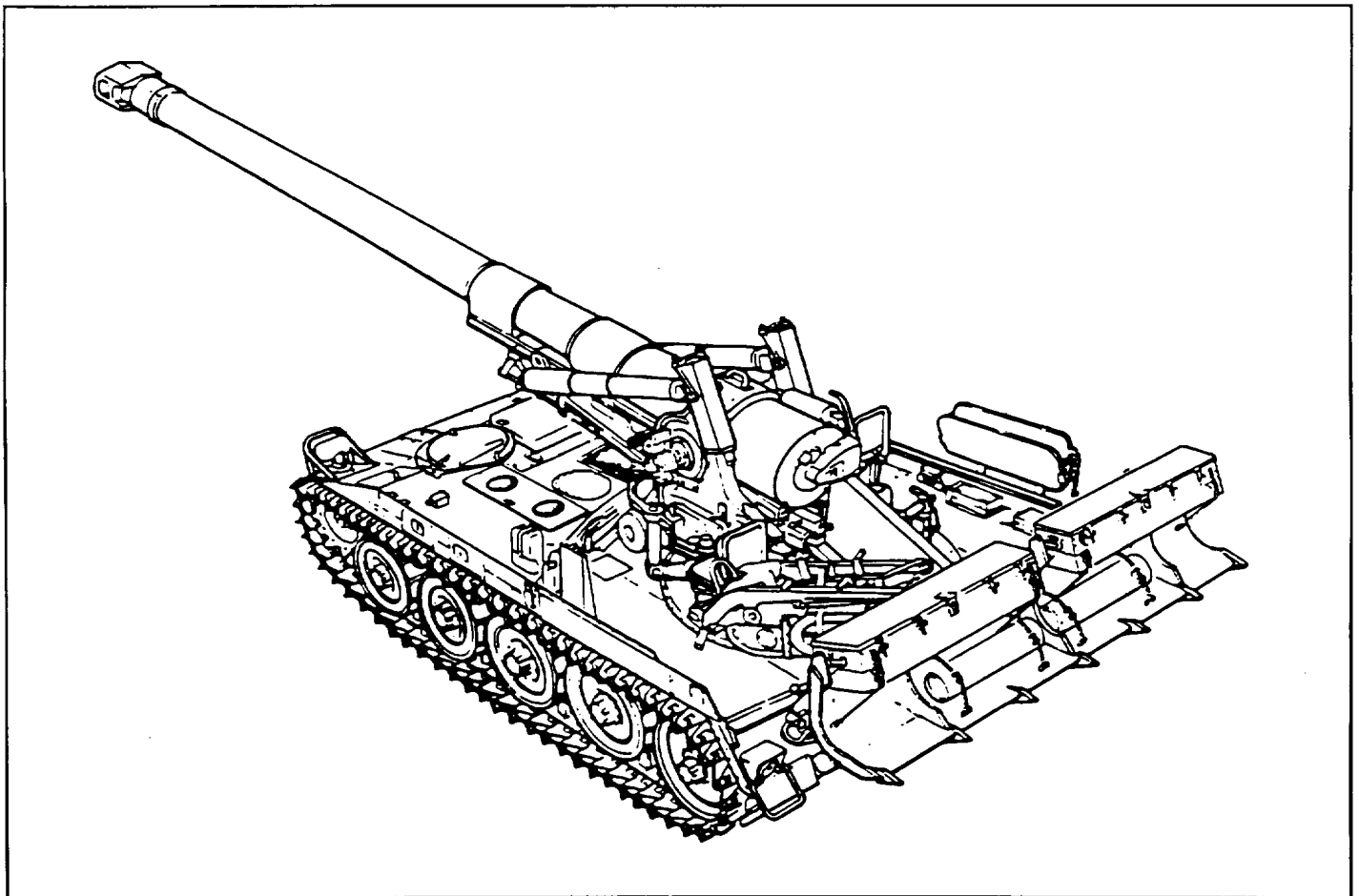
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HOW TO USE THIS MANUAL

This manual (TM 9-2350-304-34-1) contains direct support and general support maintenance procedures for the hull and related components of the M110 A2 Self-Propelled Howitzer. This manual is to be used in conjunction with TM 9-2350-304-20-1 and TM 9-2340-304-24P-1. Chapter 1 contains general information; information concerning repair parts, special tools, TMDE, and support equipment; and equipment description and data. Chapter 2 contains direct support troubleshooting and direct support maintenance procedures. Chapter 3 contains general support maintenance procedures and information concerning preparation for storage or shipment.

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 2-26 before beginning any maintenance task.

M110A2 8-INCH, HEAVY, SELF-PROPELLED HOWITZER



CHAPTER 1
INTRODUCTION

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Section I. GENERAL INFORMATION

1-1. SCOPE.

- a. *Type of Manual:* Direct support and general support maintenance.
- b. *Model Number and Equipment Name:* M110A2, 8-inch, heavy, self-propelled howitzer.
- c. *Purpose of Equipment:* M1 10A2, 8-inch, heavy, self-propelled howitzer transports a long-barrel howitzer and its crew and travels at convoy speed for artillery support in both 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 TM 9-2350-304-20-1 for detailed instructions on administrative storage.

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

Nomenclature Cross-Reference List.

<i>Common Name</i>	<i>Official Nomenclature</i>
Air duct clamp	Air regulator hose lamp
Air line	Air regulator hose assembly
Air valve	Nonexpansive rod
Bracket	Heater bracket
Ceramic rod	Headless straight pin
Combustion air blower	Air blower motor
direct current motor	
Connector	Pipe-to-tube adapter
Connector	Retaining plate
Drain plug	Machine thread plug
Electrical connector	Electrical lead assembly
Final drive puller	Hexagon head capscrew
Fitting	Pipe-to-tube adapter
Fuel line	Fuel tube assembly
Globe angle valve	Accumulator valve
Ground terminal	Terminal lug
Left fuel cell	Left-hand fuel cell
Lockwire	Nonelectrical wire
Nameplate	Identification plate
O-ring	Preformed packing
Resistor	Fixed wire resistor
Right fuel cell	Engine fuel tank
Switch	Thermostatic flame detector switch
Switch	Thermostatic overheat switch
Tachometer cable	Flexible shaft assembly

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 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. General. 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. Corrosion. 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. Reporting. If a corrosion problem is identified, it can be reported using SF 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. Forms. 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 M11 0A2 Howitzer is a weapon that defends against close-in or long-range ground targets.
- b. Capabilities and Features.**

CAUTION

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 9-2350-304-20-1

1-10. EQUIPMENT DATA. Necessary equipment data not furnished in this manual can be found in TM 9-2350-304-10 or TM 9-2350-304-20-1.

a. Engine.

- (1) Type Two-cycle, V-8, turbocharged
compression-ignition, diesel, liquid cooled
- (2) Model 8V71T
- (3) Weight, dry, as installed..... 2442 lb (1108 kg)
- (4) Number of cylinders 8
- (5) Displacement 568 cu in. (9308 cm³)
- (6) Bore 4.25 in. (10.80 cm)
- (7) Stroke..... 5.0 in. (12.7 cm)
- (8) Compression ratio..... 17:1
- (9) Maximum, gross brake horsepower (at 2300 rpm)..... 405 (302 kW)
- (10) Maximum, net brake horsepower 345 (257 kW)
- (11) Maximum, rpm (governed):
 - (a) No load 2450 rpm
 - (b) Full load..... 2300 rpm
- (12) Idle speed 550 to 600 rpm
- (13) Crankshaft rotation (viewed from
front of engine)..... Clockwise
- (14) Firing order..... 1 L-3R-3L-4R-4L-2R-2L-1 R

b. Power Takeoff.

- (1) Dimensions 19.00 in. lg x 10.75 in. h x 8.50 in. w
(48.26 cm lg x 27.30 cm h x 21.59 cm w)
- (2) Engine rpm to power takeoff output ratio..... 1.32:1

c. Final Drives.

- (1) Type Front drive sprocket
- (2) Final drive ratio 5.35:1
- (3) Weight, dry:
 - (a) Left..... 718 lb (326 kg)
 - (b) Right..... 633 lb (287 kg)

d. Transmission.

- (1) Type Crossdrive, torque converter,
planetary gear, all-torque shifting
- (2) Model XTG-411-2A
- (3) Transmission Hydraulic and mechanical
- (4) Weight, dry as installed..... 2390 lb (1084 kg)
- (5) Overall length..... 61.286 in. (155.666 cm)
- (6) Overall height..... 26.07 in. (66.22 cm)
- (7) Overall width (between output drive-to-hull
mounting faces) 83 in. (211 cm)
- (8) Torque converter type..... Hydraulic, single stage, polyphase,
(three element, with automatic lockup clutch)

- (9) Clutches Multiplate wet, hydraulically applied
- (10) Range selector Four forward speeds, two reverse speeds
- (11) Oil screen Reusable screen disk-type or disposable element
- (12) Lubrication pressure 18 to 45 psi (124 to 310 kPa)
at 1835 to 1900 engine rpm
- (13) Gear ratios:
 - (a) 1st 4.69:1
 - (b) 2nd 3.18:1
 - (c) 3rd 1.59:1
 - (d) 4th 0.794:1
 - (e) R41 5.60:1
 - (f) R2 3.79:1
- (14) Maximum rating:
 - (a) Input torque 880 ft-lb (1193 N-m)
 - (b) Input power (net) 360 hp (269 kW)
 - (c) Input speed 2300 rpm
- (15) Steering system:
 - (a) Clutches applied by Oil pressure
 - (b) Clutches released by Spring pressure
 - (c) Steering brakes applied by Oil pressure
 - (d) Brakes (service and parking) Multiplate, wet,
mechanically applied, sintered bronze on steel
 - (e) Oil pumps 5 pumps
 - (f) Type of pump Gear, positive displacement

e. *Auxiliary Drive Assembly.*

- (1) Weight 191 lb (87 kg)
- (2) Input to generator output shaft ratio 1:3.48
- (3) Input fan sheave output shaft ratio 1:0.69
- (4) Magnetic clutch:
 - (a) Voltage 24 V dc
 - (b) Ampere at 25 °C (77 °F) 4.76
 - (c) Resistance at 25 °C (77 °F) 5.04 ohms

f. *Radiators.*

- (1) Dimensions 39.25 in. h x 24.00 in. w x 5.00 in. deep
(99.70 cm h x 60.96 cm w x 12.70 cm deep)
- (2) Coolant flow (each radiator) 70 gpm (265 l/min)
- (3) Top tank temperature 210 °F (99 °C)
- (4) Weight (each) 73 lb (33 kg)

1-10. EQUIPMENT DATA (CONT).

g. Coolant Fan.

- (1) Design and construction data:
 - (a) Outside diameter 27 in. (68.6 cm) .w
 - (b) Overall length(38.1 cm)
 - (c) Weight 120 lb (53.4 kg)
- (2) Direction of rotation (viewed from pulley end)Clockwise
- (3) Direction of air flowThrough fan, into engine compartment
- (4) Number of mounting holes..... 16
- (5) Bolt circle diameter25.75 in. (65.41 cm)

h. Hydraulic Rotary Pump.

- (1) Typegear
- (2) Rate output pressure2000 psi (13,790 kPa)
- (3) Rated flow at 2000 psi23.5 gpm (88 /min)
- (4) Maximum operating rpm2500 rpm
- (5) Displacement3.02 cu In./rev (49.5 cm3/rev)

i. Lockout Cylinder.

- (1) Length:
 - (a) Retracted25.94 in. (65.89 cm)
 - (b) Extended35.47 in. (90.09 cm)
- (2) Outside diameter6.00 in. (15.24 cm)
- (3) Weight, dry..... 82 lb (37 kg)
- (4) Operating pressure150 psi (1034 kPa)

**CHAPTER 2
DIRECT SUPPORT MAINTENANCE INSTRUCTIONS**

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Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

2-1. COMMON TOOLS AND EQUIPMENT. For authorized common tools and equipment, refer to the Modified Table of Organization (MTOE) applicable to your unit.

202-24P, and appendix B of TM 9-2350-304-20-1. For an illustrated list of special tools and equipment, refer to appendix E of this manual.

2-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT. Tools, special tools, and test equipment necessary to maintain the M110A2 self-propelled howitzer are listed in TM 9-2350-304-24P-1, TM 9-2815-

2-3. REPAIR PARTS. Repair parts are listed in TM 9-2350-304-24P-1 and TM 9-2815-202-24P, covering unit, direct support, general support, and depot maintenance for this equipment.

Section II. DIRECT SUPPORT TROUBLESHOOTING

2-4. TROUBLESHOOTING INFORMATION.

a. The symptom index can be used as a quick guide to troubleshooting. Common malfunctions are listed in alphabetical order under each major assembly, which appear in MAC order, with a page number reference to the troubleshooting table where a test or inspection and corrective action are provided.

b. The direct support troubleshooting table lists the malfunction, the test or inspection indicating the malfunction, and the necessary corrective action.

c. If the malfunction still exists after all listed direct support maintenance corrective actions have been performed, notify general support maintenance.

d. This manual cannot list all malfunctions that may occur, nor all tests or Inspections and corrective actions.

If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

DIRECT SUPPORT SYMPTOM INDEX

	Troubleshooting Procedure Page
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Engine cranks slowly but does not start.....	2-4
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Engine labors, runs unevenly, smokes too much, lacks power, uses too much oil, has low oil pressure, has high oil pressure, uses too much fuel, or overheats	2-5
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2-4. TROUBLESHOOTING INFORMATION (CONT).

Table 2-1. DIRECT SUPPORT TROUBLESHOOTING

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
ENGINE		
1. STARTER FAILS TO CRANK ENGINE WHEN START SWITCH IS PRESSED.		
	<i>Step 1.</i> Check batteries for low charge.	Charge batteries, refer to TM 9-6140-200-14; or replace batteries, refer to TM 9-2350-304-20-1.
	<i>Step 2.</i> Check for proper setting of neutral position switch.	Adjust neutral position switch. Refer to TM 9-2350-304-20-1.
	<i>Step 3.</i> Check if MASTER IND light is operating.	Set MASTER and INST switches ON. If MASTER IND light is off, troubleshoot master relay and battery power circuits. Refer to TM 9-2350-304-20-1.
	<i>Step 4.</i> Check if starter engages engine.	
	a. If starter does not engage engine, troubleshoot starter circuit and starter. Refer to TM 9-2350-304-20-1.	
	b. If starter does engage engine, but does not crank, troubleshoot engine. Refer to TM 9-2815-202-34.	
2. ENGINE CRANKS SLOWLY BUT DOES NOT START.		
	<i>Step 1.</i> Check for bad connections on battery terminals and grounds.	
	a. Clean and tighten terminal clamps and nuts.	
	b. Tighten ground connections.	
	<i>Step 2.</i> Check batteries for low charge.	Charge batteries, refer to TM 9-6140-200-14; or replace batteries, refer to TM 9-2350-304-20-1.
	<i>Step 3.</i> Check for loose connections on starter. Tighten loose connections. Refer to TM 9-2350-304-20-1.	

Table 2-1. DIRECT SUPPORT TROUBLESHOOTING (CONT)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
3. ENGINE CRANKS BUT DOES NOT START.	Step 1. Check fuel level indicator for fuel level.	Fill fabric fuel cell. Refer to TM 9-2350-304-10.
	Step 2. Check engine shutdown handle.	Push engine shutdown handle against hull.
	Step 3. Check for water in primary and secondary fuel filters.	Drain water from fuel filters, refer to TM 9-2350-304-10; or replace dirty fuel filters, refer to TM 9-2350-304-20-1.
	Step 4. Check operation of air box heater by feeling air box heater on top of engine.	a. If air box heater is not warm, troubleshoot air box heater. Refer to TM 9-2350-304-20-1. b. If air box heater is warm, troubleshoot engine fuel system. Refer to TM 9-2815-202-34.
	Step 5. Check for faulty engine parts.	Troubleshoot engine fuel system and check engine compression. Refer to TM 9-2815-202-34.
4. ENGINE LABORS, RUNS UNEVENLY, SMOKES TOO MUCH, LACKS POWER, USES TOO MUCH OIL, HAS LOW OIL PRESSURE, HAS HIGH OIL PRESSURE, USES TOO MUCH FUEL, OR OVERHEATS.	Check for faulty engine systems.	Troubleshoot engine. Refer to TM 9-2815-202-34.
5. ENGINE IS NOT GETTING ENOUGH AIR.	Step 1. Check for clogged or dirty air cleaner filter elements.	Clean clogged or dirty air cleaner filter elements, refer to TM 9-2350-304-10; or replace air cleaner filter elements and seal assemblies, refer to TM 9-2350-304-20-1.