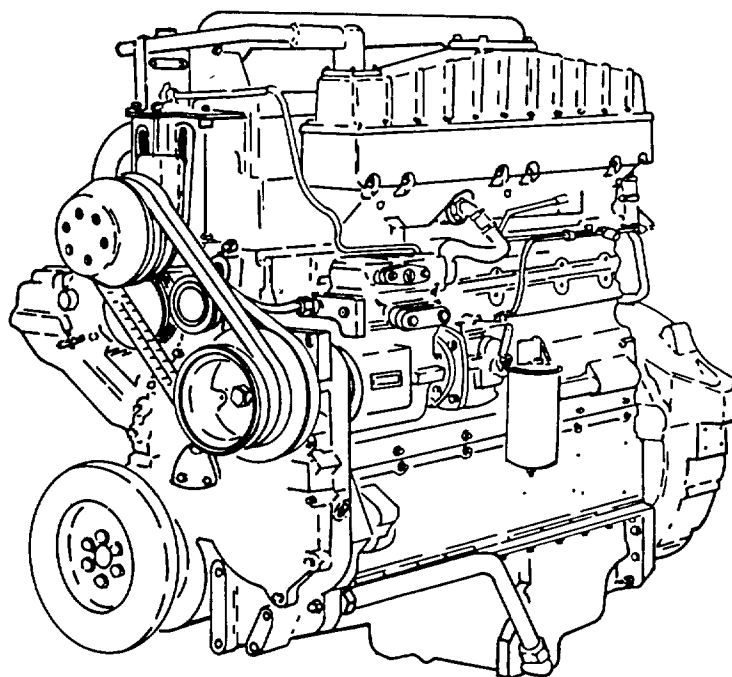


This copy is a reprint which includes current pages from Change i.

**DIRECT SUPPORT AND GENERAL SUPPORT  
MAINTENANCE MANUAL  
FOR**



**ENGINE, DIESEL, 6 CYLINDER  
INLINE, TURBOCHARGED,  
CUMMINS MODEL NTC-400 BC2  
NSN 2815-01-156-6210**

**HEADQUARTERS, DEPARTMENT OF THE ARMY**

**SEPTEMBER 1985**

CHANGE  
NO. 1

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
WASHINGTON, D.C.  
10 APRIL 1987

Direct Support and General Support  
Maintenance Manual

**ENGINE, DIESEL, 6 CYLINDER  
INLINE, TURBOCHARGED  
CUMMINS MODEL NTC-400 BC 2**

(2815-01-156-6210)

TM 9-2815-226-34, September 1985 is changed as follows:

1. Remove old pages and insert new pages as indicated below.
2. New or changed material is indicated by a vertical bar in the margin of the page.
3. Added or revised illustrations are indicated by a vertical bar adjacent to the illustration identification number.
4. The purpose of Change 1 to this manual is to identify configuration differences between the 1980, 1982, and 1984 models. Model designators can be determined by viewing the data plate on your truck chassis.

Remove Pages	Insert Pages	Remove Pages	Insert Pages
i	i	3-139 and 3-140	3-139 and 3-140
ii	ii	3-151 and 3-152	3-151 and 3-152
1-1 thru 1-4	1-1 thru 1-4	3-155 and 3-156	3-155 and 3-156
1-5/(1-6 blank)	1-5 and 1-6	3-177 thru 3-180	3-177 thru 3-180
3-29 thru 3-34	3-29 and 3-34	INDEX-1 and INDEX-2	INDEX-1 and INDEX-2
3-37 and 3-38	3-37 and 3-38		
3-53 thru 3-56	3-53 thru 3-56		
3-65 thru 3-68	3-65 thru 3-68.1/ (3-68.2 blank)		
3-133 and 3-134	3-133 and 3-134		

File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:

Official:

JOHN A. WICKHAM, JR.  
*General, United States Army*  
*Chief of Staff*

R.L. DILWORTH  
*Brigadier General, United States Army*  
*The Adjutant General*

Distribution:

To be distributed in accordance with DA Form 12-38 (block 0128), direct and general support maintenance requirements for Truck Chassis, Direct Support Section, RC25-64.

## **WARNING**

### **EXHAUST FUMES**

**The following precautions must be observed to ensure the safety of personnel when the engine of any vehicle is operated:**

1. DO NOT operate personnel heater or engine of vehicle in a closed place unless the place has a lot of moving air.
2. DO NOT idle engine for long periods without ventilator blower operation. If tactical situation permits, open hatches.
3. DO NOT drive any vehicle with inspection plates, cover plates, or engine compartment doors removed unless necessary for maintenance purposes.
4. BE ALERT at all times during vehicle operation for exhaust odors and exposure symptoms. If either are present, IMMEDIATELY VENTILATE personnel compartment. If symptoms persist, remove affected crew to fresh air; keep warm; DO NOT PERMIT PHYSICAL EXERCISE; if necessary, give artificial respiration and get immediate medical attention.
5. BE AWARE; neither the gas particulate filter unit nor the field protection mask for nuclear-biological-chemical protection will protect you from carbon monoxide poisoning.

## **WARNING**

### **COMPRESSED AIR**

**Compressed air used for cleaning purposes will not exceed 30 PSI (207 KPA). Use only with effective chip guarding and personal protective equipment (goggles, shield, gloves, etc.).**

## **WARNING**

### **FIRE AND EXPLOSION**

Do not use gasoline for cleaning or as fuel.

Do not get battery electrolyte on your skin, clothing, or in your eyes. It is an acid which can cause injury. Keep all sparks and flames away from batteries. The battery gas is explosive.

When disconnecting battery terminals, always disconnect the ground terminal first.

When reconnecting battery terminals, always connect the ground terminal last.

Methyl alcohol is highly flammable and poisonous, and can be absorbed through the skin. Do not drink or breathe it. If you spill any on your skin, wash it off immediately with water. Keep it away from sparks or flames.

Ether quick-start is explosive and poisonous. Do not permit canisters to be subjected to excessive heat. Do not attempt to start vehicle if ether line to engine is broken or disconnected.

When filling fuel tank with diesel fuel, be sure hose nozzle on container contacts filler tube on fuel tank to carry off static electricity. Do not smoke, permit open flame or uncovered battery compartments while you are servicing the diesel fuel system.

Dry cleaning solvent P-D-680 is toxic and flammable. Wear protective goggles and gloves and use only in well ventilated area. Avoid contact with skin, eyes, and clothes, and do not breathe vapors. Do not use near open flame or excessive heat.

## **WARNING**

### **EXHAUST PIPE AND MUFFLER**

During normal operation, the exhaust pipe and muffler can become very hot. Do not touch these components with your bare hands.

**WARNING**

**ENGINE COOLANT**

Take extreme care when removing engine coolant tank fill cap if temperature gage reads above 195°F (91°C), to prevent burns or serious injury.

**WARNING**

**JACKING UP TRUCK**

Hydraulic jack is intended for lifting the truck, not for supporting the vehicle when performing maintenance. To prevent serious injury, do not get under truck unless it is properly supported with blocks or jack stands.

**WARNING**

**COOLING FAN**

When working in engine compartment with the engine running, stay clear of the cooling fan. The fan may engage automatically at any time and can cause serious injury.

**WARNING**

**HOISTING TRUCK**

Direct personnel to stand clear during hoisting operation. Failure to do this may cause injury to personnel.

**DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL  
ENGINE, DIESEL, 6 CYLINDER INLINE, TURBOCHARGED,  
CUMMINS MODEL NTC-400 BC2****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 directly to: Commander, US Army Tank-Automotive command, ATTN: AMSTA-MBS, Warren, MI 48397-5000. A reply will be furnished to you.

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## CHAPTER 1

### INTRODUCTION

#### Section I. GENERAL INFORMATION

##### 1-1. SCOPE.

- a. Type of Manual: Direct Support and General Support Maintenance.
- b. Model Number and Equipment Name: Cummins Model NTC-400 BC2, Six-Cylinder Inline, Turbocharged Diesel Engine.
- c. Purpose of Equipment: Engine for Truck Chassis, Direct Support Section, Topographic Support System (TSS).

**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 MATERIAL TO PREVENT ENEMY USE.** Procedures outlined in TM 750-244-6 (Procedures for Destruction of Tank-Automotive Equipment to Prevent Enemy Use) are applicable to this equipment.

**1-4. PREPARATION FOR STORAGE OR SHIPMENT.** Instructions concerning storage or shipment of engine are found in Chapter 3, Section XXXIII of this manual.

**1-5. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR).** EIR can and must be submitted by anyone who is aware of an unsatisfactory condition with the equipment design or use. It is not necessary to show a new design or list a better way to perform a procedure. Just simply tell why the design is unfavorable or why a procedure is difficult. EIR may be submitted on SF 368 (Quality Deficiency Report). Mail directly to: Commander, U.S. Army Tank - Automotive Command, ATTN: AMSTA-QR, Warren, Michigan 48397-5000. A reply will be furnished to you.

## Section II. EQUIPMENT DESCRIPTION AND DATA

**1-6. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.** The following information describes engine characteristics and features:

Camshaft: 2-1/2 inch diameter gear driven camshaft which controls all valve and injector movement. Made of induction hardened alloy steel. Camshaft followers are roller type.

Connecting Rods: Drop forged, rifle drilled for pressure lubrication.

Crankshaft: High tensile strength steel forging. Bearing journals and fillets induction hardened. Fully counterweighted.

Cylinder Block: Alloy cast iron with removable, wet liners.

Cylinder Head: Each head serves two cylinders. Drilled fuel supply and return lines. High temperature inserts on exhaust valve seats.

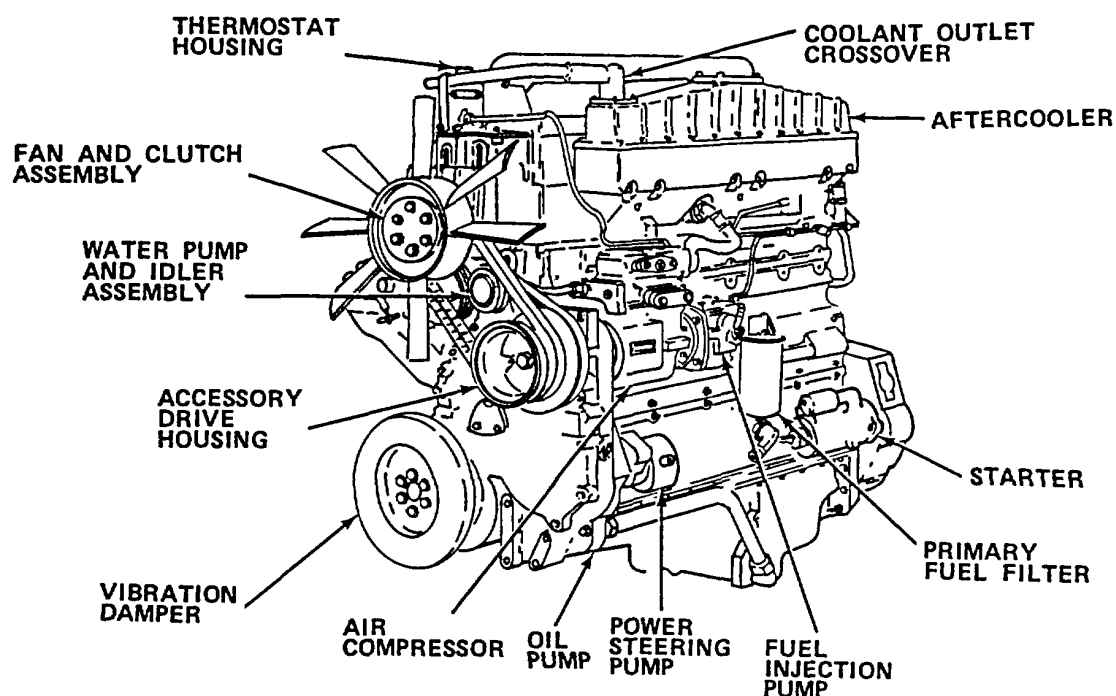
Fuel System: Integral flyweight type governor.

Injectors: Camshaft actuated top stop type.

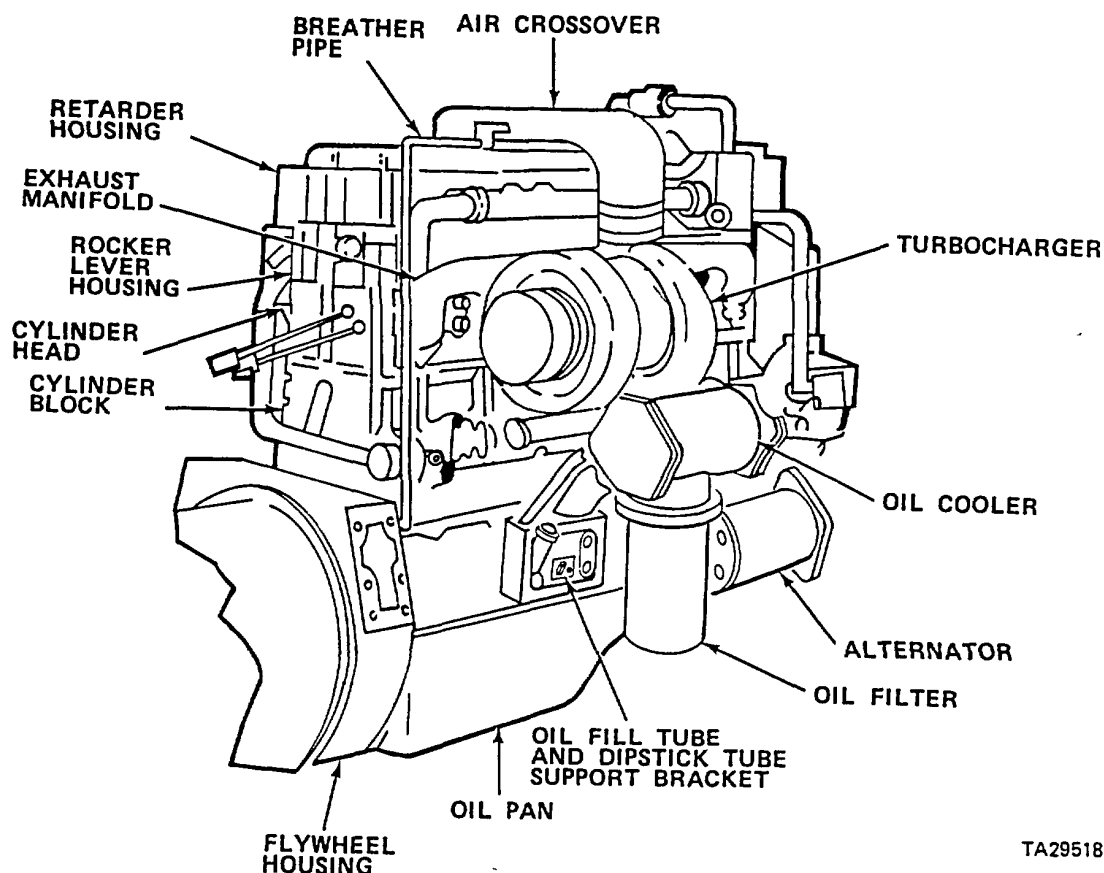
Intake Manifold: Single pass water aftercooler.

Lubricating Oil Cooler: Demand flow.

**1-7. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.** The illustrations below show the location of the major engine components.



TA295181



TA295182

**1-8. DIFFERENCES BETWEEN MODELS.** Configuration differences have been identified by model years. Actual manufactured dates may differ from model year date as stamped on your vehicle's data plate. To avoid confusion, Usable-on-Codes have been cross-referenced to U.S. Registration Numbers (stenciled on vehicle chassis) as shown below:

<u>U.S. Registration Number</u>	<u>Model Year</u>	<u>Usable-on-Codes</u>
NPO 8AO	1980	RCS
NPO 89Z	1980	RCS
NPO 89X	1980	RCS
NPO 8AI	1980	RCS
NPO 89W	1980	RCS
NPO 89Y	1980	RCS
NPO 89V	1980	RCS
NPO 62L	1982	RCT
NPO 62M	1982	RCT
NPO 62N	1982	RCT
NPO 62P	1982	RCT
NPO 62Q	1982	RCT
NPO 62R	1982	RCT
NPO 62S	1982	RCT
NPO 62T	1982	RCT
NPO 62U	1982	RCT
NPO 62V	1982	RCT
NPO 62W	1982	RCT
NPO 62X	1982	RCT
NPO 62Y	1982	RCT
NPO 89S	1984	RCV
NPO 89R	1984	RCV
NPO 633	1984	RCV
NPO 89Q	1984	RCV
NPO 632	1984	RCV
NPO 631	1984	RCV
NPO 630	1984	RCV
NPO 62Z	1984	RCV
NPO 89T	1984	RCV
NPO 89U	1984	RCV

**1-9. EQUIPMENT DATA**

Manufacturer	Cummins Engine Company, Inc.
Model	NTC-400 Big Cam 2 (BC2)
Type	4 stroke, turbocharged diesel, compression ignition
Dimensions:	
Length	58.88 in. (1495.55 mm)
Width	33.61 in. (853.69 mm)
Height	50.91 in. (1293.11 mm)
Net Weight, Dry	2680 lbs (1216.7 kg)
Cylinders:	
Number	6
Arrangement	Inline
Firing Order	1 - 5 - 3 - 6 - 2 - 4
Bore	5.5 in. (139.7 mm)
Stroke	6 in. (152.4 mm)
Displacement	855 cu. in. (14 l)
Compression Ratio	14:1
Fuel Consumption	150 pph @ maximum torque
Rated Speed and Power:	
Maximum Torque	1150 ft lbs @ 1500 rpm
Full Load Horsepower at Rated Speed	400 hp @ 2100 rpm
Blow-By (Breather Pressure) Maximum	12 in. (304.8 mm) water
Maximum No Load Speed	2400 rpm
Maximum Full Load Speed	2150 rpm
Idle Speed	580 - 620 rpm
Lubrication System:	
Type	Demand Flow Cooling
Operating Pressures:	
Rated Speed	35 - 45 psi (241.5 - 310.5 kPa)
Peak Torque (Minimum Pressure)	30 psi (207 kPa)
Idle Speed	10 - 32 psi (69 - 220 kPa)
Oil Temperature Maximum	250°F (121°C)

Cooling System:	
Type	Liquid with fan and radiator
Water Temperatures:	
Minimum	160 F° (71°C)
Maximum	205 F°(96°C)
Thermostat Temperature:	
Range	170°F - 190°F
(770C - 880C)	
Fan Operating Range:	
Engages	Above 190°F (88°C)
Disengages	Below 182 F (83°C)
Shutters Operating Range:	
Open	Above 190°F (88°C)
Close	Below 177°F°(81°C)
Fuel System:	
Manufacturer	Cummins Engine Company
Type Fuel Pump	Pressure-time, governor (PT Type G)
Type Fuel Injectors	PT (Type D) Top Stop
Engine Brake:	
Manufacturer	Jacobs Brake Company
Model	Model 30E

## CHAPTER 2

### MAINTENANCE INSTRUCTIONS

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

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

**2-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.** Special tools, TMDE, and Support Equipment for this equipment are listed and illustrated in TM 9-2815-226-34P.

**2-3. REPAIR PARTS.** Repair parts are listed and illustrated in the repair parts and special tools list TM 9-2815-226-34P covering direct support and general support maintenance for this equipment.

#### Section II. TROUBLESHOOTING

**2-4. GENERAL.** Information in this chapter is for use of supporting maintenance personnel in conjunction with, and as a supplement to, the troubleshooting procedures in TM 9-2320-281-20. This section provides continuation of instructions given in TM 9-2320-281-20.

#### WARNING

**OPERATION OF A DEADLINED VEHICLE WITHOUT A PRELIMINARY EXAMINATION CAN CAUSE FURTHER DAMAGE TO A DISABLED COMPONENT AND POSSIBLE INJURY TO PERSONNEL. BY CAREFUL INSPECTION AND TROUBLESHOOTING, SUCH DAMAGE AND INJURY CAN BE AVOIDED. IN ADDITION, THE CAUSES OF FAULTY OPERATION OF A VEHICLE OR COMPONENT CAN OFTEN BE DETERMINED WITHOUT EXTENSIVE DISASSEMBLY.**

#### 2-5. GENERAL INSTRUCTIONS AND PROCEDURES

a. This section contains troubleshooting information for locating and correcting most of the operating troubles which may develop in the Cummins NTC-400 Big Cam 2 engine. Each malfunction for an individual component, unit or system is followed by a list of tests or inspections which will help you to determine corrective actions to take. You should perform the tests/inspections and corrective actions in the order listed. The troubleshooting chart will consider the engine to be mounted on a maintenance stand with the use of various test equipment.

b. Inspection after the engine is removed from the vehicle or maintenance stand is described in specific sections for removal and installation, and disassembly and assembly of the various components and subassemblies.

c. Table 2-1 lists possible malfunctions that may be experienced during the operations of the component on the maintenance stand. Each malfunction is followed by a list of probable causes that may be considered in determining their corrective action. You should perform the tests/inspections and corrective actions in the order listed.

Table 2-1. TROUBLESHOOTING PROCEDURES

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. <u>ENGINE WILL NOT CRANK. BATTERIES ARE FULLY CHARGED.</u>		<p>Step 1. Check for hydraulic seizure.</p> <ol style="list-style-type: none"> <li>a. Remove fuel injectors (para 3-6).</li> <li>b. Rotate engine crankshaft several times (if possible).</li> <li>c. If engine now turns, reinstall injectors and start engine.</li> <li>d. If engine does not turn with injectors out, proceed to next step.</li> </ol> <p>Step 2. Check for mechanical seizure.</p> <p>Disassemble engine (para 3-6) and check for bound rod or main bearing, broken piston rings, or seized piston.</p>
2. <u>ENGINE WILL CRANK, BUT WILL NOT START OR STARTS HARD.</u>		<p>Step 1. Check fuel tank quantity.</p> <p>Service fuel tank with proper grade fuel (TM 9-2320-281-10).</p> <p>Step 2. Check for defective fuel pump shutoff valve.</p> <ol style="list-style-type: none"> <li>a. Listen for shutoff valve opening (click) when ignition switch is placed to RUN position.</li> <li>b. If opening (click) not heard, check for 12 vdc at switch terminal with ignition switch placed to RUN position.</li> <li>c. If no voltage present, troubleshoot truck electrical system (TM 9-2320-281-20).</li> <li>d. If voltage present, manually open shutoff valve and attempt start (TM 9-2320-281-20).</li> <li>e. If engine starts, replace fuel shutoff valve (para 3-77c).</li> <li>f. If engine does not start, proceed to next step.</li> </ol>



Table 2-1. TROUBLESHOOTING PROCEDURES (Cont)

## MALFUNCTION

## TEST OR INSPECTION

## CORRECTIVE ACTION

## 2. (Cont)

Step 3. Check for dirty filter elements.

- a. Drain dirty fuel from fuel filter assembly (TM 9-2320-281-10).
- b. Replace filter element (TM 9-2320-281-20).
- c. Replace main fuel filter element (TM 9-2320-281-20).

Step 4. Check fuel tank for contamination.

Drain fuel tank and fill with clean fuel (TM 9-2320-281-20).

Step 5. Check for leaks in fuel supply (suction) lines to fuel pump.

Tighten all line connectors.

Step 6. Check no-air adjustment screw in fuel pump for proper opening or setting.

- a. Disconnect AFC input line from fitting on fuel pump.

**WARNING**

**COMPRESSED AIR USED FOR CLEANING PURPOSES WILL NOT EXCEED 30 PSI (207 KPA). USE ONLY WITH EFFECTIVE CHIP GUARDING AND PERSONAL PROTECTIVE EQUIPMENT (GOGGLES, SHIELD, GLOVES, ETC). CAUTION TOO MUCH PRESSURE WILL DAMAGE AFC BELLOWS.**

- b. Apply 25 psi (172 kPa) air pressure to AFC unit and attempt start.
- c. If engine starts, reset no-air adjustment screw (para 3-84).
- d. If engine does not start, remove pump and set AFC plunger adjustment; then no-air adjustment screw (para 3-84).

Table 2-1. TROUBLESHOOTING PROCEDURES (Cont)

MALFUNCTION	
TEST OR INSPECTION	CORRECTIVE ACTION
<hr/>	
2. (Cont)	
Step 7. Check valves and injectors for proper timing.	Retime valves and injectors (para 3-94).
Step 8. Check valves and injectors for proper adjustment.	Adjust valves (para 3-94).
Step 9. Check for scored gear pump or worn gears.	Replace gear pump (para 3-80).
Step 10. Check for broken gear pump drive shaft.	Replace defective pump (para 3-80).
Step 11. Check for cracked injector body or cup.	Replace defective injector (para 3-6 and 3-94).
Step 12. Check for broken or worn piston rings.	Replace defective piston rings (para 3-19).
3. <u>ENGINE STOPS, BUT IS NOT SEIZED.</u>	
Step 1. Check fuel tank quantity.	Service tank with proper grade fuel (TM 9-2320-281-10).
Step 2. Check for broken wire to fuel pump shutoff valve.	Troubleshoot electrical system (TM 9-2320-281-20). Repair as necessary.
Step 3. Check for air leaks in fuel supply (suction) lines to fuel pump.	Tighten all line connections.

Table 2-1. TROUBLESHOOTING PROCEDURES (Cont)

MALFUNCTION	
TEST OR INSPECTION	CORRECTIVE ACTION
3. (Cont)	
Step 4. Check fuel tank for contamination.	Drain tank and reservice (TM 9-2320-281-10).
Step 5. Check for broken stand pipe inside tank.	Replace stand pipe (TM 9-2320-281-20).
Step 6. Check for seized governor plunger.	Repair governor assembly (para 3-82).
Step 7. Check for broken (sheared) gear pump shaft.	Remove gear pump and repair as necessary (para 3-80).
Step 8. Engine overheated.	Check cooling system (TM 9-2320-281-20).
4. <u>ENGINE SUDDENLY STOPS AND IS SEIZED.</u>	
Step 1. Check for seized bearing on crankshaft.	Repair or replace crankshaft as necessary (para 3-14).
Step 2. Check for seized piston in cylinder liner.	Replace defective piston and liner (para 3-6).
Step 3. Check for broken connecting rod.	Replace defective rod (para 3-6).
Step 4. Check for cracked or broken liner.	Replace defective liner (para 3-6).

Table 2-1. TROUBLESHOOTING PROCEDURES (Cont)

## MALFUNCTION

## TEST OR INSPECTION

## CORRECTIVE ACTION

5. ENGINE MISSES.

Step 1. Check for leaks in supply (suction) lines to fuel pump.

Tighten all line connectors.

Step 2. Check for water in fuel system.

a. Drain fuel filter assembly bowl (TM 9-2320-281-10).

b. Drain fuel tank (TM 9-2320-281-20).

c. Reservice fuel tank (TM 9-2320-281-10).

Step 3. Check engine valves for proper adjustment.

Adjust valves (para 3-94).

Step 4. Check for plugged injector spray holes.

Clean injector (para 3-73).

Step 5. Check for cracked injector body or cup.

Replace defective injector (para 3-6 and 3-94).

Step 6. Check for defective injector O-rings.

Replace O-rings (para 3-72).

Step 7. Check for improper injector flow adjustments.

Test and adjust injector (para 3-75).

Step 8. Check for blown or leaking head gasket(s).

a. Retorque head bolts (table 3-3).

b. Replace defective gasket(s) (para 3-6 and 3-94).

Step 9. Check for broken or worn piston rings.

Replace defective rings (para 3-20).