Section i - Introduction

Section Contents

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About the Manual

This Case 5.9 Liter Engine Troubleshooting and Repair Manual is intended to aid in determining the cause of engine-related performance issues and to provide recommended repair procedures. The material in this manual covers Case 5.9 Liter Engines. The manual is divided into sections. Some sections contain reference numbers and procedure numbers. The reference numbers provide general information, specifications, diagrams, and service tools, where applicable. The procedure numbers describe specific repair procedures and are referred to in the Troubleshooting Logic Charts.

How to Use the Manual

The manual is organized to provide an easy flow from problem identification to problem correction. A list of troubleshooting symptoms containing most common engine problems begins on Page TS-a in Section TS - Troubleshooting Symptoms. Complete the described steps to locate and correct the problem.

Refer to Section TS for a guide to troubleshooting your engine. Follow the directions given on Page TS-1 to locate and correct engine problems.

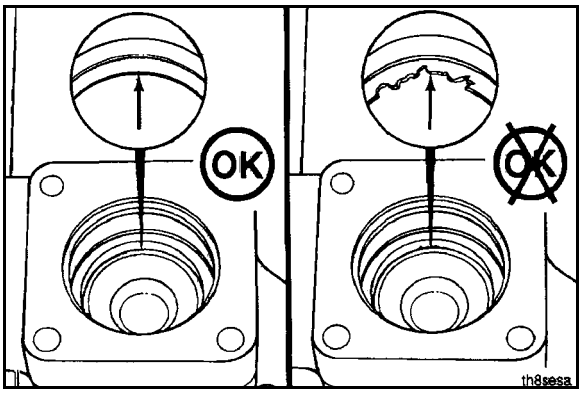
The Troubleshooting Symptoms Charts are based on the following assumption:

- The engine has been installed according to specifications.
- The easiest repairs are done first.
- Generic solutions to cover problems with the most common applications.

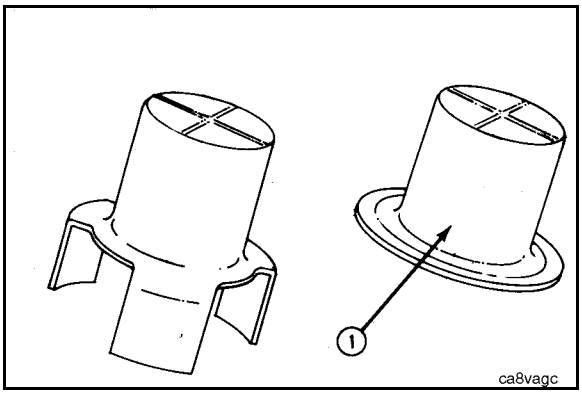
Refer to Section V for specifications recommended by Case Corporation for your engine. Specifications and torque values for each engine system are given in that section.

Illustrations

Some of the illustrations throughout this manual are generic and will **not** look exactly like the engine or parts used in your application. The illustrations can contain symbols to indicate an action required and an acceptable or **not** acceptable condition.



The illustrations are intended to show repair or replacement procedures. The procedure will be the same for all applications, although the illustration can differ.



General Safety Instructions

Important Safety Notice

∆ *WARNING* ∆

Improper practices or carelessness can cause burns, cuts, mutilation, asphyxiation or other bodily injury or death.

Read and understand all of the safety precautions and warnings before performing any repair. This list contains the general safety precautions that **must** be followed to provide personal safety. Special safety precautions are included in the procedures when they apply.

- Make sure the work area surrounding the product is dry, well lit, ventilated, free from clutter, loose tools, parts, ignition sources and hazardous substances. Be aware of hazardous conditions that can exist.
- Always wear protective glasses and protective shoes when working.
- Rotating parts can cause cuts, mutilation or strangulation.
- Do not wear loose-fitting or torn clothing. Remove all jewelry when working.
- Disconnect the battery (negative [-] cable first) and discharge any capacitors before beginning any repair work. Disconnect the air starting motor if equipped to prevent accidental engine starting. Put a "Do Not Operate" tag in the operator's compartment or on the controls.
- Use ONLY the proper engine barring techniques for manually rotating the engine. Do not attempt to rotate the crankshaft by pulling or prying on the fan. This practice can cause serious personal injury, property damage, or damage to the fan blade(s) causing premature fan failure.
- If an engine has been operating and the coolant is hot, allow the engine to cool before you slowly loosen the filler cap and relieve the pressure from the cooling system.
- Do not work on anything that is supported ONLY by lifting jacks or a hoist. Always use blocks or proper stands to support the product before performing any service work.
- Relieve all pressure in the air, oil, fuel and the cooling systems before any lines, fittings, or related items are removed or disconnected. Be alert for possible pressure when disconnecting any device from a system that utilizes pressure. Do not check for pressure leaks with your hand. High pressure oil or fuel can cause personal injury.
- To prevent suffocation and frostbite, wear protective clothing and ONLY disconnect fuel and liquid refrigerant (freon) lines in a well ventilated area. To protect the environment, liquid refrigerant systems must be properly emptied and filled using equipment that prevents the release of refrigerant gas (fluorocarbons) into the atmosphere. Federal law requires capturing and recycling refrigerant.
- To avoid personal injury, use a hoist or get assistance when lifting components that weigh 23 kg [50 lb] or more. Make sure all lifting devices such as chains, hooks, or slings are in good condition and are of the correct capacity. Make sure hooks are positioned correctly. Always use a spreader bar when necessary. The lifting hooks must not be side-loaded.
- Corrosion inhibitor, a component of SCA and lubricating oil, contains alkali. Do not get the substance in your eyes. Avoid prolonged or repeated contact with skin. Do not swallow internally. In case of contact, immediately wash skin with soap and water. In case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. IMMEDIATELY CALL A PHYSICIAN. KEEP OUT OF REACH OF CHILDREN.
- Naptha and Methyl Ethyl Ketone (MEK) are flammable materials and must be used with caution. Follow the manufacturer's instructions to provide complete safety when using these materials. KEEP OUT OF REACH OF CHILDREN.
- To avoid burns, be alert for hot parts on products that have just been turned off, and hot fluids in lines, tubes, and compartments.
- Always use tools that are in good condition. Make sure you understand how to use them before performing any service work. Use ONLY Case approved replacement parts.
- Always use the same fastener part number (or equivalent) when replacing fasteners. Do not use a fastener of lesser quality if replacements are necessary.
- Do not perform any repair when fatigued or after consuming alcohol or drugs that can impair your functioning.
- Some state and federal agencies in the United States of America have determined that used engine oil can be carcinogenic and can cause reproductive toxicity. Avoid inhalation of vapors, ingestion, and prolonged contact with used engine oil.

General Repair Instructions

This engine incorporates the latest technology at the time it was manufactured; yet, it is designed to be repaired using normal repair practices performed to quality standards.

Case Corporation does not recommend or authorize any modifications or repairs to engines or components except for those detailed in Service Information. In particular, unauthorized repair to safety-related components can cause personal injury or death. Below is a partial listing of components classified as safety-related:

Air Compressor
Air Controls
Air Shutoff Assemblies
Balance Weights
Cooling Fan
Fan Hub Assembly
Fan Mounting Bracket(s)
Fan Mounting Capscrews
Fan Hub Spindle
Flywheel
Flywheel Crankshaft Adapter
Flywheel Mounting Capscrews
Fuel Shutoff Assemblies
Fuel Supply Tubes
Lifting Brackets
Throttle Controls
Turbocharger Compressor Casing
Turbocharger Oil Drain Line(s)
Turbocharger Oil Supply Line(s)
Turbocharger Turbine Casing
Vibration Damper Mounting Capscrews

- **Follow all safety instructions noted in the procedures**

  -- Follow the manufacturer's recommendations for cleaning solvents and other substances used during the repair of the engine. Some solvents and used engine oil have been identified by government agencies as toxic or carcinogenic. Avoid excessive breathing, injestion and contact with such substances. **Always** use good safety practices with tools and equipment.

- **Provide a clean environment and follow the cleaning instructions specified in the procedures**

  -- The engine and its components must be kept clean during any repair. Contamination of the engine or components will cause premature wear.

- **Perform the inspections specified in the procedures**

- **Replace all components or assemblies which are damaged or worn beyond the specifications**

- **Use Case approved service parts and assemblies**

  -- The assembly instructions have been written to use again as many components and assemblies as possible. When it is necessary to replace a component or assembly, the procedure is based on the use of new Case approved components.

- **Follow the specified disassembly and assembly procedures to avoid damage to the components**

General Cleaning Instructions

Solvent and Acid Cleaning

Several solvent and acid-type cleaners can be used to clean the engine parts. Experience has shown that the best results can be obtained using a cleaner that can be heated to 90 to 95 degrees Celsius [180 to 200 degrees Fahrenheit]. A cleaning tank that provides a constant mixing and filtering of the cleaning solution will give the best results. **Case Corporation does not recommend any specific cleaners. Always** follow the cleaner manufacturer's instructions.

Remove all the gasket material, o-rings, and the deposits of sludge, carbon, etc., with a wire brush or scraper before putting the parts in a cleaning tank. Be careful **not** to damage any gasket surfaces. When possible, steam clean the parts before putting them in the cleaning tank.

∆ *WARNING* ∆

Acid is extremely dangerous and can damage the machinery. Always provide a tank of strong soda water as a neutralizing agent.

Rinse all of the parts in hot water after cleaning. Dry completely with compressed air. Blow the rinse water from all of the capscrew holes and the oil drillings.

If the parts are **not** to be used immediately after cleaning, dip them in a suitable rustproofing compound. The rustproofing compound **must** be removed from the parts before installation on the engine.

Steam Cleaning

Steam cleaning can be used to remove all types of dirt that can contaminate the cleaning tank. It is a good way to clean the oil drillings.

∆ *WARNING* ∆

Wear protective clothing to prevent personal injury from the high pressure and extreme heat.

Do **not** steam clean the following parts:

Glass or Plastic Bead Cleaning

1. Electrical Components
2. Wiring
3. Injectors
4. Fuel Pump
5. Belts and Hoses
6. Bearings

Glass or plastic bead cleaning can be used on many engine components to remove carbon deposits. The cleaning process is controlled by the size of the glass or plastic beads, the operating pressure, and the cleaning time.

∆ CAUTION ∆

Do not use glass or plastic bead cleaning on aluminum piston skirts. Do not use glass bead cleaning on aluminum ring grooves. Small particles of glass or plastic will embed in the aluminum and result in premature wear. Valves, turbocharger shafts, etc., can also be damaged. Follow the cleaning directions listed in the procedures.

NOTE: Plastic bead blasting media can be used to clean aluminum ring grooves. Do not use any bead blasting media on pin bores or aluminum skirts.

Follow the equipment manufacturer's cleaning instructions. The following guidelines can be used to adapt to manufacturer's instructions:

1. Bead size:-Use U.S. size No. 16-20 for piston cleaning with plastic bead media.
   -Use U.S. size No. 70 for piston domes with glass media.

-Use U.S. size No. 60 for general purpose cleaning with glass media.

2. Operating Pressure:
   -Glass: Use 620 kPa [90 psi] for general purpose cleaning.
   -Plastic: Use 270 kPa [40 psi] for piston cleaning.
3. Steam clean or wash the parts with solvent to remove all of the foreign material and glass or plastic beads after cleaning. Rinse with hot water. Dry with compressed air.
4. Do not contaminate the wash tanks with glass or plastic beads.

Section E - Engine Identification

Section Contents

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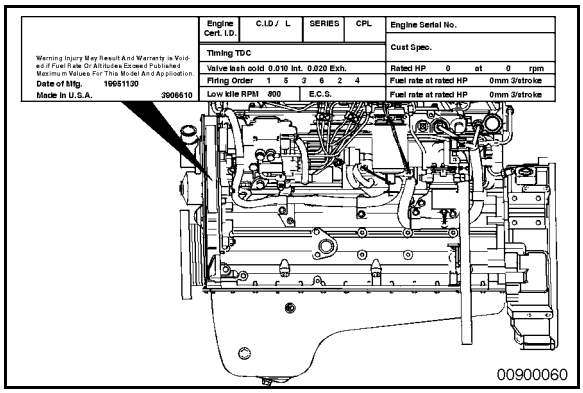
Engine Identification

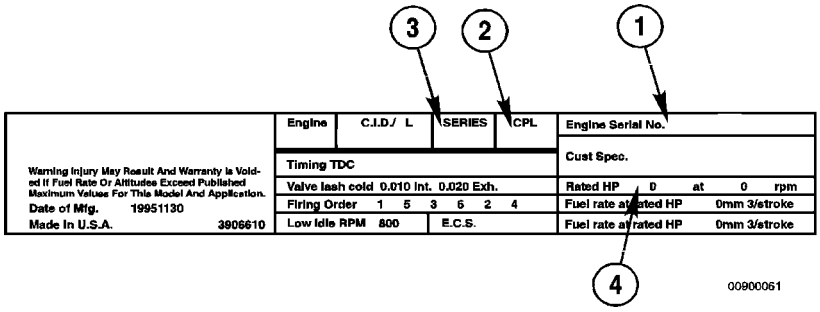
Engine Dataplate

The engine dataplate shows specific information about your engine. The engine serial number (ESN) and Vehicle Parts List provide information for ordering parts and service needs. The engine dataplate **must not** be changed unless approved by Case Corporation.

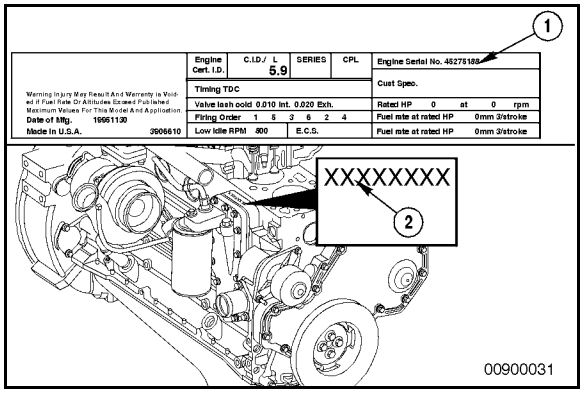


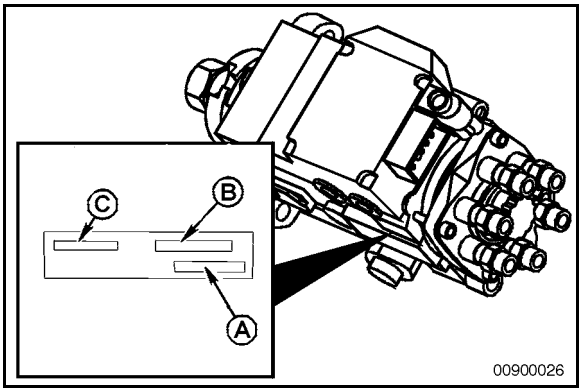
The dataplate is located on the top side of the gear housing. The information on the dataplate is mandatory when sourcing service parts.

1. Engine Serial Number (ESN)
2. Vehicle Parts List
3. Model
4. Horsepower and rpm rating



NOTE: If the engine dataplate (1) is not readable, the engine serial number (ESN) (2) can be identified on the engine block on top of the lubricating oil cooler housing. Additional engine information is available by reading the Electronic Control Module (ECM) dataplate.





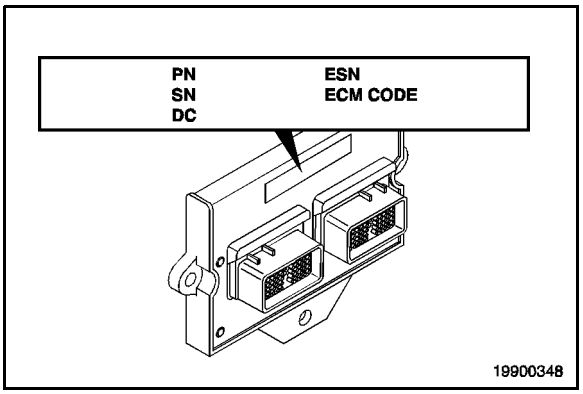
Fuel Injection Pump Dataplate

The CAPS fuel injection pump dataplate is located on the side of the injection pump. The dataplate contains the following information:

A. Part Number

B. Pump Serial Number

C. Factory Code



ECM Dataplate

The Electronic Control Module (ECM) dataplate shows information about your ECM, and how the ECM was programmed. The dataplate is located on the ECM above the ECM connectors.

The following information is available on the ECM dataplate:

- ECM Part Number (PN).
- ECM Serial Number (SN).
- ECM Date Code (DC).
- Engine Serial Number (ESN).
- ECM Code identifying the Software Number indicating how the ECM is programmed.

Specifications

General Specifications

Horsepower ..... (Refer to engine dataplate)
Bore and Stroke ..... 102 mm [402 in] X 120 mm [4.72 in]
Displacement ..... 5.9 Liters [359 C.I.C.]
Firing Order 1-5-3-6-2-4
Engine Weight (with standard accessories):
Dry Weight ..... 480 kg [1010 lb]
Crankshaft Rotation (viewed from the front of the engine) ..... **Clockwise**
Valve Clearance:
Intake ..... 0.025 mm [0.010 in]
Exhaust ..... 0.051 mm [0.020 in]

NOTE: The Case 5.9 Liter engine features a no-adjust overhead. The 5.9 Liter valve train is designed such that adjustment of the valve lash is **not** required for normal service during the first 241,502 km [150,000 mi]. The valve train operates acceptably within the limits of 0.152 to 0.381 mm [0.006 to 0.015 in] intake valve lash and 0.381 to 0.762 mm [0.015 to 0.030 in] exhaust valve lash.

Fuel System

Engine Idle Speed ..... 700 to 1000 rpm
Maximum Fuel Inlet Restriction to Lift Pump ..... 20 kPa [6 in Hg]
Minimum Lift Pump Inlet Pressure at Rated ..... 28 to 55 kPa [4 to 8 psi]
Maximum Fuel Pressure at Fuel Filter Outlet (enging cranking) ..... 254 mm Hg [10 in Hg]
Minimum Fuel Pressure at Fuel Filter Inlet (engine running) ..... 55 to 117 kPa [8 to 17 psi]
Maximum Pressure Drop Across Fuel Filter ..... 34 kPa [5 psi]
Fuel Drain Line Maximum Restriction ..... 34 kPa [10 psi]
Fuel Inlet Maximum Temperature ..... 74 °C [165 °F]
Engine Minimum Cranking Speed ..... 150 rpm

Lubricating Oil System

Oil Pressure:
at Low Idle (Minimum Allowable) ..... 103 kPa [15 psi]
at Rated Speed (Minimum Allowable) ..... 310 kPa [45 psi]
Regulated Pressure ..... 414 kPa [60 psi]
Oil Capacity Of Standard Engine:
Standard Oil Pan
Pan **Only** ..... 14.2 liters [15 qts]
Total System ..... 16.4 liters [17 qts]
Deep Sump
Pan **Only** ..... 16.1 liters [17 qts]
Total System ..... 18.3 liters [19 qts]
Oil Pan High to Low:
Standard Oil Pan ..... 12 to 14.2 liters [13 to 15 qts]
Deep Sump Oil Pan ..... 14.2 to 16.1 liters [15 to 17 qts]

NOTE: Some applications may use a slightly different lubricating oil pan capacity. Refer to the machine operators manual.

Cooling System

Coolant Capacity (Engine Only) ..... .9 liters [11.5 qts]
Standard Modulating Thermostat- Range ..... 84° to 91°C [180° to 195°F]
Maximum Allowable Operating Temperature ..... 100°C [212°F]
Minimum Recommended Operating Temperature ..... 70°C [158°F]
Minimum Recommended Pressure Cap ..... 48 kPa [7 psi]

Air Intake System

Maximum Intake Restriction (Clean Air Filter Element) ..... 254 mm H_2O [10.0 in H_2O]
Maximum Intake Restriction (Dirty Air Filter Element) ..... 635 mm H_2O [25.0 in H_2O]

Exhaust System

Maximum Exhaust Back Pressure ..... 76 mm Hg [3 in Hg]
Hg ..... 1016 mm H_2O [40 in H_2O]
H_2O ..... 76 mm [3 in]

Electrical System

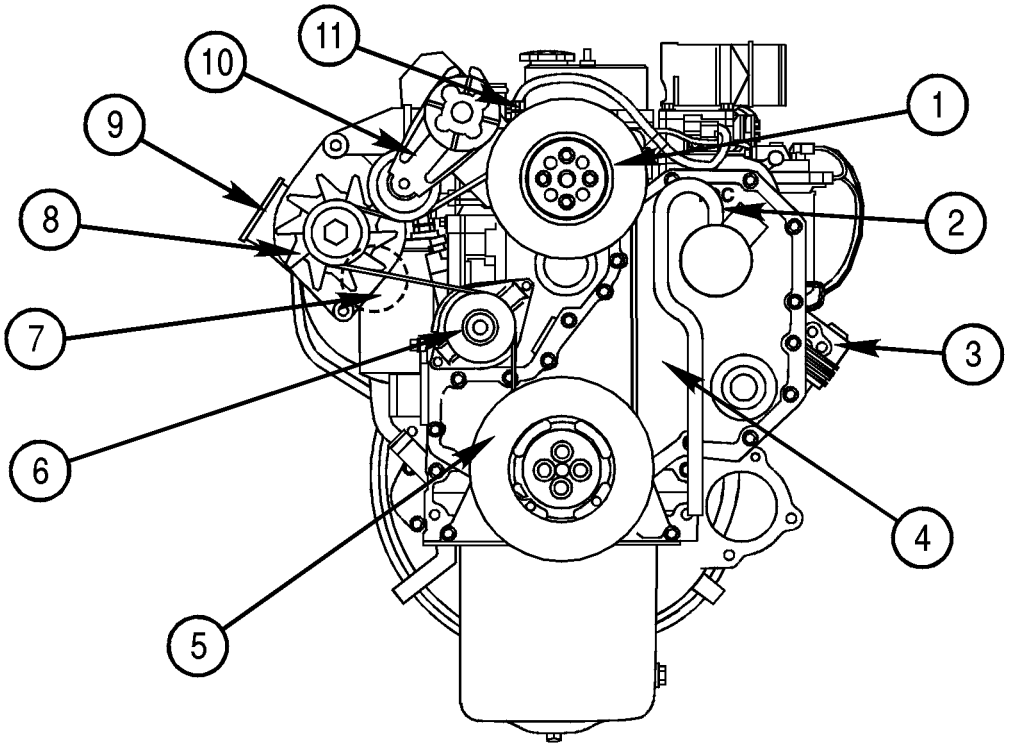
For electrical specifications, refer to the Case 5.9 Liter Engine Fuel Systems Troubleshooting and Repair Manual, Rac 6-11390.

Engine Diagrams

Engine Views

The following illustrations show the locations of the major external engine components, filters, and other service and maintenance points. Some external components will be at different locations for different engine models.

NOTE: The illustrations are **only** a reference showing a typical engine.



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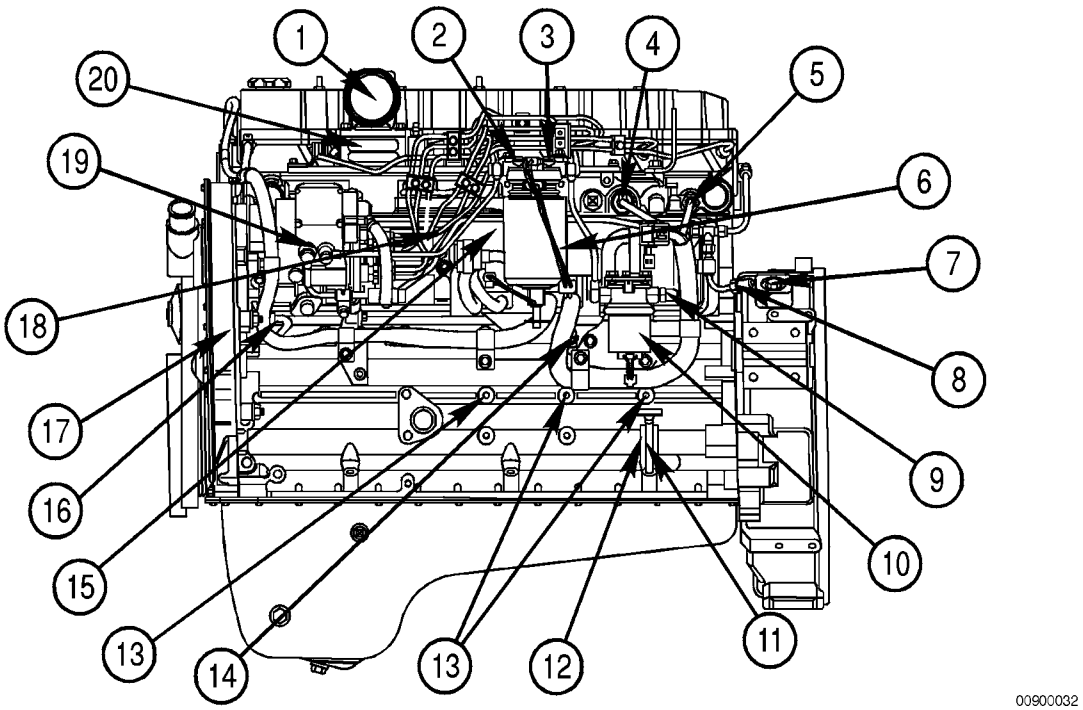
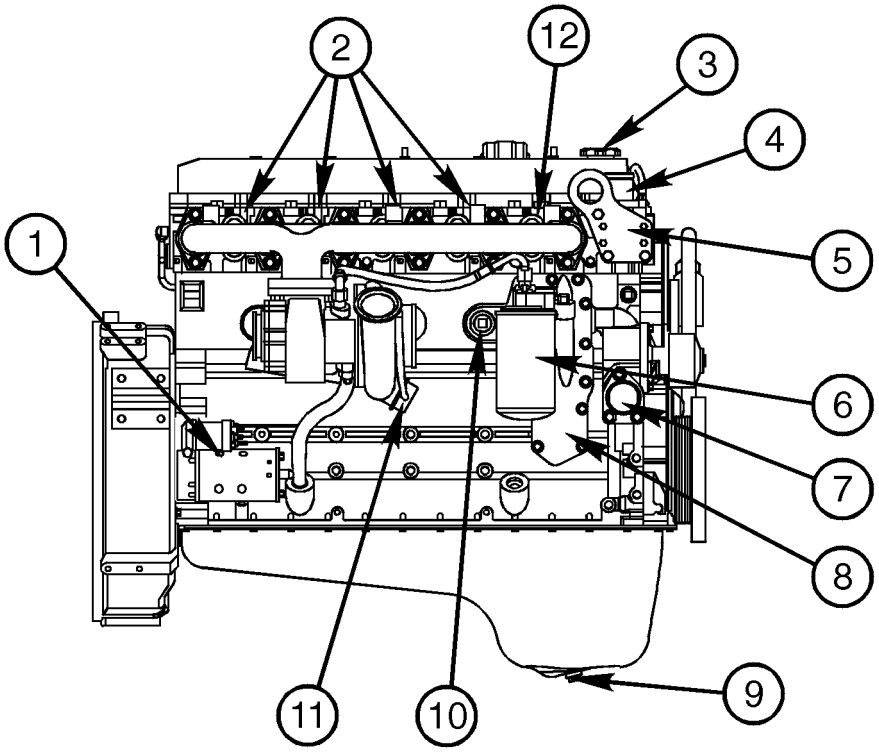
Front View

1. **Fan pulley**
2. **Top dead center indication**
3. **Air compressor**
4. **Front gear cover**
5. **Vibration damper**
6. **Water pump**
7. **Turbocharger air inlet**
8. **Alternator**
9. **Turbocharger air outlet**
10. **Automatic belt tensioner**
11. **Coolant temperature sensor**



Air Intake Side View

1. **Engine air inlet**
2. **M10 (STOR) fuel pressure after filter**
3. **M10 (STOR) fuel pressure before filter**
4. **Intake manifold pressure sensor**
5. **Intake manifold temperature sensor**
6. **Fuel filter/water separator**
7. **Magnetic pickup location (3/4-inch-16 UNF)**
8. **Fuel return connection**
9. **Fuel inlet connection**
10. **Fuel lift pump**
11. **Dipstick**
12. **Engine position sensor (EPS)**
13. **M10 (STOR) oil pressure**
14. **Oil pressure sensor**
15. **Electronic control module (ECM)**
16. **Engine Diagnostic sensor**
17. **Engine dataplate**
18. **High-pressure fuel lines**
19. **Fuel injection pump**
20. **Intake air preheater.**



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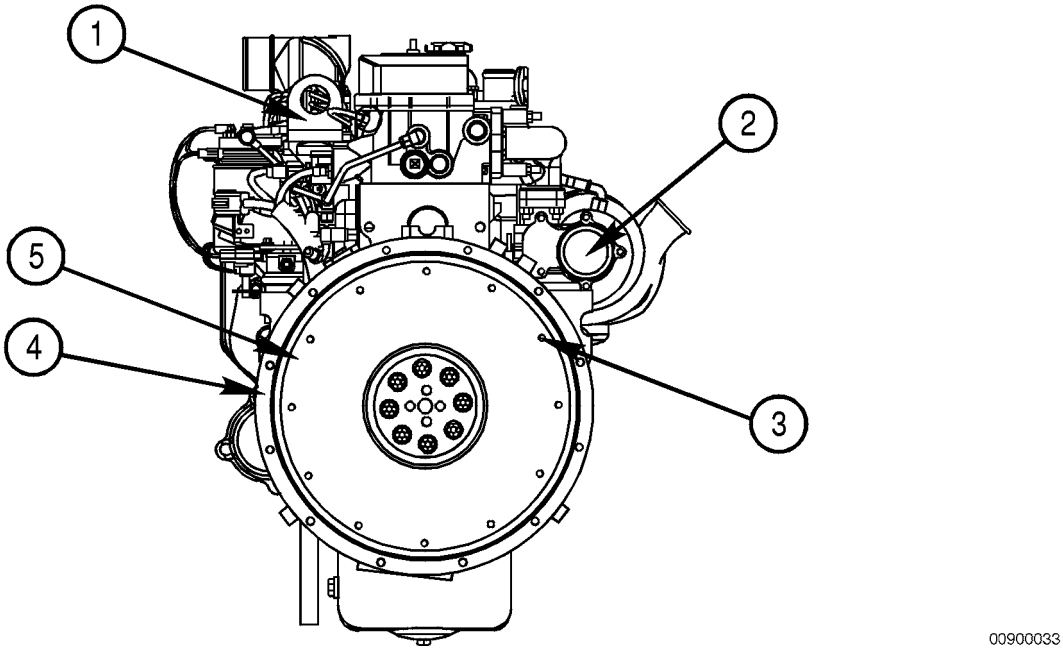
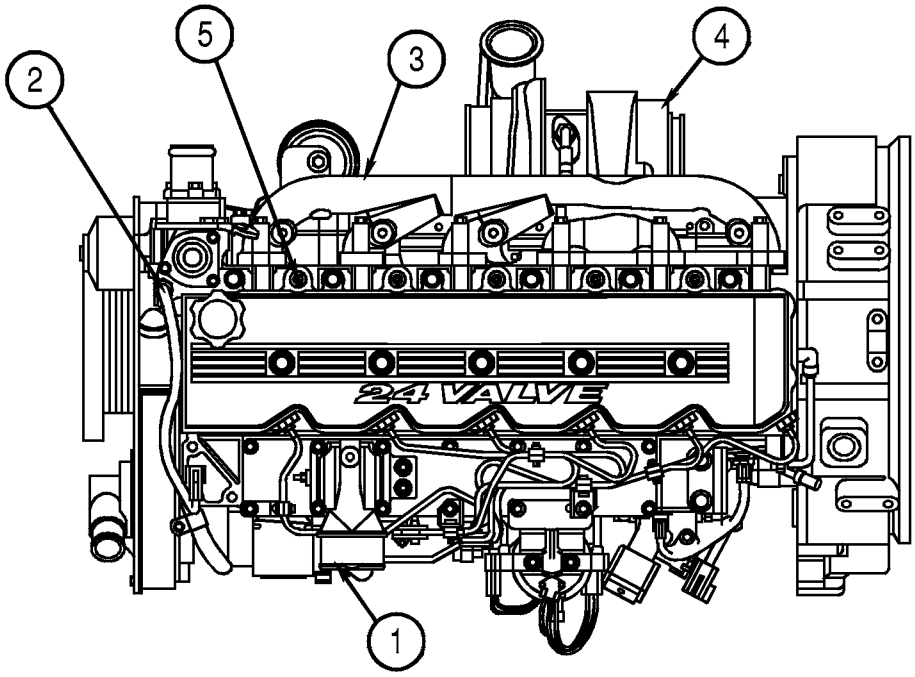
Exaust Side View

1. **Starter motor and solenoid**
2. **1/2-inch (NPTF) coolant taps**
3. **Oil fill**
4. **Water outlet**
5. **Front engine lifting bracket**
6. **Lubricating oil filter**
7. **Water inlet**
8. **Lubricating oil cooler**
9. **Oil drain**
10. **Provision for coolant heater**
11. **Turbocharger wastegate actuator**
12. **Coolant vent fitting**



Rear View

1. **Rear engine lifting bracket**
2. **Turbocharger exhaust outlet**
3. **Clutch mounting holes**
4. **Flywheel housing**
5. **Flywheel/flexplate**



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Top View

1. **Engine air inlet**
2. **Coolant temperature sensor**
3. **Exhaust manifold**
4. **Turbocharger**
5. **Coolant vent fitting**

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