

AUTOMOBILE ENGINEERING TECHNICIAN

First Year

Paper-III: Automobile Engine Lab

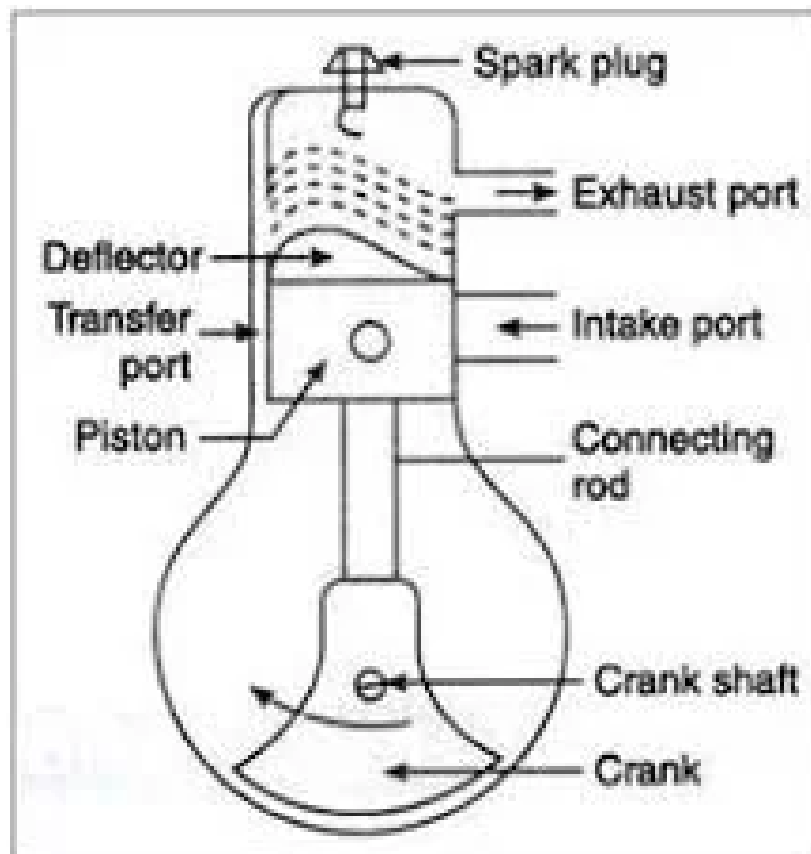
Time: 3hr

Max.Marks: 50

Section - I

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1. Overhauling the two stroke petrol engine.



Aim:

The aim of this practical exercise is to overhaul a two-stroke petrol engine, ensuring its optimal performance by disassembling, inspecting, cleaning, replacing worn-out parts, and reassembling the engine components.

Materials:

Two-stroke petrol engine

Engine overhaul kit (including gaskets, piston rings, bearings, seals, etc.)
Engine oil
Cleaning solvents
Replacement spark plugs
Emery cloth or sandpaper
Lubricants and grease
Engine assembly lube
Rags and shop towels

Tools:

Socket set
Screwdrivers (flathead and Phillips)
Pliers
Piston ring compressor
Feeler gauges
Torque wrench
Gasket scraper
Valve spring compressor
Cylinder honing tool
Bearing puller
Timing light
Compression tester

Procedure:

Preparation:

- a. Ensure the engine is cooled down and disconnect the battery.
- b. Drain the engine oil and remove the spark plug wires.
- c. Remove any external components connected to the engine.

Disassembly:

- a. Remove the cylinder head and exhaust system.
- b. Take off the carburetor and fuel lines.
- c. Disconnect the ignition system and remove the flywheel.
- d. Detach the piston and connecting rod from the crankshaft.
- e. Remove the crankshaft and main bearings.

Inspection:

- a. Inspect the cylinder walls for scratches, scoring, or wear.
- b. Check the condition of pistons, rings, and wrist pins.

- c. Examine bearings for wear and replace if necessary.
- d. Inspect the cylinder head, valves, and valve seats.
- e. Check the crankshaft for straightness and wear.

Cleaning:

- a. Clean all parts thoroughly using appropriate solvents.
- b. Remove carbon deposits from the combustion chamber and piston.
- c. Use a gasket scraper to clean gasket surfaces.

Replacement and Reassembly:

- a. Install new piston rings using a ring compressor.
- b. Replace bearings, gaskets, and seals.
- c. Reassemble the engine components in the reverse order of disassembly.
- d. Torque all bolts and nuts to manufacturer specifications.
- e. Lubricate moving parts during reassembly.

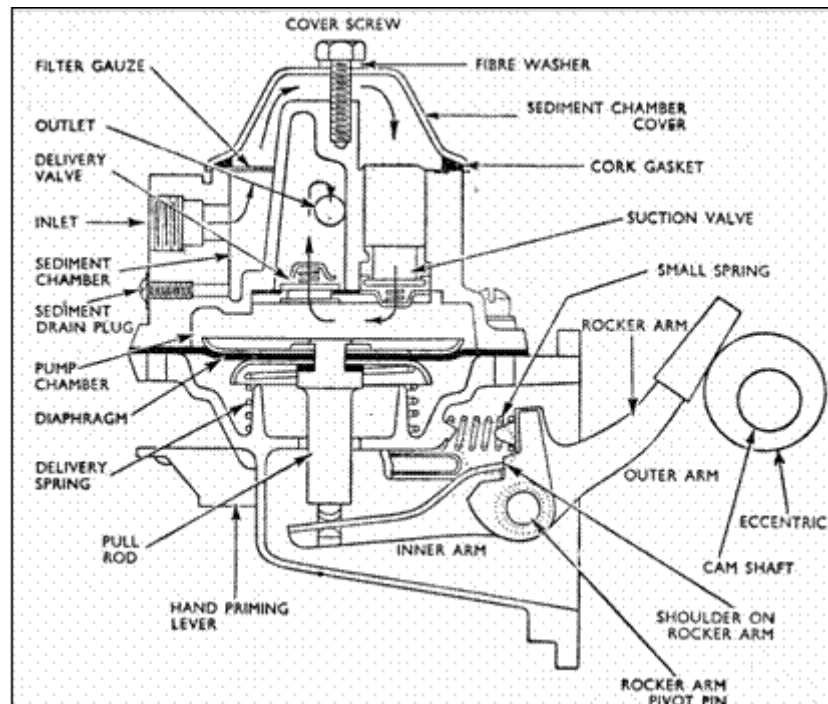
Testing:

- a. Conduct a compression test to ensure proper cylinder compression.
- b. Check ignition timing using a timing light.
- c. Start the engine and listen for any unusual noises.
- d. Monitor for leaks and verify the overall performance.

Results:

Upon completion of the overhaul, the two-stroke petrol engine should exhibit improved performance, increased reliability, and a smoother operation. Compression levels should be within the specified range, and the engine should start and run smoothly without any abnormal sounds or signs of malfunction. Regular maintenance and adherence to manufacturer specifications are crucial for sustaining the benefits of the overhaul.

2. Overhauling the mechanical fuel pump.



Aim:

The aim of this practical exercise is to overhaul a mechanical fuel pump, ensuring its proper functioning and reliability by disassembling, inspecting, cleaning, replacing worn-out components, and reassembling the pump.

Materials:

Mechanical fuel pump overhaul kit (includes diaphragms, gaskets, valves, etc.)
Cleaning solvent
Replacement fuel filter
Lubricants and grease
Rags and shop towels

Tools:

Screwdrivers (flathead and Phillips)
Pliers
Gasket scraper
Small socket set
Torque wrench
Diaphragm stretch tool (if required)
Bench vise
Fuel pressure gauge

Tubing wrench

Fuel container

Procedure:

Preparation:

- a. Ensure the fuel system is depressurized by disconnecting the fuel line.
- b. Disconnect the battery to prevent accidental sparking.
- c. Remove the fuel pump from the engine.

Disassembly:

- a. Remove the pump cover and diaphragm.
- b. Take note of the arrangement of components for accurate reassembly.
- c. Disassemble the pump further, removing valves and other internal components.
- d. Inspect each component for wear, damage, or signs of malfunction.

Cleaning:

- a. Clean all disassembled parts thoroughly using an appropriate solvent.
- b. Use a gasket scraper to remove any old gasket material.
- c. Inspect the pump housing for debris or sediment and clean as necessary.

Replacement of Worn Parts:

- a. Replace diaphragms, valves, and gaskets with components from the overhaul kit.
- b. Ensure proper seating of valves and check for any signs of leakage.
- c. If required, use a diaphragm stretch tool to ensure proper diaphragm tension.

Reassembly:

- a. Reassemble the pump in the reverse order of disassembly.
- b. Torque bolts to manufacturer specifications.
- c. Lubricate moving parts with an appropriate grease.
- d. Install a new fuel filter in the fuel line.

Testing:

- a. Install the overhauled fuel pump back into the engine.
- b. Reconnect the fuel line and battery.

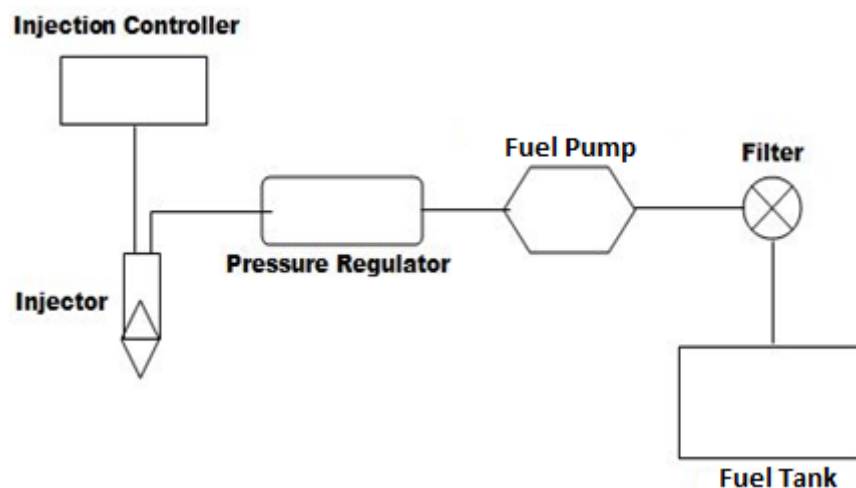
c. Start the engine and check for proper fuel pump operation.

d. Use a fuel pressure gauge to verify that the pump is delivering fuel at the correct pressure.

Results:

Upon completion of the overhaul, the mechanical fuel pump should operate efficiently, delivering fuel at the specified pressure without leaks or irregularities. The engine should start and run smoothly, and the fuel pump should perform its function reliably. Regular maintenance and adherence to manufacturer specifications are essential for sustaining the benefits of the overhaul.

3. Overhauling the petrol fuel injection system.



Aim:

The aim of this practical exercise is to overhaul a petrol fuel injection system, ensuring optimal fuel delivery, combustion efficiency, and overall engine performance by disassembling, inspecting, cleaning, replacing worn-out components, and reassembling the system.

Materials:

- Fuel injector overhaul kit (includes O-rings, seals, filters, etc.)
- Fuel system cleaner
- Throttle body cleaner
- New fuel injectors (if necessary)
- Replacement fuel filter
- Engine oil
- Rags and shop towels

Tools:

- Screwdrivers (flathead and Phillips)
- Pliers
- Fuel pressure gauge
- Fuel injector puller or removal tool
- Multimeter
- Torque wrench
- OBD-II scanner (optional, for diagnostic purposes)
- Fuel line disconnect tool
- Compression tester
- Throttle position sensor adjustment tool (if applicable)

Procedure:**Preparation:**

- a. Disconnect the battery to ensure safety.
- b. Relieve fuel system pressure by removing the fuel pump fuse or relay and starting the engine until it stalls.
- c. Disconnect the fuel lines and remove the fuel rail.

Disassembly:

- a. Remove the fuel injectors from the fuel rail.
- b. Disconnect electrical connectors from each injector.
- c. Inspect the injectors for any visible damage or clogging.
- d. Check the fuel rail and associated components for wear or leaks.

Cleaning:

- a. Clean the fuel injectors using a fuel system cleaner.
- b. Use throttle body cleaner to clean the throttle body and intake manifold.
- c. Inspect and clean the fuel rail and associated components.

Replacement of Worn Parts:

- a. Replace O-rings, seals, and filters with components from the injector overhaul kit.
- b. If injectors are excessively worn or clogged, consider replacing them with new ones.

Reassembly:

- a. Install the overhauled or new injectors into the fuel rail.

- b. Reconnect electrical connectors to each injector.
- c. Reinstall the fuel rail, making sure all connections are secure.
- d. Reconnect fuel lines and ensure proper torque on fittings.
- e. Install a new fuel filter in the fuel line.

Testing and Calibration:

- a. Use a fuel pressure gauge to check the fuel system pressure.
- b. Start the engine and monitor for any fuel leaks.
- c. Use an OBD-II scanner to check for any diagnostic trouble codes (DTCs).
- d. Perform a throttle position sensor calibration (if applicable).
- e. Conduct a compression test to ensure engine health.

Results:

Upon completion of the overhaul, the petrol fuel injection system should operate efficiently, providing proper fuel delivery and contributing to improved combustion and engine performance. The engine should start and run smoothly, and there should be no signs of fuel leaks or irregularities. Regular maintenance and adherence to manufacturer specifications are essential for sustaining the benefits of the overhaul.

4. Overhauling the carburettor.

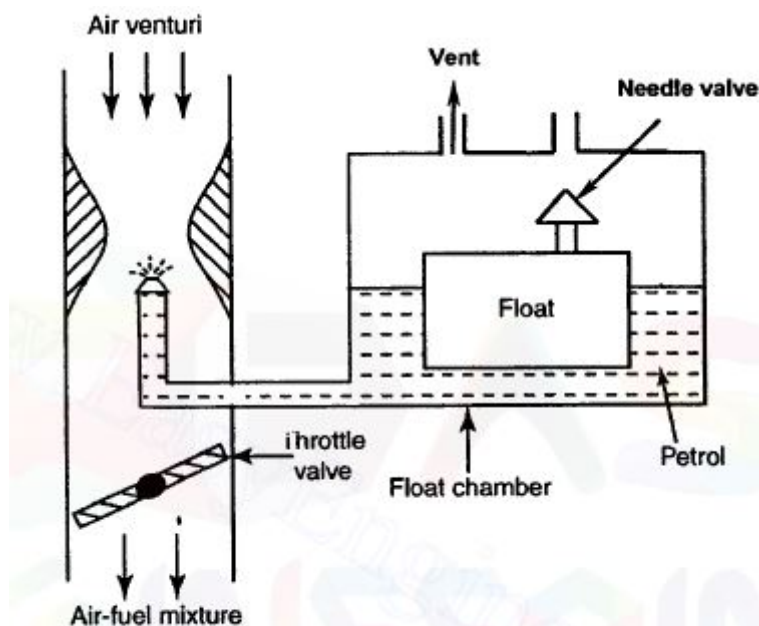


Figure 2.1 Simple carburetor

Aim:

The aim of this practical exercise is to overhaul a carburetor, ensuring optimal air-fuel mixture, improved engine performance, and fuel efficiency by disassembling, inspecting, cleaning, replacing worn-out components, and reassembling the carburetor.

Materials:

Carburetor overhaul kit (includes gaskets, O-rings, needle and seat, etc.)
Carburetor cleaner
Compressed air
Replacement fuel filter
Lubricants and grease
Rags and shop towels

Tools:

Screwdrivers (flathead and Phillips)
Pliers
Carburetor adjustment tools
Wire brush
Fuel line disconnect tool
Small socket set
Feeler gauges
Torque wrench
Vacuum gauge (optional)
Synchronizer (for multiple carburetor systems)

Procedure:**Preparation:**

- a. Disconnect the battery to ensure safety.
- b. Remove the carburetor from the engine.
- c. Drain any remaining fuel from the carburetor.

Disassembly:

- a. Disassemble the carburetor, taking note of the arrangement of components for accurate reassembly.
- b. Remove the float bowl and inspect the float and needle valve.
- c. Remove the throttle body and idle circuit components.
- d. Inspect each component for wear, damage, or signs of malfunction.

Cleaning:

- a. Clean all disassembled parts thoroughly using carburetor cleaner and a wire brush.
- b. Use compressed air to blow out any clogged passages.
- c. Soak metal components in carburetor cleaner to remove varnish and deposits.
- d. Clean the fuel inlet screen and passages.

Replacement of Worn Parts:

- a. Replace gaskets, O-rings, and other components with parts from the carburetor overhaul kit.
- b. Inspect the float and needle valve; replace if worn or damaged.
- c. Ensure proper seating of the float and adjust if necessary.

Reassembly:

- a. Reassemble the carburetor in the reverse order of disassembly.
- b. Set float levels to manufacturer specifications using a feeler gauge.
- c. Adjust idle speed and mixture settings according to the manufacturer's guidelines.
- d. Install a new fuel filter in the fuel line.

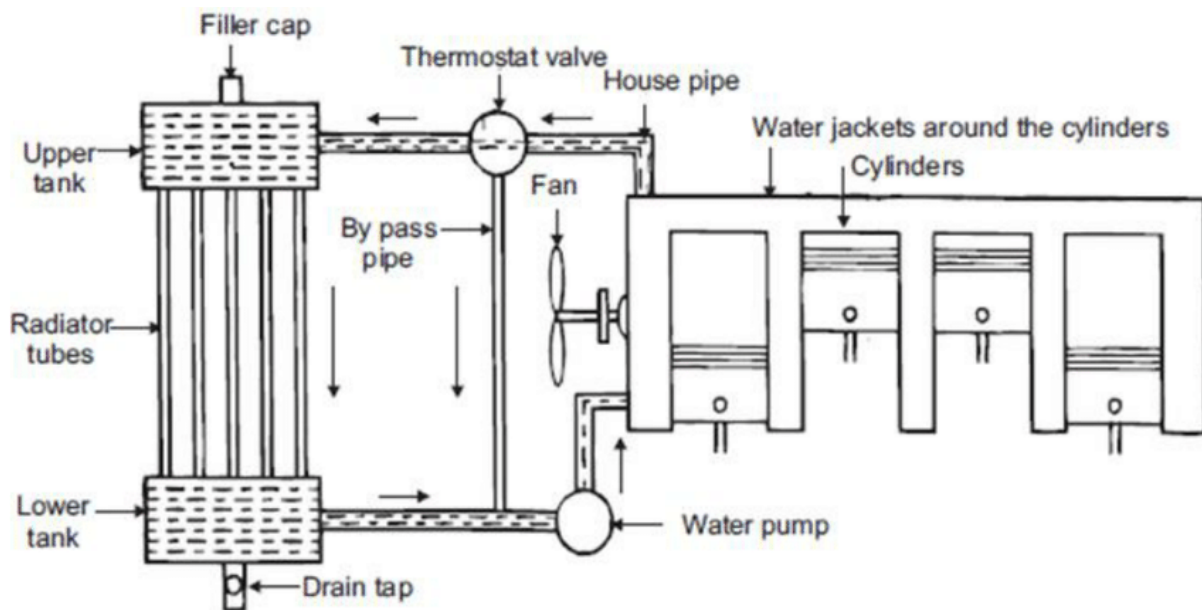
Testing:

- a. Install the overhauled carburetor back onto the engine.
- b. Reconnect the fuel line and battery.
- c. Start the engine and adjust the idle speed and mixture for smooth operation.
- d. Use a vacuum gauge (if available) to fine-tune carburetor settings.
- e. Check for any signs of fuel leaks.

Results:

Upon completion of the overhaul, the carburetor should deliver a proper air-fuel mixture, resulting in improved engine performance, smooth idling, and fuel efficiency. The engine should start and run smoothly, and there should be no signs of fuel leaks or irregularities. Regular maintenance and adherence to manufacturer specifications are essential for sustaining the benefits of the overhaul.

5. Overhauling the water cooling system.



Aim:

The aim of this practical exercise is to overhaul a water cooling system, ensuring efficient heat dissipation and preventing engine overheating by disassembling, inspecting, cleaning, replacing worn-out components, and reassembling the cooling system.

Materials:

- Coolant (antifreeze)
- Radiator hoses
- Thermostat
- Radiator cap
- Water pump
- Heater core (if applicable)
- Hose clamps
- Cooling system flush solution
- Distilled water
- Rags and shop towels

Tools:

- Socket set
- Screwdrivers (flathead and Phillips)
- Pliers
- Hose clamp pliers
- Coolant drain pan

Funnel
Cooling system pressure tester
Hose cutter
Hose clamp tool
Torque wrench

Procedure:

Preparation:

- a. Ensure the engine is cool before starting the overhaul.
- b. Drain the existing coolant into a suitable drain pan.
- c. Remove the radiator cap to aid in draining.

Disassembly:

- a. Disconnect and remove the radiator hoses, taking note of their positions.
- b. Remove the thermostat and inspect it for proper operation.
- c. Remove the water pump, checking for any signs of leakage or wear.
- d. If applicable, remove the heater core for inspection.

Inspection and Cleaning:

- a. Inspect hoses for cracks, bulges, or signs of wear; replace if necessary.
- b. Check the radiator for clogs or damage; clean or replace as needed.
- c. Inspect the water pump impeller for wear or damage; replace if necessary.
- d. Inspect the thermostat housing and gasket; replace if needed.
- e. Flush the cooling system using a cooling system flush solution.

Replacement of Worn Parts:

- a. Install new radiator hoses, ensuring proper fit and routing.
- b. Replace the thermostat with a new one.
- c. Install a new water pump with a new gasket.
- d. If applicable, replace the heater core.

Reassembly:

- a. Reconnect the radiator hoses to the proper locations.
- b. Install the new thermostat and gasket.
- c. Reinstall the water pump with a new gasket.
- d. Reconnect the heater core if it was removed.
- e. Use new hose clamps and tighten them securely.

Refilling and Testing:

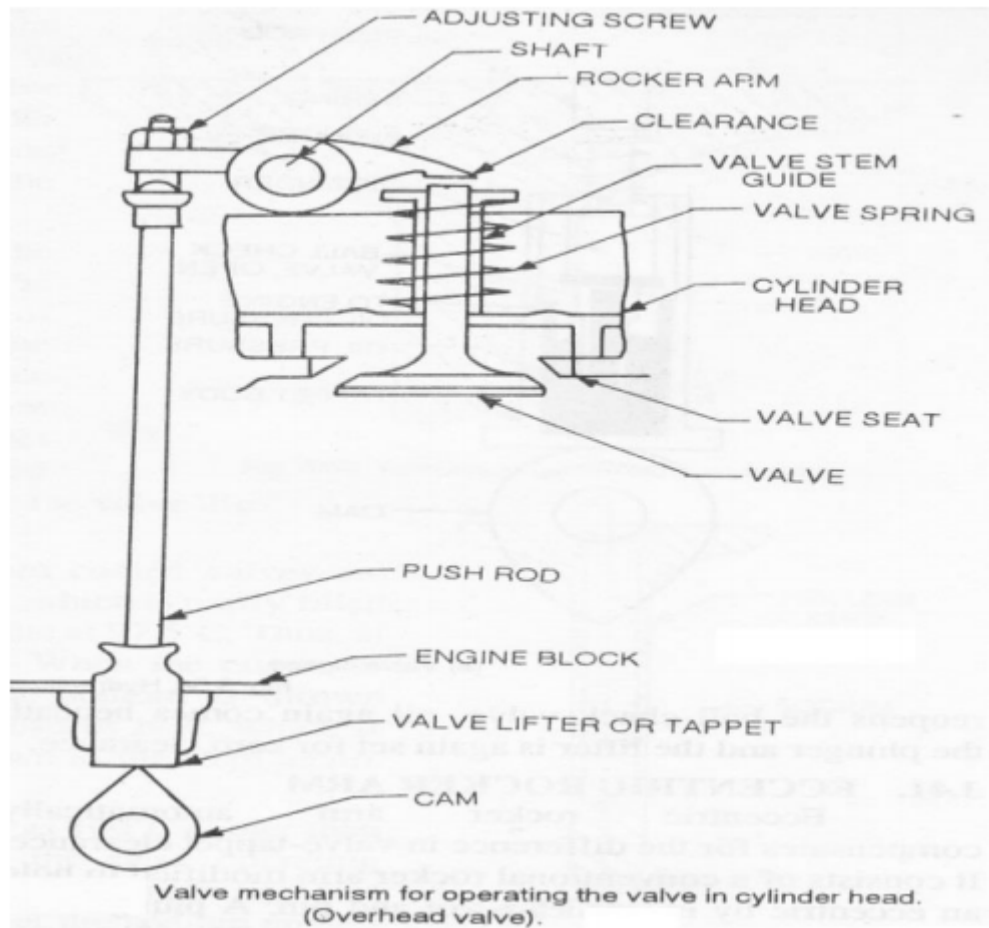
- a. Refill the cooling system with a mixture of coolant and distilled water.
- b. Bleed air from the system by running the engine with the radiator cap off.
- c. Use a cooling system pressure tester to check for leaks.
- d. Top off the coolant as needed and reinstall the radiator cap.
- e. Start the engine and monitor the temperature gauge to ensure proper cooling.

Results:

Upon completion of the overhaul, the water cooling system should effectively dissipate heat, preventing engine overheating. There should be no signs of leaks, and the engine should maintain a consistent and appropriate operating temperature. Regular maintenance and adherence to manufacturer specifications are crucial for sustaining the benefits of the overhaul.

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6. Inspect the component for wear and tear of the overhead valve operating mechanism.



Aim:

To inspect the overhead valve operating mechanism for wear and tear and assess its overall condition.

Materials:

- Safety goggles
- Mechanic gloves
- Overhead valve engine (disassembled)
- Cleaning solvent
- Rags or shop towels

Tools:

Screwdrivers
Socket set

Combination wrench set
Valve spring compressor
Feeler gauge set

Procedure:

Safety Precautions:

- Wear safety goggles and mechanic gloves.
- Ensure the engine is cool before starting the inspection.

Engine Disassembly:

- Disassemble the engine to expose the overhead valve operating mechanism.
- Remove the valve cover and any other components necessary to access the valve mechanism.

Visual Inspection:

- Visually inspect components for signs of wear, corrosion, or damage.
- Check for loose or damaged parts, such as rocker arms, pushrods, and valve springs.

Clearance Measurement:

- Use feeler gauges to measure the valve clearance.
- Check both intake and exhaust valve clearances for each cylinder.

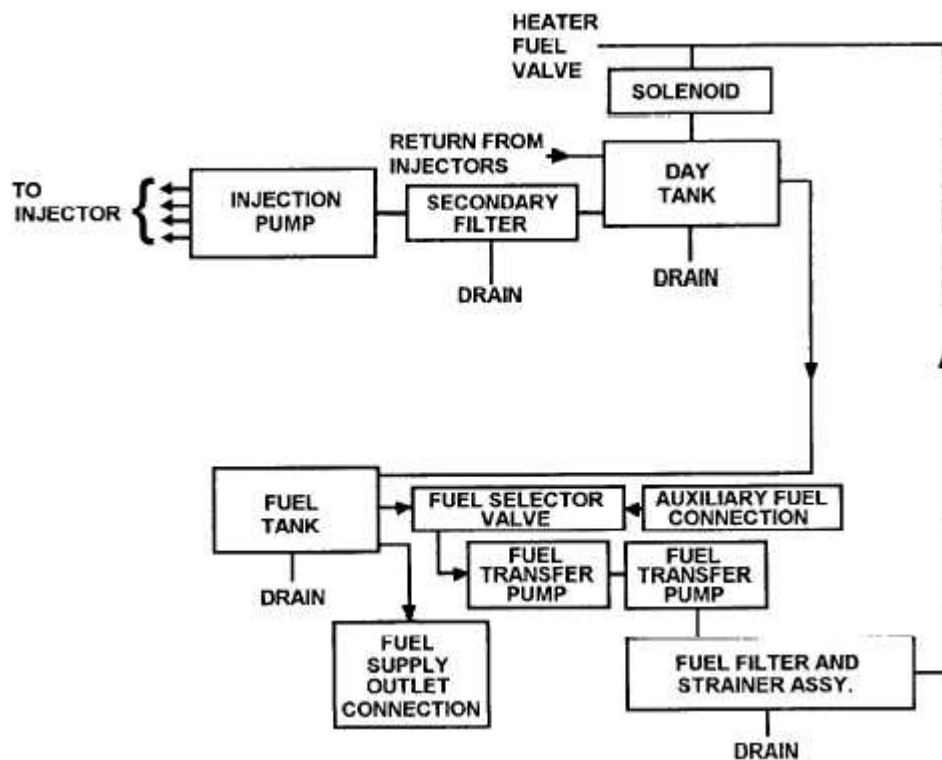
Reassembly and Testing:

- Replace any worn or damaged components.
- Assemble the engine components back together, following proper torque specifications.
- Start the engine and listen for abnormal noises from the valve train.
- Recheck the valve clearances to ensure they are within the specified range.

Results:

Upon inspection, any wear or tear in the overhead valve operating mechanism was identified and addressed, ensuring optimal engine performance and longevity.

7. Inspect the fuel components of the fuel tank and fuel lines.



Aim:

To inspect the fuel components of a fuel tank and fuel lines to ensure their integrity and functionality.

Materials:

- Safety goggles
- Gloves
- Wrenches
- Inspection mirror
- Clean rags
- Flashlight
- Fuel system cleaner (optional)

Tools:

Wrench set

Inspection mirror

Flashlight

Procedure:

Safety Precautions:

- Wear safety goggles and gloves to protect eyes and hands.

Visual Inspection:

- Use a flashlight and inspection mirror to visually inspect the fuel tank and lines for any visible signs of leaks, corrosion, or damage.

Tightness Check:

- Use wrenches to check the tightness of the fuel line connections and ensure there are no loose fittings.

Cleanliness Check:

- Inspect for any accumulated dirt or debris in and around the fuel components. Use a fuel system cleaner if necessary.

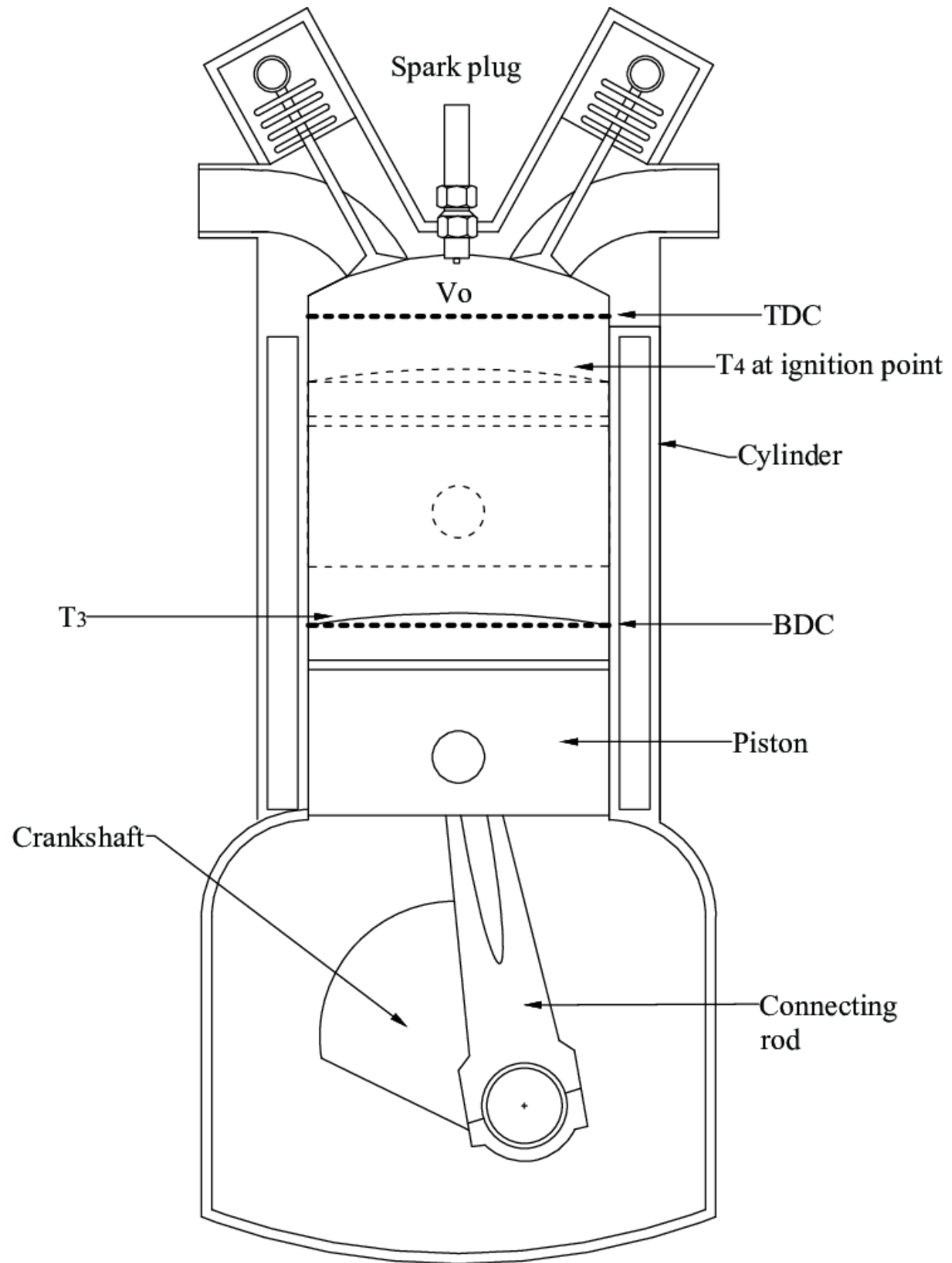
Pressure Test (Optional):

- Conduct a pressure test on the fuel system to identify any leaks or weaknesses. Follow manufacturer guidelines for the specific procedure.

Result:

Upon inspection, if no leaks, damage, or irregularities are found, the fuel components are deemed to be in good condition. Any identified issues should be addressed promptly to maintain the optimal performance and safety of the fuel system.

8. Inspect and cleaning of combustion chamber.



Aim:

To inspect and clean the combustion chamber of an internal combustion engine to optimise fuel combustion and engine performance.

Materials:

Safety goggles
Gloves
Engine degreaser
Carbon deposit cleaner
Scraper or brush
Shop towels

Tools:

Socket and ratchet set
Spark plug socket
Combustion chamber cleaner tool (if available)

Procedure:

Safety Precautions:

- Wear safety goggles and gloves to protect eyes and hands.

Spark Plug Removal:

- Use a spark plug socket to remove the spark plugs to gain access to the combustion chamber.

Visual Inspection:

- Inspect the combustion chamber for carbon deposits, soot, or other buildups using a flashlight.

Cleaning:

- Apply engine degreaser and carbon deposit cleaner to the combustion chamber. Use a scraper or brush to gently remove deposits.

Wipe Clean:

- Use shop towels to wipe the combustion chamber clean of any remaining residue and ensure a thorough cleaning.

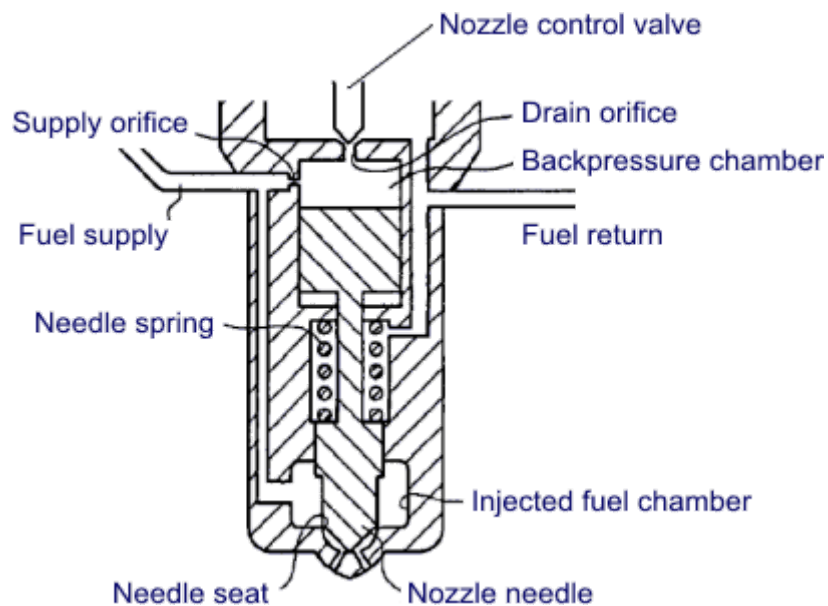
Spark Plug Reinstallation:

- Reinstall the spark plugs to the specified torque, ensuring a proper seal.

Result:

Upon completion, the combustion chamber should be free of carbon deposits and other contaminants, promoting efficient fuel combustion. This process helps maintain optimal engine performance and fuel efficiency while reducing emissions. Regular inspection and cleaning contribute to the longevity of the engine.

9. Inspect and testing of fuel injection.



Aim:

To inspect and test the fuel injection system to ensure proper fuel delivery and combustion in an internal combustion engine.

Materials:

Fuel pressure gauge
Noid light set
Multimeter
Safety goggles
Gloves
Fuel system cleaner (optional)

Tools:

Wrench set
Screwdriver set
Fuel pressure tester
Noid light kit
Multimeter

Procedure:

Safety Precautions:

- Wear safety goggles and gloves to protect eyes and hands.

Fuel Pressure Test:

- Connect the fuel pressure gauge to the fuel rail and check for the specified fuel pressure according to the vehicle's manual.

Injector Function Test:

- Use a Noid light set to test the injector pulse by connecting it to the injector harness while cranking the engine. Ensure that the Noid light flashes.

Resistance Check:

- Use a multimeter to measure the resistance of each fuel injector. Compare the values with the manufacturer's specifications.

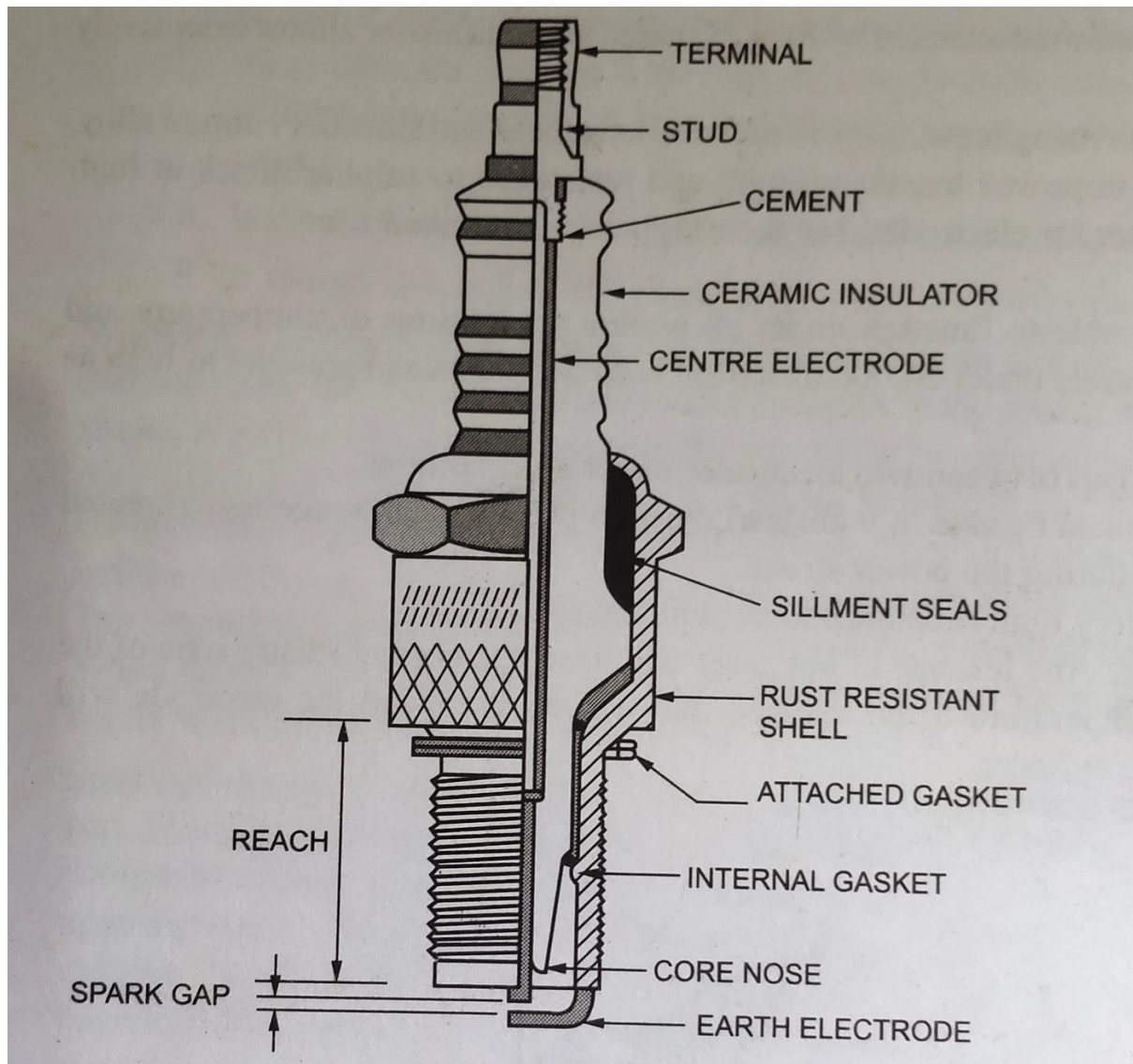
Cleaning (Optional):

- If necessary, use a fuel system cleaner to clean the fuel injectors and remove any deposits that may affect performance.

Result:

Upon completion of the inspection and testing, if the fuel pressure is within the specified range, the injectors show proper pulse and resistance, and any necessary cleaning has been performed, the fuel injection system is deemed to be in good condition. This ensures optimal fuel delivery and combustion, contributing to the efficient operation of the engine.

10. Inspect and clean the spark plug.



Aim:

To inspect and clean spark plugs to ensure proper ignition and combustion in an internal combustion engine.

Materials:

- Safety goggles
- Gloves
- Wire brush
- Spark plug gap tool
- Spark plug cleaner or solvent
- Compressed air

Tools:

Spark plug socket and ratchet
Spark plug gap tool
Wire brush
Spark plug cleaner or solvent

Procedure:**Safety Precautions:**

- Wear safety goggles and gloves to protect eyes and hands.

Spark Plug Removal:

- Use a spark plug socket and ratchet to carefully remove each spark plug.

Visual Inspection:

- Inspect the spark plugs for signs of wear, fouling, or deposits.

Cleaning:

- Use a wire brush to gently clean the electrodes and insulator. Use a spark plug cleaner or solvent for more thorough cleaning if necessary.

Gap Adjustment:

- Use a spark plug gap tool to ensure that the spark plug gaps are set to the manufacturer's specifications.

Reinstallation:

- Carefully reinstall the spark plugs and tighten them to the recommended torque.

Result:

After cleaning and inspection, if the spark plugs show no signs of damage, have the correct gap, and are free of deposits, they are considered to be in good condition.

This ensures efficient ignition and combustion, contributing to the overall performance and fuel efficiency of the engine. Regular maintenance of spark plugs is essential for optimal engine operation.