SNS COLLEGE OF TECHNOLOGY

COIMBATORE - 35

DEPARTMENT OF MECHANICAL ENGINEERING

Valve timing and port timing diagrams are critical for understanding the operation of two-stroke and four-stroke engines. These diagrams show the opening and closing of valves (or ports) and their relation to the piston's position during the engine cycle.

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1. Four-Stroke Engine Valve Timing Diagram

Phases of the Four-Stroke Cycle

1. **Intake Stroke**:
   - The intake valve opens before the piston reaches the top dead center (TDC) to allow the air-fuel mixture to enter the cylinder.
   - Intake valve closes after the piston passes the bottom dead center (BDC), ensuring maximum charge enters.
2. **Compression Stroke**:
   - Both valves remain closed as the piston moves from BDC to TDC, compressing the air-fuel mixture.
3. **Power Stroke**:
   - The spark plug ignites the mixture, causing a rapid increase in pressure that pushes the piston downward.
   - Both valves remain closed.
4. **Exhaust Stroke**:
   - The exhaust valve opens before the piston reaches BDC to release exhaust gases.
   - It remains open as the piston moves upward, expelling burnt gases.

Valve Timing Diagram for a Four-Stroke Engine

- **Intake Valve**: Opens 10°–20° before TDC and closes 40°–50° after BDC.
- **Exhaust Valve**: Opens 30°–50° before BDC and closes 10°–20° after TDC.
- **Overlap**: Both intake and exhaust valves are slightly open at TDC during the transition from exhaust to intake strokes (10°–20°). This overlap improves scavenging.

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2. Two-Stroke Engine Port Timing Diagram

In two-stroke engines, the valves are replaced by ports, and the timing of these ports determines the engine's operation.

Phases of the Two-Stroke Cycle

1. **Intake Phase**:
    - As the piston moves upward, a vacuum is created in the crankcase, drawing in the air-fuel mixture through the intake port.
    - The transfer port is closed during this phase.
2. **Compression Phase**:
    - The piston compresses the air-fuel mixture in the combustion chamber while the transfer and exhaust ports are closed.
3. **Power Phase**:
    - The compressed mixture is ignited, and the resulting explosion forces the piston downward.
4. **Exhaust Phase**:
    - As the piston moves downward, the exhaust port opens, releasing burnt gases.
    - The transfer port also opens, allowing the fresh charge from the crankcase to enter the cylinder.

Port Timing Diagram for a Two-Stroke Engine

- **Exhaust Port**: Opens ~110° before BDC and closes ~110° after BDC.
- **Transfer Port**: Opens ~120° before BDC and closes ~120° after BDC.
- **Intake Port**: Opens ~140° before TDC and closes ~140° after TDC.

Key Differences Between Valve Timing and Port Timing

Aspect	Four-Stroke Engine	Two-Stroke Engine
Cycle	4 strokes (2 revolutions)	2 strokes (1 revolution)
Timing Mechanism	Valves (camshaft-controlled)	Ports (piston-controlled)
Overlap	Intake and exhaust overlap	Transfer and exhaust overlap
Efficiency	Higher, with more precise control	Lower, with simpler construction

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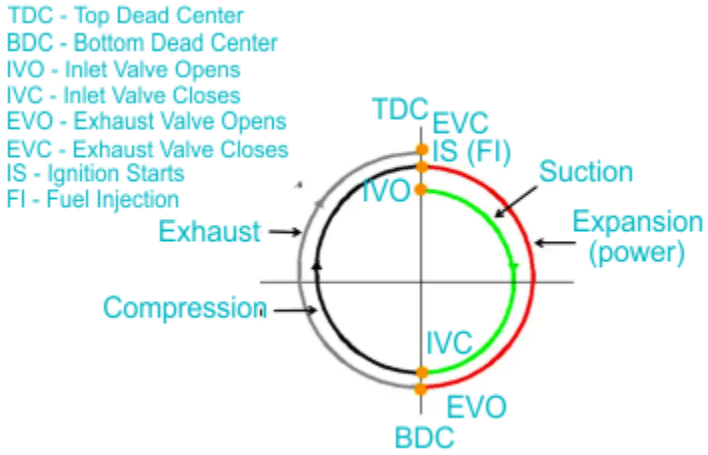
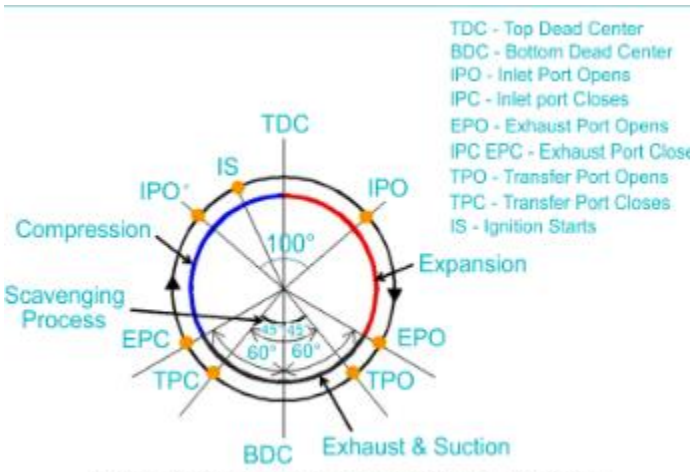
Purpose of Timing Diagrams

1. **Maximizing Efficiency**:
    - Ensures the air-fuel mixture is fully utilized for combustion.
2. **Improving Power Output**:
    - Optimizes the timing of valve/port operations to maximize power.

3. **Reducing Emissions**:
    - Prevents unburnt fuel or incomplete combustion by improving scavenging.
4. **Ensuring Smooth Operation**:
    - Reduces knock, misfires, and irregularities in engine operation.



Theoretical Valve Timing Diagram of 4 Stroke Engine



Valve Timing Diagram of 2 Stroke Petrol Engine