

SB031

Camshaft Lobe Design & Specification

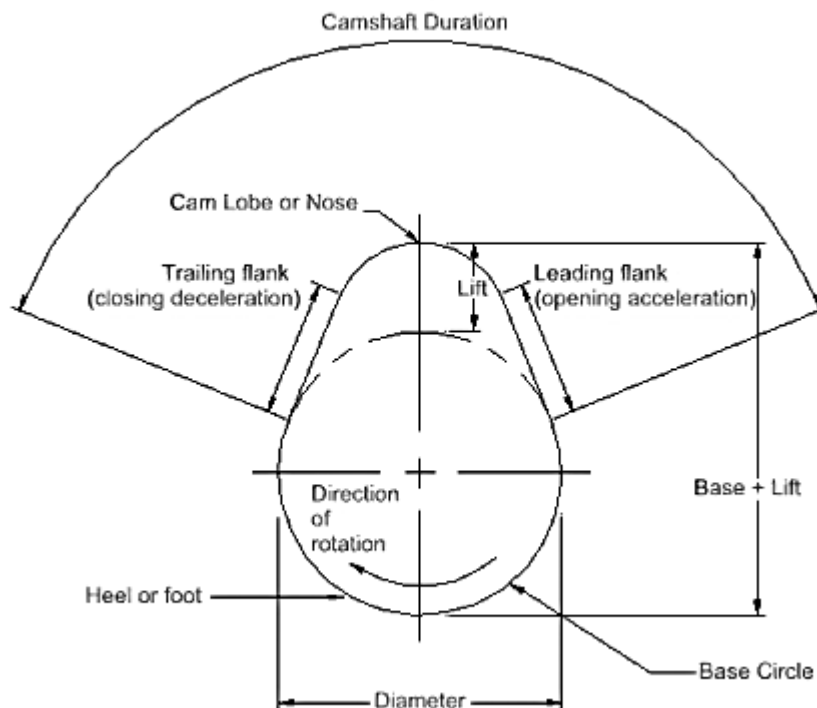


Figure 1. Camshaft Lobe Terminology

Camshaft Timing Specifications: The measurement of the start of opening and finish of closing of the intake and exhaust valves, *stated in terms of the angle of the crankshaft* in relation to the piston stroke Top Dead Center (TDC) or Bottom Dead Center (BDC). This specification is often listed in the workshop manual and unless otherwise stated will usually refer to the opening and closing at the specified tappet setting.

Example Mitsubishi 4M40: Inlet valve opens 19° BTDC (Before Top Dead Centre)
Inlet valve closes 53° ABDC (After Bottom Dead Centre)
Exhaust valve opens 60° BBDC (Before Bottom Dead Centre)
Exhaust valve closes 16° ATDC (After Top Dead Centre)

Note: Remember that one revolution of the camshaft represents two revolutions of the crankshaft and that these specifications are for the crankshaft and are actually half of this at the camshaft.

Camshaft Duration: The number of degrees of crankshaft rotation for which the valve is lifted off the valve seat.

Example: Inlet valve duration: $19^\circ + 180^\circ + 53^\circ = 252^\circ$
Exhaust valve duration: $60^\circ + 180^\circ + 16^\circ = 256^\circ$

Asymmetrical camshaft: When the intake and exhaust valve durations are different. If the durations are the same, the camshaft is said to be symmetrical.

Example: Inlet valve duration 252° & Exhaust valve duration 256°, therefore Asymmetrical.

Valve Overlap: The number of degrees of crankshaft rotation between the exhaust and intake strokes for which both valves are off their seats.

Example: Valve overlap: $19^\circ + 16^\circ = 35^\circ$

Cylinder Under Pressure: The number of degrees of crankshaft rotation between the compression and power strokes for which both valves are closed.

Example: Cylinder under pressure: $(90^\circ - 53^\circ) + 180^\circ + (90^\circ - 60^\circ) = 247^\circ$

Lobe Separation or Lobe Spread: The separation between the centerlines of the intake and exhaust lobes measured in actual *camshaft degrees*.

Example: No. of degrees of separation.
$$= \frac{1}{2} \times \left(\left(\frac{\text{In. duration}}{2} - \text{In. BTDC} \right) + \left(\frac{\text{Ex. duration}}{2} - \text{Ex. ATDC} \right) \right)$$

$$= \frac{1}{2} \times \left(\left(\frac{252^\circ}{2} - 19^\circ \right) + \left(\frac{256^\circ}{2} - 16^\circ \right) \right)$$

$$= \frac{107^\circ + 112^\circ}{2} = 109.5^\circ$$

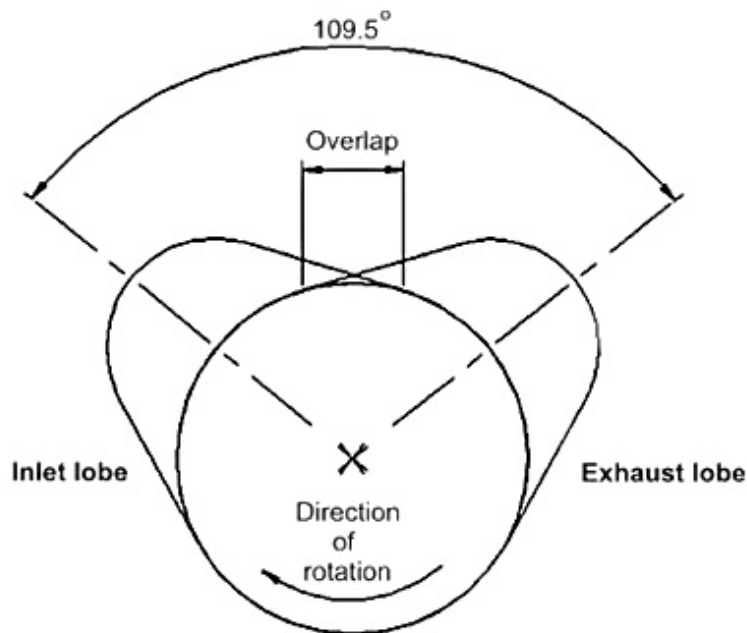


Figure 2. Valve Overlap and Lobe Separation

Camshaft Lift: Typically the measure of the maximum distance that the valve is lifted off the valve seat. This is the same as the actual cam lobe lift less the hot tappet clearance in an overhead cam engine where the camshaft lobes run directly on the cam buckets. However, in any engine with a 'rocker arm', the valve lift is equal to the lobe lift multiplied by the rocker arm ratio less the hot tappet clearance.

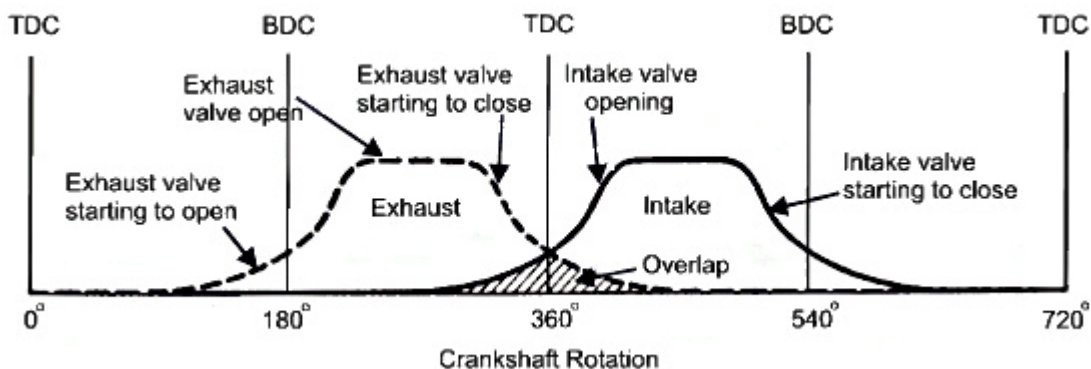


Figure 3. Graphic representation of a typical camshaft showing the relationship between the intake and exhaust valves.