

## Technical Tips No.4

### Timing Gear Matters

I have recently rebuilt an Isabella engine and was faced with a timing gear with two keyways and no timing mark. Like a number of Borgward technicalities the information on the subject is either difficult to understand, vague, or non-existent. Differing opinions abound but what is the definitive answer?

**Standard.** Viewing the timing gear on its outer face, a standard timing gear with one keyway has the marked tooth as the 13<sup>th</sup> tooth counted anti-clockwise from an imaginary line drawn diametrically through the keyway (not including the tooth through which the line passes). Diagram C.

**Two Keyway Gear.** The manual says, "*The hub of the camshaft timing gear has two keyways which are offset to each other at slightly less than 90°. This allows an engine performance correction by advancing the camshaft by half a tooth width. In such a case adjust the camshaft standard setting as mentioned above. Pull off camshaft timing gear, without altering the position of the camshaft, place key in unmarked keyway (less mark '0') and turn camshaft in rotating direction by half a tooth until tooth and tooth gash mesh properly. The 14<sup>th</sup> tooth of the camshaft gear, counted from zero to left side (including '0' tooth) must be placed then between '0' - '0' marks on crankshaft timing gear.*"

The above paragraph does not give figures for the change in valve timing, does not describe the effect of the correction on engine performance; and does not explain why a correction is needed when in manufacture the relationship between crankshaft and camshaft is fixed. Note: Usually, the crankshaft gear has a single '0' mark at the base of a tooth gap.

My experimentation gives figures for the change in valve timing for various crankshaft/camshaft gear positions. Perhaps because of camshaft lobe wear, my figures (in degrees) fall a little short of the design specification.

#### **Method**

Borgward states that with a tappet clearance of .015 inches, the valve timing is:

Inlet opens 18 degrees btdc, closes 56 degrees abdc.

Exhaust opens 56 degrees bbdc, closes 18 degrees atdc.

The Borgward KD sheets describe two ways of judging when a valve opens and closes:

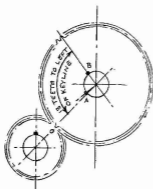
1. Using ones fingers to rotate the valve spring cap.
2. Using a clock gauge.

But I used my own method which was to set the clearance to .025 inch. Then, I determined the point at which the valve opened or closed using a .010 inch feeler. The valve begins to open when the feeler is first pinched. The valve closes just when the feeler is released. Providing the rocker faces are flat, I see no reason why this method should not work.

I measured the valve timing angles by counting the flywheel teeth either side of the TDC mark relative to the pointer on the bell housing mounting plate. A bit rough and ready, but good enough for the purpose. **Note:** The flywheel has 117 teeth, i.e. 1T (1 tooth) = 3.077°.

**Diagram A**

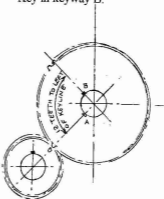
Key in keyway B.



Inlet opens 2.5T BTDC (7.69°)  
Exhaust closes 6.5T ATDC (20.00°)

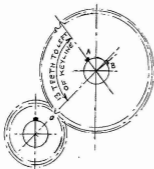
**Diagram B**

Key in keyway B.



Inlet opens 6.5T BTDC (20.00°)  
Exhaust closes 2T ATDC (6.15°)

**Diagram C (Standard)**



Key in keyway A.  
Inlet opens 4.5T BTDC (13.85°)  
Exhaust closes 4T ATDC (12.31°)