

## **Camshaft understanding**

I will begin by stating that your understanding of what I try to get across will be GREATLY enhanced if you obtain a degree wheel, fab up a pointer and do some checking on your own

### **Camshafts, valve timing and valve lash, and my take on them**

There are problems with the Indian camshafts

How bad are they?

I will just say that if you are the intricate type and have read the valve timing specs that R.A. Lister published for the CS engine, that you will be astonished if you stick a degree wheel on your engine and a dial indicator on your valve retainers and chart some results

I have not checked every camshaft that has passed through my fingers but the ones I have checked are, uhh, let me say, they do look like a CS camshaft, but the similarities pretty much end there

I think that obvious questions at this point would be - if they are as bad as you say why does my engine run along nicely and all I did was line up the marks, set the valves and start her up?

Many of us cut our teeth on gasoline engine technology and the older set probably on carbureted engines.

Now on to diesel technology and antiques at that!

Barring a blocked air-filter, most of the time the Lister can move plenty of combustion air through its lungs even with inefficient or less than optimum ports and valve openings - even if they are somewhat out of time

Most of the performance issues will rest on fuel delivery and that is all about injector (and pump) technology and timing of the injection pulse

That is why so much focus (including diagnostics) is all about the fuel injection and very little about valves and air-flow

Why does my engine run so nice if the camshaft is off spec?

A spark ignition engine that is not in good tune or is mistimed will run rough, miss and otherwise very well show the owner that it is not a happy camper

A slow speed diesel meanwhile is going to hit every other revolution until things are off so far that it will hardly run

The engines go putt-putt-putt-putt-putt almost no matter what

Some of the sharpies here have noticed things like intake noise and exhaust notes that are clues to unhappiness but it takes a trained ear to know these things.

**Engine like their valve events to happen in a certain time frame:**

Valve events are:

Intake opening  
Intake closing  
Exhaust opening  
Exhaust closing

Air-flows through a diesel engine running at 650 RPM are quite uncomplicated. This is not my wisdom, but factual information I am just passing on

## **Understanding lash**

In the perfect world an engine designer specs a desired lift for his valves that starts at some desired time, and ends at some desired time

Because of thermal expansions and contractions there must be clearances (lash) to allow this to happen without holding the valves off their seats as the engine heats

Simple calculations allow for the designer to say that in order to have this all happen the camshaft lobes must have a given profile and the clearance in the system (lash) that operates the valves must be at XYZ

In engines that operate above a given RPM it is important for lash to be eliminated prior to the real lift starting (this is ramp in camshaft terminology) because if things come together too abruptly they are destroyed in the process

This is not a consideration in a slow speed engine

The importance of lash in a slow speed engine is limited to:

A: That it is large enough to allow for thermal actions and let the valve close on the seat

B: That it isn't so large that the parts and pieces can get out of order such as your lash caps coming off the valves, or the push rods fall out of the sockets

If we lock ourselves into that thought that lash must be the figures in the manual sent with the engine then we cannot use the one and only tool the D-I-Y guy has at his disposal to adjust the important valve events in his engine

**No matter the rpm of type of engine, the ideal is to:**

Have the intake valve opening when combustion chamber pressure is lower than the intake manifold pressure

Have the intake valve closed when combustion chamber compression pressure is equal to intake manifold pressure

Begin opening the exhaust valve as close to BDC as possible

Use all the expansion ratio possible in the power stroke

And yet have the valve open soon enough the exhaust valve is not a restriction on the exhaust stroke

Close the exhaust valve when as much of the exhaust gasses have been pushed from the combustion chamber

All this without smacking any valves into a piston

**That is a nice description of the two most important of the four valve events which are:**

Opening the intake valve at the right time

And closing the exhaust valve at the right time

Second to last in importance, according to most all of the experts is the opening of the exhaust valve

And last important in all circles is closing of the intake valve

This of course does not mean that #3 and #4 are of no importance, it means that if for some reason valve timing must be compromised those two events can be with less consequence than the first two

And compromise is what we must do when trying to utilize the camshafts that we are supplied with

### **OK some actual readings from this build**

First is the Lister factory valve timing specs

We are going to stick with 8/1 here for the sake of simplicity

Intake valve opening 5-9 BTDC (351-355 degrees)  
Intake valve closes 15-19 ABDC (195-199 degrees)  
Exhaust valve opens 51-55 BBDC ((125-129 degrees)  
Exhaust valve closes 15-19 ATDC (15-19 degrees)

Here are the actual specs from the recent build 8/1 engine

Lash .008  
Total lift at the intake valve .296"  
Total lift at the exhaust valve .346

Intake valve open 30 BTDC  
Intake valve closed 25 ABDC  
Exhaust valve open 55 BBDC  
Exhaust valve closed 25 ATDC

Lift is probably less critical in a slow speed engine, especially on intake

Thus the basis for this thread, how to get the cam timing better without spending a dime,, not perfect, but better