

LAB – Ignition Timing

Students: 1. _____
 2. _____
 3. _____

Date: _____
 Block: _____

THIS LAB CAN ONLY BE DONE ON AN ENGINE WITH A DISTRIBUTOR

Distributors are antiquated technology today. Luckily, some of us still work with antiques.



Fill in each box with the appropriate information. Place checks (Y) where applicable. Be sure to have Instructor's initials before moving on to the next step. Each team member will need to answer questions to receive credit for this lab.

VEHICLE IDENTIFICATION			
Year:		Make:	
Model:		Mileage:	
VIN Number:			
SYSTEM INVESTIGATION			
	<p>If your engine is Carburetted, get a signature here and skip ahead to "UNDERSTANDING."</p> <p>If your engine is Fuel Injected, search "HOW TO set BASE TIMING" on your vehicle. There might be a sequence of things you do, or wires to disconnect, or pins to jumper to disable any advance happening at idle. What do you need to do?</p>		
STOP!	INSTRUCTOR'S INITIALS:		

UNDERSTANDING

"Ignition Timing" is **CRITICAL** for the **POWER AND FUEL ECONOMY** of an engine.

WHY WE NEED IT:

It takes TIME for combustion to reach maximum pressure. Maximum pressure needs to occur JUST as the piston begins to head down the cylinder. Because of the TIME it takes to build maximum pressure, we need to ignite the air/fuel mixture (spark plug!) a little bit *before* the piston reaches the **Top** of its travel, **Dead Center** of its rotation (**TDC**). As the engine runs faster and faster, we need to spark the plugs earlier and earlier.

If we make the spark plugs fire *earlier*, it's called "**ADVANCED**," and if we make the plugs fire *later*, it's called "**RETARDED**" (*and yes, you're allowed to use this word, but only in this circumstance*).

WHAT IF IT IS NOT ENOUGH?

If the air and fuel is ignited too LATE (that is: the piston is already on its way down when combustion is at its maximum), the fire just chases the piston, costing POWER and ECONOMY. Also, the engine may run HOTTHER, as the flame heats up the cylinder walls as it chases the piston!

WHAT IF IT IS TOO MUCH?

If we ignite the plugs **TOO SOON**, the combustion pressure can try to drive the piston **BACK DOWN THE CYLINDER**, costing us power. In some cases, combustion pressure can increase TOO MUCH, causing an EXPLOSION instead of CONTROLLED COMBUSTION, which can damage the pistons (you hear this as "knock," "ping," or "detonation" – sounds kinda like wee rocks in a tin can).

SPECIAL CIRCUMSTANCE: CRUISE

If we are cruising on the highway, we can add even MORE advance. Since the throttle isn't opened much the cylinders don't fill as easily (or as fully), so there is a lot of space between all the fuel molecules, so the "flame travel" is slower = we need *more* time to get the job done, so we **ADVANCE** the timing *more*. This extra advance is ONLY during light throttle, light load conditions.

WHY CHECK IT?

For maximum power and economy, of course, but also in checking to make sure everything is working properly. The **FIRST STEP** in solving a problem, is making sure everything you **HAVE** is working **PROPERLY**.

SETUP

Find the **TIMING MARKS** at the front of the engine. These are usually notches on a pulley and degree marks on a pointer, or vice-versa.

I **STRONGLY** recommend marking the timing marks with **WHITE PAINT** so they are easier to see. I paint the **TDC** mark, and usually the degree mark I am shooting for (if base timing is at 10°, I paint the 10° marker).

EFI Vehicles: Perform the disconnect/set procedure you researched to set **BASE TIMING**. If idle speed is adjustable, set it to the required speed.

Carburetted Vehicles: Disconnect the Vacuum Advance hose from the distributor and plug it (this removes potential extra advance at idle). Set idle to required speed

CONNECTION

Get the **TIMING LIGHT** from the Tool Room

Connect the **RED** clip to
BATTERY +

Connect the **BLACK** clip to
BATTERY -



Connect the crazy looking red clamp thing around **SPARK PLUG #1 WIRE**

**MAKE SURE NO WIRES GET CAUGHT IN FANS, BELTS, MOVING PARTS
OR MELTED ONTO THE EXHAUST MANIFOLDS!!!**

EFI Vehicles: Perform the disconnect/set procedure you researched to set **BASE TIMING**.

With the engine running (and EFI Spark Advance disabled), shine the flashing light at the Timing Marks.

What degree is it at?

STOP!

INSTRUCTOR'S INITIALS:

SET BASE TIMING

More timing may provide more power, and it may require Premium gas, or it may even provide LESS power (I'm looking at YOU, Honda!)

Loosen the distributor hold-down bolt ONLY enough to turn the distributor with some resistance. It should not be sloppy, it should be able "stay" where you set it.

Turn the distributor until the timing marks line up the way they are supposed to.

You can always experiment with MORE advance (set it to 12° instead of the 10° it calls for), and see how it runs.

CONFIRMATION OF OPERATION

The "hot rod" engine in my '77 C10 runs 18° base timing, and full manifold vacuum advance at idle, for a total of 33° spark advance at idle! (Not normal)

It is also set to provide 35° at full throttle, all in by 2500rpm.

On this engine, I actually set timing by full advance, NOT base timing. I let base timing end up wherever base timing ends up. It's "Full Advance" that I care about.

Reconnect whatever you had to do to set base timing.

With the engine running, watch the timing marks as you (or a lackey) slowly increases the engine speed a bit. You should see the timing marks advance as the engine speed increases.

What does your engine do as you slowly increase the engine speed?

Many engines have a "maximum advance" that works well (it never keeps on advancing forever). This will usually happen around 3000rpm. Rev your engine up to (and a little bit over) 3000rpm, and see what the timing marks advance to. This is easier if you have an ADVANCE Timing Light, which can "delay" the Timing Light strobe so it can be read on the Timing Marks.

What does your engine advance to at 3000rpm?

(It should be higher than base timing)

LOCK DOWN the distributor if you are finished making adjustments

STOP!

INSTRUCTOR'S INITIALS:

KNOWLEDGE TEST

Why does spark occur before TDC, and not right at TDC?

What are three disadvantages to Retarded Spark Timing?

What is the greatest disadvantage of too far Advanced Spark Timing?

Return all your tool to the tool room, clean up your mess, and pat the back of the person next to you.

STOP!

INSTRUCTOR'S INITIALS: