

## Mopar Timing

The purpose of this document is to describe the precise way to set timing on your Mopar engine. It applies to non-computer controlled engines only. The author accepts no responsibility for your safety or the safety of your vehicle by using the instructions included in this document. It is expected that the user of this information is fully knowledgeable of the safety practices required to protect themselves from bodily harm and to protect their vehicle from hazards. Adequate safety precautions should be taken anytime work is performed on a motorized vehicle. Work should never be performed in a closed building without adequate exhaust ventilation.

### Tools Needed

- Timing Light
- Vacuum Gauge
- Vacuum pump (hand held)
- Vibration Damper Timing Tape
- Allen Wrench (if car has vacuum advance distributor)
- Tachometer (hand held or a helper if dash mounted)
- Distributor Hold Down Wrench

### Ignition Timing Theory

Timing is the point, measured in crankshaft degrees, that the distributor fires each respective spark plug. The measurement is established on the number 1 cylinder of all Mopar engines. Once the timing is set the distributor fires each consecutive spark plug at the same number of degrees. The crankshaft is divided into 360 degrees, a perfect circle. The point of reference is 0° (Top Dead Center {TDC}). Timing is measured After Top Dead Center (ATDC) or Before Top Dead Center (BTDC). The 0° reference means the number 1 cylinder piston is on the compression stroke at the maximum point of travel before beginning to move away from the head on its power stroke. All engines include a timing mark on the vibration damper and a gauge usually attached to the timing gear cover. The gauge usually measures from 0° to about 12° Before Top Dead Center (BTDC). BTDC is also called advanced timing because firing occurs before the crankshaft reaches the 0° point in rotation. ATDC is called retarded timing because firing occurs after the crankshaft reaches the 0° point in rotation.

The objective is to establish the minimum timing and the maximum timing of an engine. The maximum timing is the most critical from a performance standpoint. An engine needs less timing (fewer degrees of advance) at low RPM and more at increased RPM. The increase in BTDC degrees occurs over a smooth line as engine RPM increases. The line may be linear or exponential depending on the type of equipment added to control timing.

## Components That Affect Timing

**Distributor** – the primary device, which is adjusted to establish minimum timing.

**Vacuum Advance** – a device that increases or decreases the timing by moving the distributor plate. It is controlled by the amount of vacuum the engine produces. The source of the vacuum is a ported opening in the carburetor.

**Mechanical Advance**- consists of weights attached to the distributor shaft, controlled by coil springs attached to the distributor plate. Centrifugal force created by the speed of the turning distributor shaft is transferred to the weights attached to it.

Total timing is determined by measuring Initial timing (distributor setting) + Vacuum Advance (the setting of the small diaphragm can attached to the distributor) + Mechanical Timing, the advance caused by the weights attached to the distributor plate and controlled by the strength of the springs.

Correct adjustment of timing affects the quickness of the engine starting, gas mileage, amount of horsepower, rod bearing life, valve ping, and idle quality. Timing that is set outside the parameters of the capability of the engine may cause severe damage to the engine.

## PROCEDURE

**Step One** Determine the base line of the settings that affect timing and write them down.

### Initial timing

-Start with a COLD non-running engine. Find the timing mark on the vibration damper (the big round wheel about 1 inch thick behind the belt pulleys at the very bottom front of the engine). It is a perpendicular mark that is cut into the damper. Clean the mark with an appropriate shop cleaner such as WD40 so it is clearly visible. If it is not clearly visible after cleaning it use an artists brush with white paint to paint a thin line on the mark.

-Attach Mopar timing tape or measure and mark degree increments on the vibration damper to about 40° BTDC. (Note 1 inch equals 16° and 2 ¼ inches equals 36°.

-Find the degree gauge usually attached to the timing cover and visible from the top of the engine. Clean it also, so the numbers and marks are clearly visible.

-Find the distributor hold-down clamp and bolt. Loosen bolt then tighten very slightly.

- Find and disconnect the vacuum line to the distributor. Connect the vacuum gauge to the line.
- START ENGINE**, outside of garage, and run until Engine operating temperature is reached and choke is completely off, transmission in Park.
- Determine your vehicle's ideal idle speed in RPM; usually 600-800 RPM. If you have a high performance cam it may be as much as 1100 RPM.
- Connect tachometer to determine idle rpm (SEE DRAWING No. 1).
- Adjust carburetor idle screw to achieve desired rpm.
- TURN ENGINE OFF**.
- Connect Timing Light (SEE DRAWING No. 2)
- START ENGINE** and point timing light at mark on damper.  
**Record the timing reading and the vacuum reading.**
- Disconnect the vacuum gauge.
- Re-connect the vacuum line to the distributor.
- Run the engine up to 3000 RPM, point timing light as above.
- **Record the timing reading.**
- TURN ENGINE OFF**

You have now established the theoretical minimum and maximum timing. Mopar performance recommends a maximum (total) of 35° BTDC for street engines. The following step will identify and quantify the source of timing which exceeds the minimum (initial) timing.

## Step Two

- Disconnect the vacuum line to the distributor.
- Connect a vacuum gauge to the end of the vacuum tube you disconnected.
- START ENGINE**, RUN UP TO 3000 RPM, repeat with timing light as above. **Record the timing reading and the Vacuum gauge reading.**
- Subtract the first maximum timing reading from the second maximum timing reading. The difference is the number of degrees of advance timing the vacuum system is adding.
- Subtract the minimum (initial) timing (step 1) from the maximum timing as recorded in step two. The difference is the number of degrees of advance timing the Mechanical advance system is adding.

Now lets look at an example, which will help you decide the next steps. Lets say the minimum timing is set at 8° BTDC, the vacuum advance provides an additional 13°, and the mechanical advance provides 21° at 3000 RPM.  $8+13+21=42^{\circ}$ . This is too much advance timing. We have 3 choices:

- 1) Reduce the minimum timing (initial) to a point that 35° is achieved by the above tests. Set up the minimum timing procedure and retard the distributor to a number less than 8°, then re-measure everything again. Keep adjusting and measuring until the number is achieved. OR;
- 2) Reduce the Vacuum advance to a point that 35° is achieved. This done by removing the vacuum line at the canister on the distributor and inserting the 3/32 inch Hex head Allen wrench, through the hole where the line was connected, into the set screw (inside the canister) and turn the screw to the right (in) to reduce the amount of advance (or left to increase). Turn the screw one (1) turn and record the amount “1 turn right”. Re-connect the vacuum line, run the engine back to 3000 RPM and check the timing again. If still too high turn to the right and record the number of turns (or partial turns). Check timing again. Continue to adjust until the 35° is achieved.  
-Alternately you may use the hand held vacuum pump and the reading for vacuum from the first and second step instead of running the engine up to 3000 RPM. OR;
- 3) Change the springs on the distributor plate and check timing in the same manner at 3000 RPM. This is a fairly complex process and beyond the scope of this document.

You may have to use some combination of all three to achieve the desirable results which include; easy start, good idle, power throughout the RPM range, and no valve pinging.

**Disconnect all equipment and replace hoses. Happy motoring!!!!**

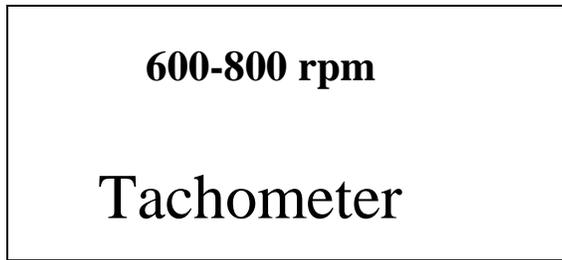
The EPA prefers low BTDC settings to reduce emissions. Unfortunately, this is counter to a high performance engine.

If you don't have the above equipment and/or do not want to go through the involved process, there is a fairly simple procedure to use, which will produce, desirable but not optimum performance.

#### **Steps**

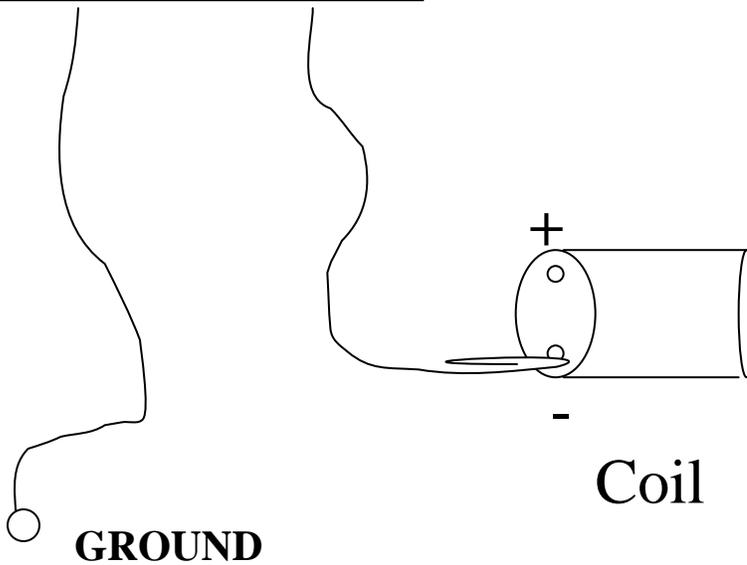
- Loosen the distributor hold-down clamp bolt.
- Start the engine and turn the distributor a small amount in the direction that the engine speeds up. This is advancing the timing.
- Tighten the bolt without moving the distributor.
- Turn engine off, and then re-start. It should turn over without hesitation and start quickly. If not reduce timing slightly.
- Test drive the vehicle. From cruising speed (about 50 MPH) accelerate slightly and listen for valve noise from under the hood. Accelerate fully and observe valve noise and vehicle performance.

If no valve noise, repeat the entire process. When valve pinging is heard reduce the advance by turning the distributor slightly in the opposite direction from above. Re-test and adjust if needed. Once this state is achieved your engine is handling all the advance timing it can take.



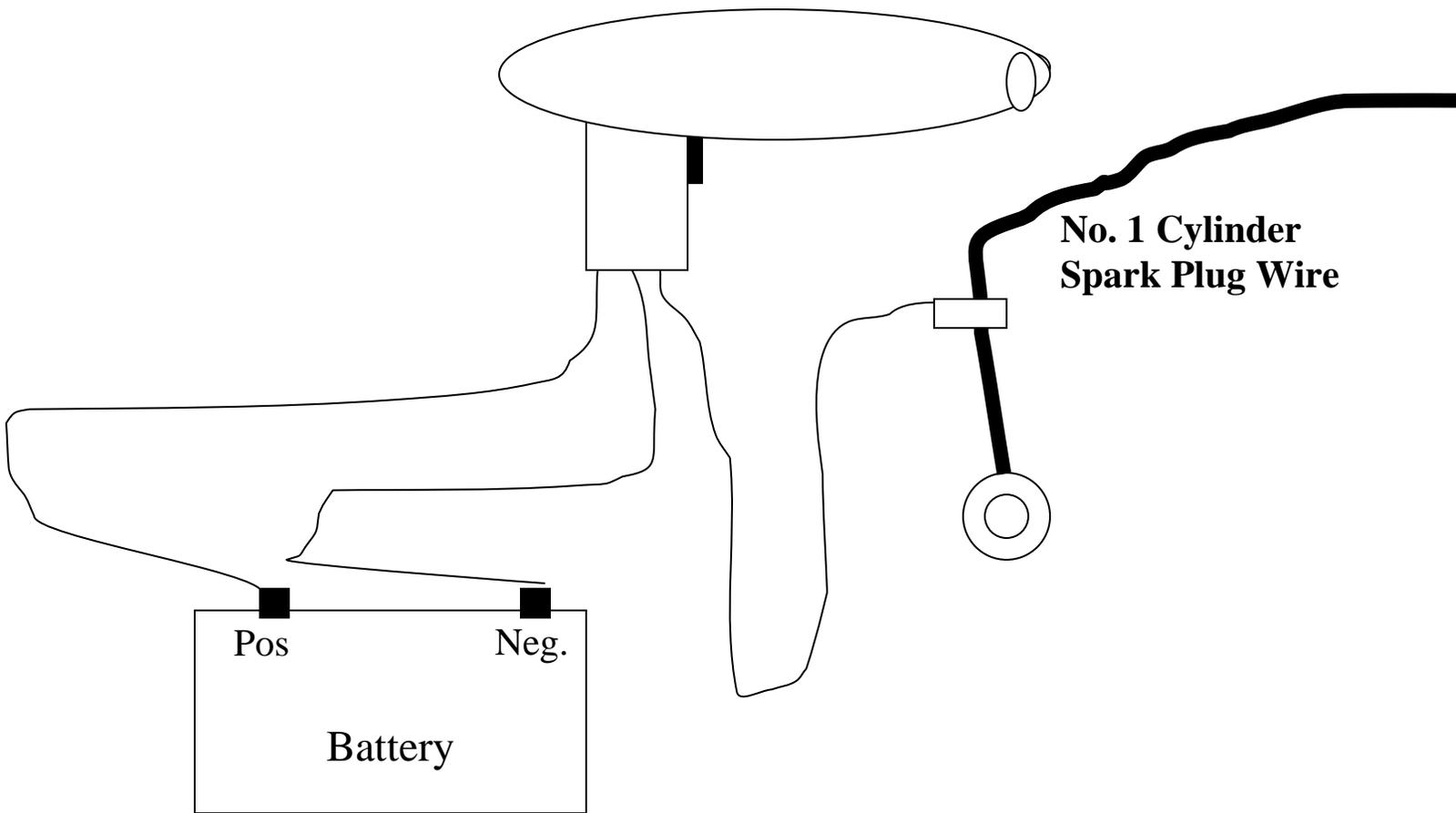
Connect Ground lead to a good source of ground.

Connect other lead to the Negative (-) side of the coil



**Drawing No. 1**

# Timing Light



**Drawing No. 2**