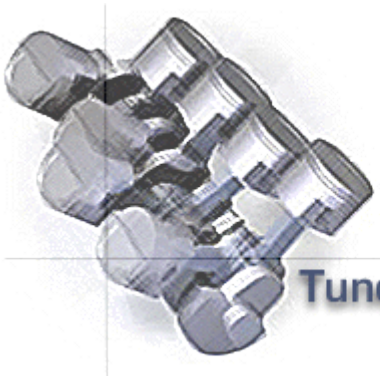

Technical Information Bulletin Rev. A 6-4-04

How to Determine Top Dead Center (With the Engine in the Car)

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For some reason, Chevrolet engines have a bad tendency for the harmonic balancer to "slip." The failure mode is very subtle and difficult to detect, and can cause all kinds of problems when trying to tune the engine. The outer "ring" of the harmonic balancer tends to rotate, or "slip," on the rubber cushion that connects it to the inner part of the balancer. When this happens, the timing can no longer be correctly set on the car, and the car will have the symptoms of running horribly, with no power, after the timing has been "correctly" set. In fact, the timing is as far off as the balancer ring has managed to twist itself, and there is no easy or obvious way to detect this. This tech paper will discuss how to determine where the actual Top Dead Center of the engine is to see if the timing mark on the balancer is in the correct location.

As always, I'm going to include the disclaimer that many of these are my own comments and opinions based on my personal tuning experience. It is recognized that other people will have different methods of doing things, and may disagree with specific methods and procedures that I use. This procedure, used as outlined in this paper, does work, and will provide reasonable accuracy. I have made every attempt to present factual, technically accurate data wherever possible. If you find factual errors in this information, please let me know so I can correct it.

Tools and Equipment Required

As a minimum, you will need the following tools & equipment:

1. Long 14mm Bolt
2. Spark Plug Socket with Ratchet & Extensions
3. Socket that fits the Harmonic Balancer Center Bolt with Extensions and Breaker Bar
4. Sharp Tipped Felt Marker
5. Flexible Scale or accurate Tape Measure

Procedure

- Park the car on a level surface, set the brake, block the wheels, and put it in "neutral" or "park."
- Disconnect the battery ground terminal. If you don't want to loose all your late-model radio station pre-sets, disconnect your coil primary lead wire (for standard ignitions) or the distributor "BAT" wire (for HEI systems). Just do something to make darned sure the ignition system won't fire….
- Remove the #1 spark plug. To make the job easier, I recommend that ALL of the spark plugs be removed, since you'll be turning the engine over by hand during this process. Whether or not you pull all of the plugs depends on how easy (or difficult) your plugs are to get to. Pull as many as you can.
- Using a socket and a breaker bar (or good ½" drive ratchet) on the Harmonic Balancer center bolt, turn the engine over by hand (clockwise as seen from the front) until the timing mark on the balancer starts coming up towards the edge of the timing plate. Stop.
- If your engine does not have a Harmonic Balancer Center Bolt, you can remove the pulleys on the Harmonic Balancer and then insert two of the pulley attach bolts back into the balancer in adjoining holes. You can then wedge a screwdriver between the two bolts and use the leverage to turn the crank over as described above.
- Smooth and de-burr the end of the 14mm bolt by slightly rounding the edges. Wire wheel it to smooth out the grinding and to keep the threads in good shape.
- Screw the bolt into the #1 spark plug hole. Screw it in by hand until it touches the top of the #1 piston.

NOTE: As an alternate method, if you cannot locate a bolt to screw into the plug hole, you can take a 3/8" drive ratched extension, 6" long, and slip it through the plug hole until it touches the piston. Use a felt marker and place a mark on the extension where the plug hole is. Pull the extension out and wrap a big wad of masking tape around the extension at the mark. Drop the extension bak into the hole until it stops on the masking tape "dam." Although slightly less accurate than a well-fitting bolt, this will allow you to determine if your balancer has slipped, and it will allow you to get a timing mark on your balancer close enough to time the engine.

- With your socket and breaker bar, turn the crank to put the piston softly but firmly up against the bolt. You're not trying to drive the bolt through the top of the piston, so use a little finesse and "feel" when doing this to avoid gouging the piston with the bolt. The piston should come into firm contact with the bolt when turning the crank clockwise (as seen from the front).

NOTE: If your timing mark was positioned as noted above, you inserted the bolt until it hit the piston, and turning the crank clockwise as described moves the piston AWAY from the bolt, then your timing mark is WAY, WAY off, and you must re-position your crank so that the piston is on its way up towards top center. You can do this by removing the bolt from the spark plug hole, shining a flashlight into the plug hole, and observing the piston. Use of a mirror is handy when doing this. When the piston is visually near the spark plug hole, insert the bolt as described above and proceed.

- Using your sharp felt marker, place a mark on the harmonic balancer at the timing plate "0" line.
- Now, using your socket and breaker bar, turn the crankshaft counter clockwise until the piston once again comes into contact with the bolt. Again, have a little "feel" for this so you don't bash the piston into the bolt with excessive force.
- Once the piston is up against the bolt with the same soft but firm feel as before, use your felt marker to place a line on the harmonic balancer at the timing plate "0" mark.
- Measure the distance between the two resulting lines on your harmonic balancer and split the distance exactly in half. This is exact Top Dead center. If it is not right on top of the engraved line on your balancer, you have a problem that needs to be corrected.

If the factory engraved line and your new felt-marker TDC line do not line up, you either have a slipped balancer outer ring, an incorrect balancer for the engine, an incorrect timing tab/timing cover, or an offset key installed in the crank. Most offset keys are only 2 degrees, so if you're off by more than 2 degrees, you most likely need a new balancer. It is also possible that the timing plate on your timing chain cover is not the correct setup for your engine combination. Whatever the reason, you need to correct the issues before trying to set your timing for proper performance.

Questions, Comments & Technical Assistance

If you have questions or comments regarding this article, or if you notice any errors that need to be corrected (which is quite possible since I'm writing this from memory…), please feel free to drop me an e-mail. Also, if you need any technical assistance or advice regarding this process, or other maintenance issues, feel free to contact me:

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