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Compression Testing

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Compression Testing

by **lannvouivre** » Tue Apr 01, 2014 8:13 pm


Max pressure allowed is 218 psi, minimum is 145 psi. The maximum difference (between highest and lowest) GM and Toyota allow is 15 psi.

And as it turns out, it's the same in the 1ZZ-FE, 2ZZ-GE, 2ZR-FE, and 2AZ-FE engines.

NOTE: Don't do this on a windy day unless you're sheltered from the wind/dust. Be careful of damaging the aluminum threads while the engine is hot (which is usually the intended time to perform testing).

1ZZ-FE COMPRESSION TEST METHOD:

- [*] Disconnect negative battery terminal and push it where it can't flop up and hit the negative post.
- [*] Remove the EFI relay in the engine bay fuse box.
- [*] Remove decorative plastic cover (if equipped): 10 mm nut and bolt, plus weird plastic clips (x2) at exhaust side of the engine. No idea how to remove them properly, mine have been gone for about 5 years.
- [*] Unplug ignition coils: squeeze the release tab and use the flat of a standard screwdriver to gently push the plug free if necessary. Don't push the blade under the lip of the plug, just use the broad, flat side. You can also use the flat to press down on the release clip if your fingers are too soft like mine. Again, DON'T PRY ANYTHING, you don't want to damage the plastic! 😊
- [*] Remove the two 10 mm bolts from the ignition wiring bracket and gently lift it so it's not obstructing the ignition coils.
- [*] Carefully remove the four 10 mm bolts securing the ignition coils to the valve cover.
- [*] Pull the ignition coils out and inspect them.
- [*] Clean dirt/dust off of valve cover around spark plug holes.
- [*] Blow the spark plug holes out THOROUGHLY with compressed air to prevent debris from entering combustion chamber.
- [*] Remove spark plugs (plug socket 5/8 in I think. A deep socket will work as well, but you'll need a magnet or needle nose pliers to pick the plugs up and out). You'll need a fairly long extension, they are deep in there.
- [*] Reconnect your battery.
- [*] Drive-By-Wire: remove throttle body and intake tube from intake manifold, move TB aside. The TB has four 10 mm bolts/nuts securing it, the nuts will need a deep socket. I don't remember how to remove the stock intake because I haven't had it on for years. You can block the plate open, but it may be easier to disconnect it from the intake manifold and set aside.
- [*] Drive-By-Cable: while cranking, fully depress the gas pedal.
- [*] Gently thread compression tester gauge into the spark plug sockets. Do not overtighten, as aluminum threads are very soft while hot. Turn the gauge so you can watch it while cranking if you're working alone.
- [*] You may need to hook the battery to a charger. Turn the key to the "start" position and watch the gauge. The gauge should rise quickly and evenly; something like 50 psi per "puff." You will crank the engine for four or five "puffs," although some manufacturers want you to wait until the gauge reaches the highest point it's going to. If it takes more than 4-5 puffs, you are probably in trouble.



lannvouivre
Posts: 1573
Joined: Thu Jun 09, 2011 1:00 pm
Location: Texas yay

[*] Repeat this test once more on the same cylinder. You will do this test twice on each cylinder, recording your observations. Record what you SEE, not what you want to see.

[*] To do the "wet" test, squirt a small volume of the proper engine oil into each cylinder; 2 squirts from an oil can, or two table spoons. Wait for a couple of minutes, so that the oil goes around the sides of the pistons. The idea here is that the oil will help seal around the rings. The oil cannot get to the valves to seal them, so you're only testing the rings here. When the rings wear, they don't press to the walls of the cylinder as well because they're less springy.

[*] Repeat the compression test on each oiled cylinder.

Today I ran one on mine (2006 base model with 95,000ish miles) during engine repair and engine performance 2 class:

- 1 was 155 psi (dry); 195 (wet)
- 2 was 180; 200
- 3 was 180; 210
- 4 was 150; 190

So it looks like I've got poor ring-to-cylinder-wall sealing. I'll probably have to rebuild the bottom end soonish? I don't know how soon, really. I'd like to have a clean work space and good lighting, as well as an engine hoist and all that jazz. I have overhauled the bottom end of an engine (LM7) before, but we didn't remove valves or anything like that, plus its heads are about as different as you can get and still have valves.

We ended up not doing a leak down since the instructor is having to do a live job from A/C repair, as well as a melted and heavily spliced engine harness on a 1998 or so GMC C3500.

Last edited by [lannvouivre](#) on Sun Feb 14, 2016 12:46 pm, edited 3 times in total.

"If you don't love me at my diddliest, you don't deserve me at my doodliest." - User ktluvscricket of reddit

Re: Compression Testing

by [joatmon](#) » Wed Apr 02, 2014 6:50 pm

That's more range than I'd expect at only 95K miles

The compression tester I have doesn't fit down the plug hole, and I never bothered to buy another or an adapter/fitting, so I never checked mine. Now I'm interested to find out. Maybe I can borrow one from an auto parts store.



[joatmon](#)

Posts: [8843](#)
Joined: Fri Mar 21, 2003 5:19 am
Location: SMC MD
Contact:

Re: Compression Testing

by [lannvouivre](#) » Wed Apr 02, 2014 7:37 pm

joatmon wrote:

That's more range than I'd expect at only 95K miles

The compression tester I have doesn't fit down the plug hole, and I never bothered to buy another or an adapter/fitting, so I never checked mine. Now I'm interested to find out. Maybe I can borrow one from an auto parts store.



[lannvouivre](#)

Posts: [1573](#)
Joined: Thu Jun 09, 2011 1:00 pm
Location: Texas yay

When I was a teenager in high school, I let it run real low on oil once. I imagine that's what caused the wide range and suspect those numbers should be much closer to 218, however, on the other hand I think the rings aren't sealing well due to losing springiness like my instructor postulated. I don't see how low oil would affect their springiness, just how it could possibly wear down the outer edges. I also heard that Toyota wanted to save money and so used unusually small pistons, and compensated with oversized rings that would wear out fast when they first began to make the 1ZZs.

I picked up my tester kit from an estate sale for \$10. I'm glad it actually works!

"If you don't love me at my diddliest, you don't deserve me at my doodliest." - User ktluvscricket of reddit

Re: Compression Testing

by [IanVS](#) » Thu Apr 17, 2014 9:33 am

Yesterday I borrowed a compression tester from an auto parts store and checked out my 2005 Vibe with 190,000 miles. I let the car warm to about 150 degrees F, and tested both first bump and fifth bump. First bump supposedly indicates the health of the valvetrain (according to [this thread](#)). All first bumps were right at 120 psi and the 5th bump numbers were extraordinarily good:

[IanVS](#)

Posts: [6](#)
Joined: Fri Feb 07, 2014 8:42 am

- 1: 205
- 2: 204
- 3: 204
- 4: 204

I was frankly amazed that an engine this old would have such good numbers. Way to go 1ZZ-FE!! Ready for another 200k miles!?

Edit: These are all dry numbers, BTW.

Re: Compression Testing

by Chiadog » Tue Apr 22, 2014 6:07 am

lanVS wrote:

All first bumps were right at 120 psi and the 5th bump numbers were extraordinarily good....

- By "first bump" do you mean one revolution of the engine? 5th bump, 5 revolutions?
- Did you open the throttle "wide open" for the compression test? If so, how do you open the throttle on a 2005 - "drive by wire" throttle body?
thanks,
chiadog



Chiadog

Posts: 971
Joined: Thu Aug 09, 2012 9:41 am
Location: Abrams, wisconsin

Re: Compression Testing

by IanVS » Tue Apr 22, 2014 6:45 pm

Yes, that is what I meant by first bump and 5th bump. As for the throttle, I, perhaps ignorantly, simply floored the accelerator pedal. Are you saying in DBW systems that is insufficient? If so, how would that skew the numbers I got? It seems logical that the TB should be wide open to allow sufficient airflow to the cylinders. If restricted, one would think the numbers would come out low, in which case my actual compression would be higher than measured. Or is my logic faulty?

IanVS

Posts: 6
Joined: Fri Feb 07, 2014 8:42 am

Re: Compression Testing

by Iannvouivre » Tue Apr 22, 2014 8:00 pm

I took the intake and throttle body off of my car for the compression test. Cranking compression is intended to be taken at WOT, not sure what differences you may see if you didn't have it open; I didn't get to try testing with mine on since my instructor is really uncooperative and hypercritical.

Speaking of the latter, today he told me to stop messing with the MAF sensor plug, then he broke the locking clip off of it. 😞 On closer inspection, the way I was trying to pull it was correct, but I couldn't pinch the release hard enough with my bare hand to get it free.

"If you don't love me at my diddliest, you don't deserve me at my doodliest." - User ktluvscricket of reddit



Iannvouivre

Posts: 1573
Joined: Thu Jun 09, 2011 1:00 pm
Location: Texas yay

Re: Compression Testing

by Chiadog » Tue Apr 22, 2014 8:16 pm

Unfortunately, I do not know much about the operation of the DBW system. But my guess was that holding wide-open-throttle from the pedal may not work, seeing as how the computer controls actual throttle position. The all-knowing computer may over-ride your input and attempt to start the car as normal - Throttle Closed.
As far as compression numbers being low with a closed-throttle test, I agree. In addition, I think compression numbers could be erratic with a closed-throttle during the test. I've only done two compression tests in my life and that was years ago, so I'm mostly guessing. Hopefully, someone with actual experience can bail Us out!
Two more questions. Did you disconnect the injector wires to prevent flooding the engine and did you ground the spark plugs to allow normal coil discharge to ground? I plan to check my 05 Base's compression in about a month once I know how to do it.
Thanks,
chiadog



Chiadog

Posts: 971
Joined: Thu Aug 09, 2012 9:41 am
Location: Abrams, wisconsin

Re: Compression Testing

by Iannvouivre » Tue Apr 22, 2014 9:14 pm

I pulled the EFI relay. My instructor claimed that in DBW systems, the injectors won't fire at WOT, but I'm pretty sure that he's wrong since the Mustang we've been working on sprayed gasoline in my face out of the exhaust when we did a



leakdown on it.

"If you don't love me at my diddliest, you don't deserve me at my doodliest." - User ktluvscricket of reddit

Iannvouivre

Posts: **1573**
Joined: Thu Jun 09, 2011 1:00 pm
Location: Texas yay

Re: Compression Testing

by **IanVS** » Wed Apr 23, 2014 6:28 am

At first I neglected to disconnect the injectors. The result was that my compression steadily increased as I tested. It was something like 175, 180, 185, 190 and then I went back and did the first few again and got close to 200. My theory is that the gas was building up and resulting in a more "wet" test. I put the car back together, started it up (took longer than usual, likely because it was flooded), let it run for a few minutes until it was back up to temp, then redid the test, this time disconnecting the fuel injectors. I also disconnected the coils, so didn't have to worry about grounding anything.

Now that I think about it, I'm suspicious of my awesome results, since the first test started off closer to 175. Maybe I'll have to repeat the test again and see if I get comparable results.

As for DBW, it would be pretty easy to determine if flooring the pedal does anything, by disconnecting the inlet to the TB and asking a helper to watch the butterfly as the car is cranked.

IanVS

Posts: **6**
Joined: Fri Feb 07, 2014 8:42 am

Re: Compression Testing

by **Iannvouivre** » Wed Apr 23, 2014 9:36 am

IanVS wrote:

Now that I think about it, I'm suspicious of my awesome results, since the first test started off closer to 175. Maybe I'll have to repeat the test again and see if I get comparable results.

Don't use my results as a baseline or anything. Mine were pretty bad. I would agree that the fuel in the cylinders would cause incorrect values due to decreasing the available cylinder volume. Luckily, it's an easy test to repeat.

"If you don't love me at my diddliest, you don't deserve me at my doodliest." - User ktluvscricket of reddit



Iannvouivre

Posts: **1573**
Joined: Thu Jun 09, 2011 1:00 pm
Location: Texas yay

Re: Compression Testing

by **Chiadog** » Wed Apr 23, 2014 7:53 pm

Iannvouivre wrote:

I pulled the EFI relay.

IanVS wrote:

As for DBW, it would be pretty easy to determine if flooring the pedal does anything, by disconnecting the inlet to the TB and asking a helper to watch the butterfly as the car is cranked.

Great ideas, Guy's!

Thanks,
chiadog



Chiadog

Posts: **971**
Joined: Thu Aug 09, 2012 9:41 am
Location: Abrams, wisconsin

Re: Compression Testing

by **Derf** » Sat Jan 09, 2016 3:52 pm

Thanks for the great step by step. At 202k miles, with a relatively cool engine got the following.

- 1 was 190 psi (dry); 223 (wet)
- 2 was 190; 224
- 3 was 183; 238
- 4 was 178; 232

Appears cylinders 3 and 4 have some minor ring leak. Not sure why the wet test went so high on 3 and 4 I used the Lisle 20250 compression tester (Made in US). Results can vary by tester model used.

<http://www.lislecorp.com/divisions/products/?product=75>

Attached an Excel sheet to log compression and valve lash results. Save with car for determining any issues during next test interval.

 [Valve Clearance 1ZZ FE.xlsx](#)



Derf

Posts: **491**
Joined: Mon Feb 04, 2013 5:19 pm
Location: NW Ohio
Contact:

(36.8 KiB) Downloaded 9 times

2005 #10,524 Neptune Vibe "Bandit" Auto, Moon & Tunes 202k 😊
1991 Pontiac Bonneville 3.8L "Granny's Whip" 133k



Re: Compression Testing Smoke

by Derf » Fri Jan 15, 2016 3:45 pm

After completing the compression test along with a tensioner o-ring job, valve lash check and valve cover gasket replacement, started the engine and had smoke everywhere. Started checking frantically for oil leak off one of the new seals onto the exhaust manifold. Then I remembered I put oil in the cylinders the day before for the wet compression test. What oil was left on the piston tops was just burning off. 😊

2005 #10,524 Neptune Vibe "Bandit" Auto, Moon & Tunes 202k 😊
1991 Pontiac Bonneville 3.8L "Granny's Whip" 133k



Derf
Posts: 491
Joined: Mon Feb 04, 2013 5:19 pm
Location: NW Ohio
Contact:

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