Product installations, evaluations, and gearhead commentary by James Langan.

TURBO ACTUATOR FAILURE AND CITY DIESEL REPLACEMENT

On July 30, 2020, I was close to home, starting up a twisty backroad, and dipping into the accelerator after a slow left turn. Turbo boost started to rise but suddenly it dropped to zero, normal acceleration ceased, and it was obvious that I was driving a naturally aspirated diesel. The exhaust/turbo brake was also no longer working. With a check engine light on the dash, I pulled into my shop and read the trouble codes using my Edge CTS2.

The result: P00AF, "turbo boost control module", and P003A, "turbocharger boost control module position exceeded learning limit" had been triggered by the ECM. After a quick Turbo Diesel Register forums search, I learned that these are telltale codes with a nonfunctioning *turbo actuator*. The P00AF code is almost always indicative of a bad actuator, but if the P226C code is also present (it was not) that typically signals a failed turbocharger.

Telltale codes for a failed turbo actuator.

I learned that these are telltale codes with a nonfunctioning turbo actuator.

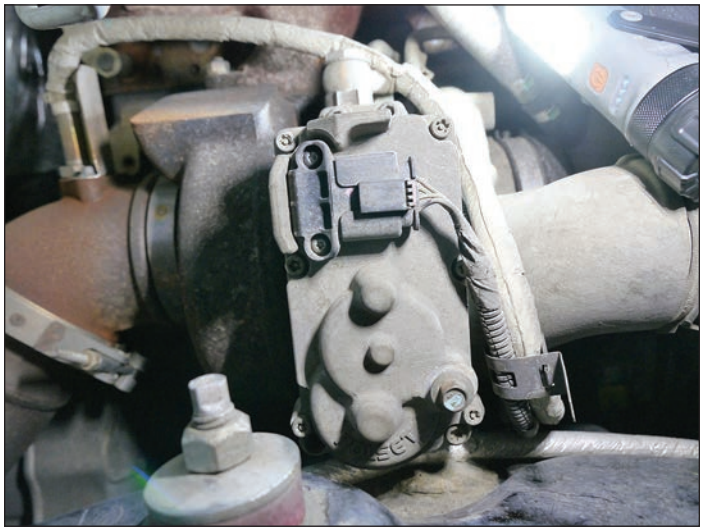
Time for Research

This was on my 2014 crew cab with a mere 54,700 miles, and 1,591 hours (334 idle and 1,257 drive) on the clock. One would think that a critical component like the turbocharger on a modern diesel, including the necessary integral actuator, would not have such an early failure. However, unfortunately this is fairly a common 6.7L Cummins problem. More research followed as I dug for solutions. I recalled a TDR article (Issue 104, pages 22-24) that discussed the replacement of the turbocharger actuator with a remanufactured unit built by City Diesel, an authorized Holset repair shop. My research continued.

Better Than OEM

The simplest and most straightforward repair for most broken parts is to install a new or rebuilt OEM replacement. However, with such a ridiculously low life-cycle, that option was not appealing. Thankfully the folks at City Diesel had recognized these frequent, premature actuator failures, and they decided to do something by engineering and building a superior aftermarket piece. The Issue 104 article told their story.

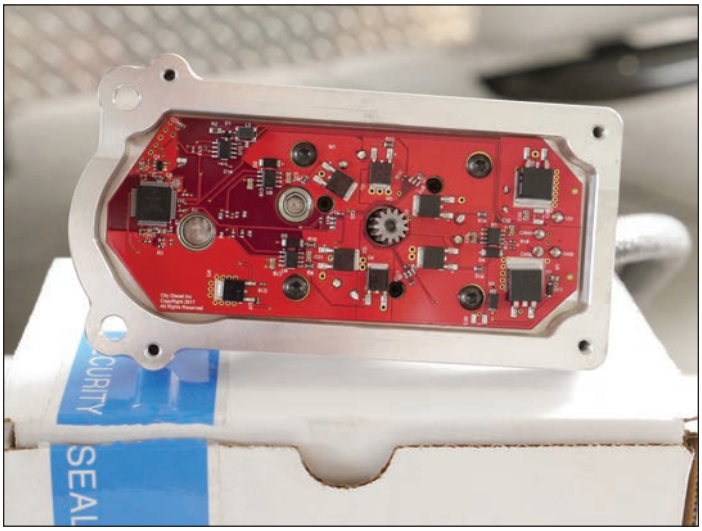
As a technical journalist always looking for extra details, so I called City Diesel and was connected with the designer, Mr. Jason Clifton. During a long chat, he shared several facts and data points about the OEM part and City's replacement. We were both convinced that my 2014 had the common actuator failure (not a bad turbo) and that their upgraded kit was the best, though not least expensive, repair option. Jason shared tidbits that made choosing his parts easy.



OEM Holset VGT actuators are getting a reputation for poor longevity.

Ridiculously Low Duty-Cycle Stock Actuator

Jason said the factory turbo actuator often quits around 5,000 hours, but my 2014 fell far short of that benchmark, with less than 1,600 hours; it was very premature. City's actuator kit for my 2013-up truck, which includes both their new actuator and their proprietary circuit board, is designed to last up to 15,000 hours, three times the typical life of the original parts. Heat is often the enemy, so City Diesel's circuit board is rated for 170°C, whereas the OE board is only rated for 140°C. While I didn't get close to 5,000 hours, just tripling the lifespan experienced on my 2014 would let me reach 150,000 miles, or 18 years instead of merely six. These are palatable numbers; it would be even better to get close to the rated longevity.



City Diesel's VGT circuit board is designed to withstand higher temperatures than OEM.

Cost Versus Benefit/Value

Remanufactured Cummins actuators have proven problematic for many. According to Jason, Cummins will not honor their actuator warranty unless it's installed by a dealer. When I was shopping, a new OEM actuator from Geno's Garage (and other sources) was $600. City's parts were 50% more, $900, but they are designed to last longer and include a warranty honored even when I install the part myself. My thinking is that better parts are preventative maintenance, and I'll pay extra now to avoid paying more later.

If one wanted to go a less expensive route, choosing Holset, most will not be able to complete the job themselves because a new actuator needs to be calibrated using a professional-level scan tool. Depending on the rates for shop labor in your area, add $150 for calibration, plus the cost to transport your non-operable truck to the repair facility. The City Diesel actuator is self-calibrating. The price differential in parts becomes negligible.

My 2014 became disabled during the final days of preparation before a big summer camping adventure trip to Colorado and then to the Northwest in my 2017 regular cab. The 2014 Crew Cab was parked in the back of my shop and waited for both my return and the out-of-stock City Diesel parts to ship from Geno's Garage.

Parts Swapping Preparations

Because the backside of the turbo actuator housing is cooled by engine coolant, the coolant must be completely drained before beginning the remove and replace procedure to insure the new parts remain clean and dry. *Coolant contamination can ruin the electronics and will void the City Diesel warranty.*

Project preparations included the following:

- Place the front axle on a jackstand
- Remove right front tire and wheel
- Drop fender liner for access
- Remove the grille and radiator rubber side flap to access coolant drain plug
- Connect 5/16" hose to the radiator drain and route to a pan to limit mess (it worked)
- Open 16 mm radiator drain nut; access is tight
- Remove radiator cap
- Let everything drip and drain as much as possible

Pulling the grille was optional, but I prefer fewer knuckle scrapes, hassles, and better access.

Fender liner dropped (front still attached) to reach the actuator.

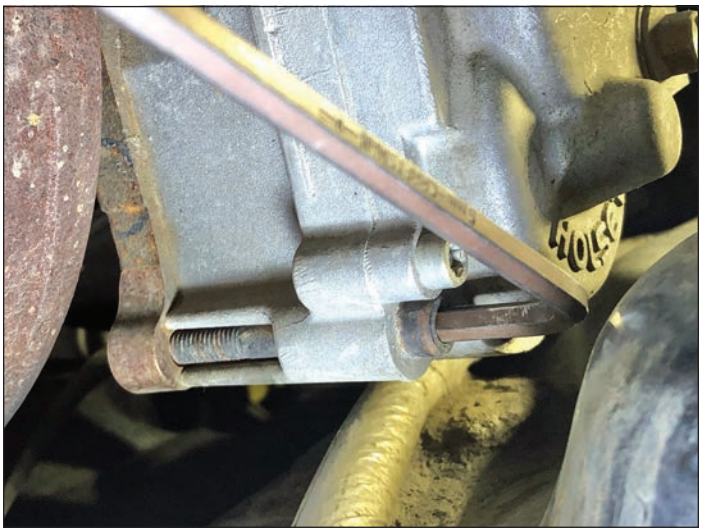
Combined with the grille, removing this wind flap made it much easier to fit a tube on the radiator drain.

I didn't spill a drop, until the pan started to overflow.

Radiator drain tube fitted. A new stubby 16 mm was helpful to open and close the drain.

Remove and Replace

Swapping the turbocharger actuator is straightforward and relatively easy for a do-it-yourself mechanic like me; the challenge is access. There are four 5mm hex socket bolts, two on the top and two on the bottom, which need to be loosened to remove the factory assembly. On 2013-up trucks with the newer radius-arm front suspension, the right front shock tower severely restricts access to the lower two bolts. Using a standard hex bit and ratchet is impossible. Jason shared that if you use a ball-shaped bit or angles their hex key, rounding or stripping is likely. If that happens the project will become *much* more difficult. Knowing this possible snag before starting, then confirming it myself, helped me conquer haste and avoid frustrating mistakes.



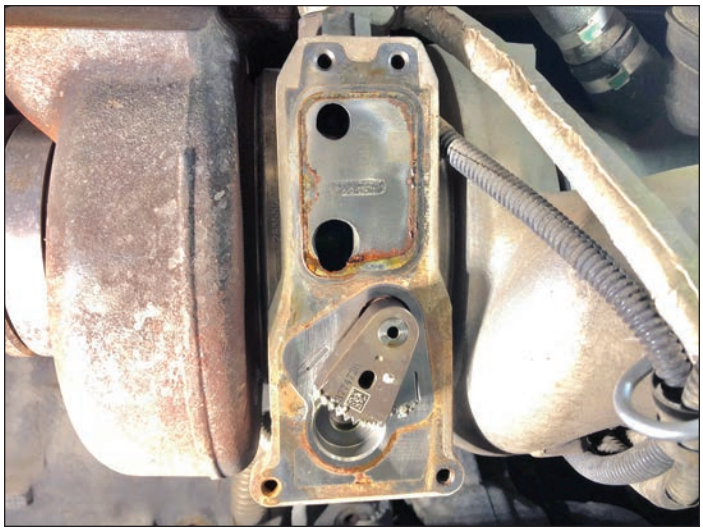
One may be able to get a 5mm hex key into the bolts, but there's almost zero space to turn the tool.

Got Special Tools?

Like many shops and technicians that need to perform a task where access is difficult, City Diesel made a custom bit for these difficult bolts. (Hopefully I am not performing turbo actuator swaps often, maybe another on my 2017.) After trying all the hex bits and keys in my main toolbox, and confirming all were too long, I dove into one of the spare, cheap, extra tool kits I have lying around. I found a stubby 5mm bit intended to slide into the female end of a magnetic driver. As Jason suggested, turning this bit with a 1/4" box-end wrench is a good way to remove the hidden fasteners. With the Holset part off, I carefully cleaned the mounting surface with a razor blade and wiped it dry with a shop towel.

Miniature 5mm hex bit, turned by a 1/4" box-end, was a much better solution, as suggested by City Diesel.

You must also confirm that the turbo actuator gear lever, visible with the actuator housing removed, is not stuck. If it is, the turbocharger likely needs to be replaced. You should be able to move the gear lever right and to the left by hand (though it takes some strength). This is addressed in step six of the installation instructions provided by Geno's Garage. The total travel is approximately one-inch. Mine appeared fine. The City Diesel boxes have *security seal* tape, so don't break the seal if you're not sure the actuator is your (only) problem.



Stock Holset actuator removed for the first time. Turbo actuator gear lever at bottom must not be seized.

Closeup of turbo actuator gear lever. Ensure it still works before breaking the security seal on the new actuator parts.

Factory photos of the 2021 Ram Turbo Diesel.

Bolt-On

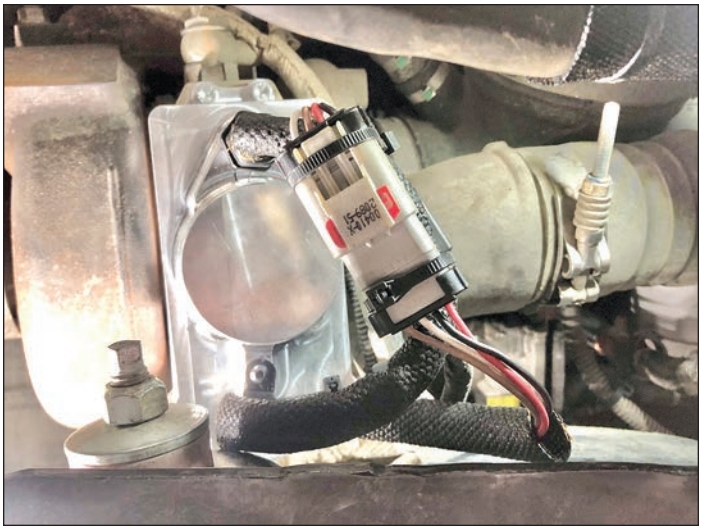
My previously assembled City Diesel actuator and electronics were fitted to the turbo and the bolts snugged. When looking at the engine through the right wheel well, the lower left bolt needed to be *in* the new assembly, as there's not room to insert it with the actuator sitting on the turbocharger.

Assembling the new actuator upgrade kit from City Diesel.

Jason had stressed that *even a small amount of coolant contamination could damage the electronics and void the warranty.* Because I didn't need to rush to finish that evening, I let the project sit overnight. The following morning, I removed the City Diesel parts to confirm everything was still dry and clean.

Again I slid the new actuator into place, and tightened the four, 5mm bolts. Recommended torque is "around 25-inch-pounds," but there's no space to use a torque wrench on the lower bolts. The top two were torqued to specification, with the bottom two tightened by *feel*.

Factory Holset 6.7L VGT actuator left, and new City Diesel replacement on the right.



Wiring harness is longer than needed for my application, but secured, zip-tied, and tidy.

New Fleetguard Coolant

Using a new 16mm stubby wrench, I closed the radiator drain and filled the cooling system with four gallons of Fleetguard ES Compleat OAT 50/50 premixed ethylene glycol coolant, purchased from my local Cummins dealer. Then I started the engine and checked for leaks. None were found.

The grille, fender liner, and wheel were replaced, and I drove two miles with the low coolant warning on the EVIC display, before returning to my shop. Two more quarts were added before covering another 20 miles. After a complete cool down, the system needed another two quarts, for a total of five gallons of Fleetguard OAT EG premix coolant.

No Calibration Necessary

Again, one huge advantage for a do-it-yourself mechanic is the self-calibrating nature of the City Diesel actuator. A straightforward remove-and-replace is all that is required. However, it appears that the self-calibrating feature may be related to a function and drivability issue. Keep reading.

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Does It Work The Same As Stock? Mostly

With the new actuator installed the turbocharger and exhaust brake feature work as I had expected, with one notable exception. After a cold start, boost builds normally, but *the exhaust brake doesn't work*. When the button is pressed, the braking action feels and sounds like about 10% of what it should be for a given rpm, gear, and road speed. It's so slight that it's difficult to feel or hear any backpressure. After the warm engine is stopped and restarted, the exhaust brake works normally and on demand…until the next cold start. (Note: *cold start*, not cold temperatures.)

Apparently I am not the first customer to experience this, as City Diesel is aware of another customer having similar lack-of performance, but they have not been able to reproduce the problem. Based on that customer's input, they theorized the issue is related to cold weather, and that they were not able to replicate the symptom because it does not get cold enough in Decatur, Alabama. They even stored a turbo and actuator in a freezer overnight. They still were not able to reproduce the problem.

City Diesel suspected (but could not confirm) that low battery voltage during cold weather, including the cycling of the intake grid heater, possibly dropped voltage below the minimum 11.0 volts required at the actuator harness for calibration. Their customer supposedly resolved the issue by cleaning and tightening his battery cables. My almost daily observations over six months tells me something else is going on that is not dependent on ambient temperatures, poor battery connections, and/or low voltage.

Cold Start Yes, But Not Low Temperatures

One of the things that City Diesel is possibly missing is that, at least in my case, the essentially nonexistent exhaust brake performance is related to *cold starts, not cold weather.* My new actuator was installed in September, which is warm, even hot, in Reno, Nevada. My trucks are parked inside an insulated shop, and the grid heater is never needed nor activated during the warmer months. During winter my shop temperature never drops below 45°F. This is not very cold for the late-model Cummins 6.7L engines, which are easy to fire. Often I just twist the key to *start*, without stopping at *run,* not giving the grid heater a chance, and therein no alleged voltage-drop from the grid heater. There are no hiccups, and the mighty Cummins simply runs.

Additionally, the batteries in my 2014 crew cab were replaced just months before the actuator failed. I cleaned the connectors with a proper wire brush battery terminal tool, and I frequently connect a trickle charger to keep the cells topped and healthy if the truck is not driven for a few days. My engine compartment is grime and dirt free, and I'm confident low voltage is not the issue. The exhaust brake has rarely worked after a cold start since the new City Diesel actuator was installed.

I've emailed City three times asking for input, hoping to help them solve the problem. However, only the guys at Geno's Garage have replied and confirmed I'm not the first customer to have this issue with City's aftermarket actuator.

Still a good truck and my all-arounder.

Still Prefer Longer Duty-Cycle

This drivability problem is slightly irritating because I often hop in my truck and drive long distances. During these drives I don't have an exhaust brake available unless I stop, let the turbo cool, shut-off the engine, then do a hot restart. In contrast, the stock parts on my 2017 work on demand, regardless of temperatures or conditions, whenever the button is pressed, even with the factory batteries, just like the original on the 2014. Yet the duty-cycle of the OEM actuator was poor. If I have to live with this niggle to have reasonable turbocharger longevity, I guess that is the current tradeoff.

But Wait, There's More

The morning of this issue's deadline I thought of trying something different and illogical. Instead of turning the key to start *after* the wait-to-start light disappeared, I did nothing for a few seconds. Letting *all* audible and visible gizmos settle and prepare themselves for flight, which apparently takes more time than *wait-to-start*, I fired the engine. *Eureka!* The exhaust brake worked immediately after this cold start, without needing a hot restart.

The next morning I intentionally started without waiting; no exhaust brake. One block from home I stopped, turned-off the engine, waited, and performed a restart. Even though the engine was still cold, the extra few second pause *after* the wait-to-start went dark again allowed the exhaust brake to work normally. Strange.

Evidently the City Diesel actuator self-calibration electronics need a little more time (only when cold) than the factory parts. The OE actuator always works, regardless of the starting procedure. Who knew? Cautious optimism prevails.

Drive diesel and tell 'em you read it in the TDR!

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