How To: High Compression QR25

For years I have been searching for a high-compression setup for the QR25 engine. It had seemed that while the VQ35 got a nice factory 10.3:1 compression (perfect for NA power), QR fans were left with a lower 9.5:1 setup. Not wanting to go the route of forced induction, I began my quest for more “all motor” power with the ultimate goal of a reliable, affordable, drop-in solution that would appeal to any QR25 owner.

The first step was finding the right piston solution. I finally discovered that the QR20 piston from Nissan’s X-Trail was a direct fit for the QR25. Its 89 mm bore and pin height was a perfect complement.

With a new set of QR20 pistons in hand, I began tearing down the engine in preparation for the swap. Mind you, this swap is no easy task. The cylinder head, lower oil pan, and upper oil pan all have to be removed before the pistons can be accessed. After carefully removing the stock rods and pistons, a side-by-side comparison revealed the QR20 piston to be much beefier with a larger ring land area than the stock QR unit. Since the QR25 pistons have been known to crack, the stronger aspects of the QR20 assured me that not only would we make more power, but we would also have more reliable internal components. Another noticeable difference: the dome on top of the QR20 piston stands higher than that of the QR25 piston, creating the higher compression we are looking for. When swapped into the stock QR25 block, the QR20 piston increases compression to a staggering 12.3:1!

With 12.3:1 compression now at hand, my attention turned immediately to a timing solution. Knowing that this sort of compression ratio would be awesome at full throttle and higher rpms, I feared that it would knock itself to death at low revs and partial throttle situations. Even premium fuel (91+ octane) alone wouldn’t be enough to combat detonation.

After searching for a timing management system, I wasn’t satisfied with what I found. Some of the less expensive solutions, like the Greddy E-manage, were nice at first glance, but the additional complexity and cost wasn’t going to be an attractive solution for most QR25 enthusiasts.

While researching a timing solution, I disconnected the knock sensor to close the electrical loop to the ECU. Doing so causes the ECU to put the engine into what I call “low-octane mode.” In this mode, the base timing goes from 15 degrees to 5 degrees and has a much more conservative timing map throughout the entire rpm band. This enabled me to drive the vehicle but didn’t allow me to get the best power out of the engine as the timing maps are very reserved. I attribute this to Nissan’s ingenuity: one can have a bad knock sensor and still drive the vehicle without any excessive danger to the engine.

After running the engine through a few tanks of gas, we turned our attention toward a fuel solution versus a timing solution. We started focusing on E-85 as the fuel source, and while we absolutely swear by it, research was needed. My investigation revealed that Snow Performance produces a MAF Voltage Based Progressive controlled Water/Meth Injection kit. This kit has a pulse wave modulation unit that drives the pump based on the MAF voltage, which will then instantaneously regulate the mixture percentages based on the voltage readings. Since the progressive controlled kit works all the time, I do not have to be so concerned about part throttle, low rpms, or quenching issues. With something as simple as -20 windshield wiper fluid I could now raise pump gas from 93 Octane to 110.

It seemed too good to be true, so there was only one way to find out: put it to the test. After installing the meth kit and a 7-gallon reservoir in the trunk, it was time to see what would happen when we fired up the engine. To my amazement, the injection of -20 windshield wiper fluid resolved all of our timing needs! Now we were able to run pump gas with the knock sensor installed, but without any knock. We were truly impressed.

At this point, many would have declared success and called it a day, but not us. Trying to see just how far we could push the power envelope on this new system, we decided to get even more aggressive with the timing. After much tinkering, we found a very stable limit at a new base timing of 17 degrees. Dyno results showed an impressive gain of over 16 horsepower with numbers churning in at 181 whp. I am now a believer, as this whole experience has opened my eyes to the power of high-compression on pump with -20 degree wiper fluid!

—William Perdigon, CEO WRAP Technology

Thanks to myspecv.com for photos and help with the build.

QR20 piston and QR25 connecting rod.

The drawback of needing larger injectors (and the necessary fuel system adjustments for it to work properly) just wasn’t jiving with us.

I was about to put in a hardwired timing management system when a colleague suggested a water/meth kit for this application. After all these years of tuning and pushing the envelope, I thought I knew everything there was to know about this, but quickly found that further

Snow Performance’s MAF-based water-meth injection kit makes this build possible.