Cooling system margin improvements:
Results of 145 cooling system tests on my 'A model' KLR650

July 15, 2006

I placed thermocouples in various locations on my KLR650 for about 18 months and watched water and oil temps on days that have been as hot as 112°F. My commute is pretty consistent, so I'd record what temperature the coolant stabilized at during my drive on the freeway (55-65 mph actual, 60-70 indicated). I won't bore you with the 145 tests and their variability, or all the little details of thermostat used etc – all this data has been reduced to make this write-up as "to-the-point" as possible.

I evaluated a number of changes to see how useful they were at reducing coolant temps. These changes were all reasonably "easy". Sure, a taller radiator or second radiator would really help out fast, but I thought we'd see what we could do cheaply first.

Some of you will ask why, as one of the tests, I didn't richen the air/fuel mixture to see what that was worth - as this tip comes up on the KLR forums. But I'm a mileage weenie and it just seems wrong to pour a $3/gallon liquid over something simply for cooler temps. I think there are smarter solutions.

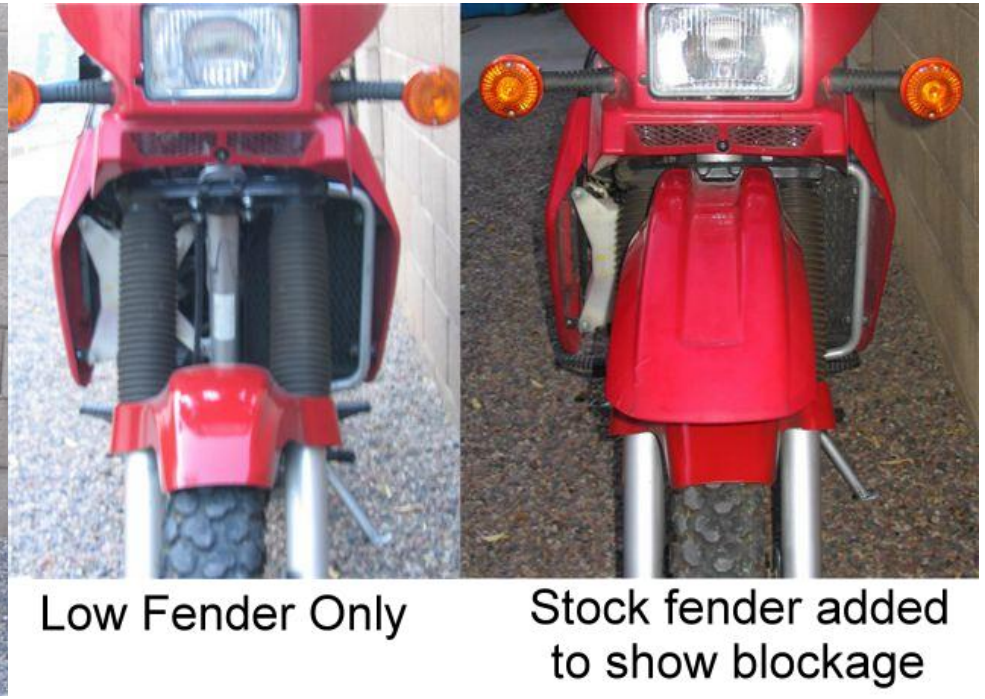
Rather than accept an opinion that someone THINKS will work, I simply tested each change a number of times to see how temperatures changed on my ride to and from work. I have run four different coolants (stock, 50/50 ethylene glycol and distilled water, 100% distilled water with Prestone Anti-Rust (and also water wetter as a separate test) and a 10/90 mixture of Zerex Super Racing Coolant with distilled water. Also run were the stock front fender, no fender at all, and a low fender from UFO. I've run with the skid plate on and off. I've run with the "Pat-man mod", and I've run with no left radiator shroud at all. I've also tested with the fan on all the time. Hence the 145 tests which combined all kinds of different variations of those. And the repeatability was good. Here are a few other notes and then I'll give the results!

*** Speed is a player, but not a huge one. At 40-50 mph the bike runs, on average about 4 degrees cooler. Up at 75-80 mph, the water is about 3-5 degrees hotter… but as an aside, the oil temp rises much more (like 20 degrees).

*** This will not surprise you – tailgating cuts airflow to the radiator. If you're back as the "two second rule" suggests (or further), results are fine but if you close that gap up you could see a 10 degree increase pretty easily.

With that said, here are the improvements in order of effectivity on a stock bike at a reasonably steady 60 mph:

1) 14 degree decrease: Removing the stock front fender (or running a low fender such as the UFO). This unplugs the entrance airflow to the radiator.



Low Fender Only

Stock fender added to show blockage

2) 11 degree decrease: Running with the fan constantly on (this result is at 60 mph, where a lot of people feel that the “ram air” can’t be helped by the fan. Answer: yes it can, I’ve seen this in my automotive-based tests as well. Obviously the fan makes an even bigger difference as you go slower. At 0 mph, that fan is worth, what, maybe 100 degrees?

3) 10 degree decrease: Changing from a 50/50 coolant mixture of Ethylene Glycol and distilled water to either 100% distilled water with an additive such as Prestone “Anti Rust”, or “Water Wetter” – or changing to a 10/90 mixture of Zerex Racing Super Coolant with distilled water (I prefer the latter – the middle container in the photo below).

4) 9 degree decrease: The “Pat-man mod” , which doesn’t allow air to sneak around the radiator core… and interestingly, I got the same improvement by simply REMOVING the left radiator shroud entirely. This works because it unplugs the exit area of the radiator. You can’t do both mods of course – but either appears to be worth about 9 degrees.

5) 2 degree decrease: Remove the stock skidplate and run unprotected. This probably makes a bigger difference in oil temp, but there’s no water down that low in the engine except for the water pump.

One other note should be made, and I saw a 5 degree decrease between some tests that, long story short, involved not only the bike breaking in and loosening up, but changed from the factory Kawasaki Blue coolant to traditional 50/50 ethylene glycol and distilled water. These tests were real early in the loop when the bike had only 1,000 miles on it and factory coolant – and this 5 degree decrease could be that the factory coolant wasn’t mixed to a 50/50 ratio, or maybe my bike just loosened up a bit over those first 5,000 miles and ran a little cooler. I tend to believe the latter reasoning.

APPLICATION:

I found that my bike, when new at 60 mph steady state, stabilized around 117 degrees over ambient. With additional miles and the coolant change to 50/50 ethylene glycol, that number became 112 degrees. (We’ve seen a number of other KLR riders with instrumentation quote 110 to 120 degrees as well). What I’m getting at is on a 110 degree day, my stock bike would stabilize at 222°F as a water temp, and on a 60 degree day, it would stabilize at a water temp of 172°F. Since the stock thermostat is a 158°, in theory if ridden on a 40 degree day it would try to stabilize at 152°F, but of course the thermostat wouldn’t allow that and would close off to hold the water up at 158°.

My point: remember the number 112 degrees. This is the baseline for a stock bike, broken in, with coolant changed to 50/50 ethylene glycol and distilled water.

All those numbers I've quoted above (14 degrees for a fender change, 11 for the fan on, etc) are not additive if you do more than one of the mods. But it's actually pretty close. I have a more complex write-up which shows the cumulative effects if anyone is dying to see it, but here's the bottom line: by doing mods 1, 3 and 4 on my bike, I have seen a 28 degree decrease in water temps (against a simply-added total of 33). Again, there are 145 tests that were conducted to come up with these numbers, and as an example, test #145 was run yesterday (July 14, 2006) on the way home. It was 108°F on the ride and my water stabilized at 192°F on the freeway. That's 84 degrees above ambient. Stock was 112.

I'm pretty happy with the results. Hope this helps you.

Don't forget that this data is all for moderate road speeds. If you get stuck in 0-20 mph traffic a lot, mods 1 and 4 have almost no value to you, and 2 and 3 are still very useful.