

Thermo-Bob™ FAQ (KLR-Based)

(The 10 most Frequently Asked Questions)

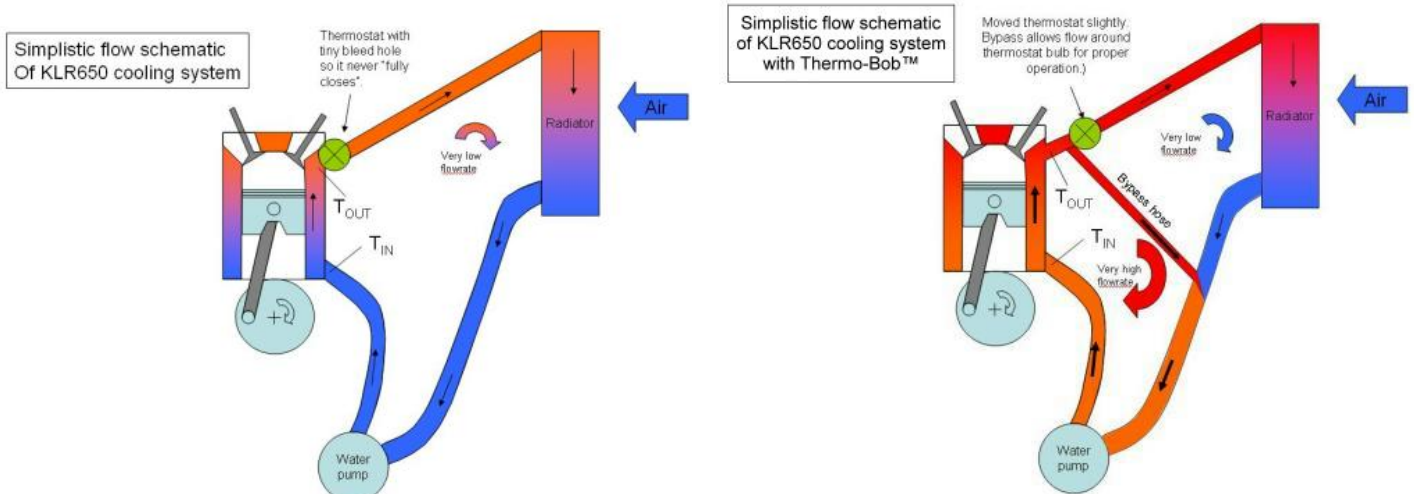
1) What is a Thermo-Bob™ and what does it do?

The Thermo-Bob is a cooling system modification for the KLR. Every car for the last 70 years keeps coolant flowing all the time through the engine to stabilize temperatures, but Kawasaki simply cut corners on some bikes such as the KLR to save a few bucks - and didn't install a radiator bypass. Temperature measurements show that the KLR factory cooling system relies on surges of cold coolant every 30 seconds at the bottom of the cylinder to control engine temperature. Data plots are shown below.

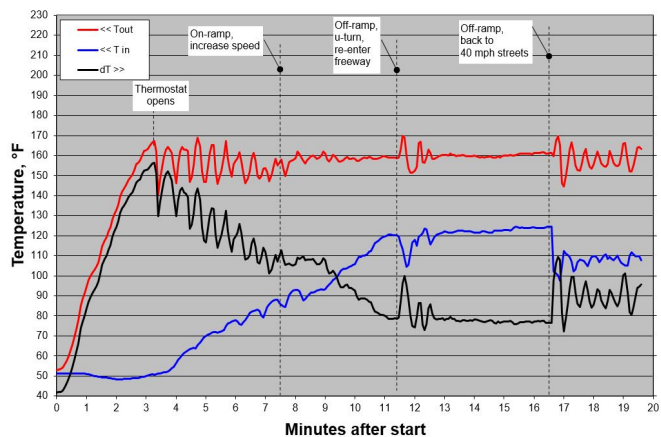
I have a separate "Testing Results and History" link that explain it in detail, but the bottom line is that you want the temperatures in all parts of the engine block to be similar, not significantly different from each other to minimize distortion and thermal stress. Round cylinders have better oil control than oval ones!

The Thermo-Bob is an external thermostat with a coolant bypass. It allows coolant to flow at all times, bypassing the radiator during warm-up and eliminating the surges of cold coolant year-round. It also raises the operating temperature at the top of the cylinder to 195°F from 158°F... more importantly, it raises the operating temperature at the bottom of the cylinder to 185°F from downright cold, (I've measured inlet temps as cold as 30°F). The warmer temps should extend engine life as well as increase oil change intervals, and improve economy by a few MPG. It was the first product to ever receive a 10-out-of-10 rating at KLR World, and was strongly recommended by the late Cary Aspy, who was the developer of the 685 and 705 KLR big-bore kits. Cary also liked how this gave more consistent carburetor jetting.

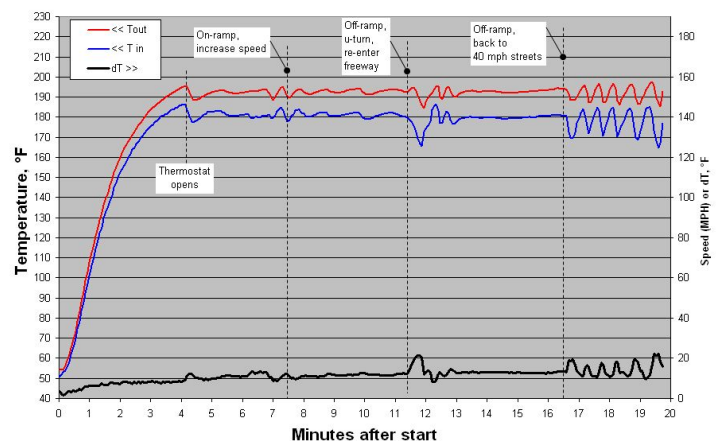
This is a PDF file, so you can enlarge the picture to see better details below.



Stock Setup: 158° Stat, no bypass



Water Temperature with Thermo-Bob™ : 37° F Morning



2) Where did the name "Thermo-Bob" come from?

It is a little word play on 'Thing-a-ma-bob'... since the KLR650's most well-known modification is a 'doohickey' (easier to remember than 'balancer chain idler sprocket adjustment quadrant'), I was originally going to name this thermostatic control as the 'Thingamabob'. But it seemed natural at that point to make it "Thermo-Bob".

3) Why 195°F? Didn't Kawasaki want this bike to run at 158°F?

If Kawasaki wanted these bikes to not exceed 158°F, they would have put on a larger radiator so temps would stay down there, and it would run 158° max all year. But they don't - they run in the 200's all summer.

The stock cooling system on an '08-and-newer KLR typically sees 190°-210°F running temperature in the peak of summer, and the 07-and-older bikes run about 10 degrees hotter. With a stock bike, you have 158°F coolant all winter (and 80°F, 100°F, 120°F all winter at the bottom of the cylinder) and 190°-220° all summer. With a Thermo-Bob you have 195° all winter (185° at the bottom) until the dead of summer where you'll then see 200°, 210°, 220° because you're still limited by the stock radiator sizing.

I think Kawasaki picked the cold thermostat temp just to allow the bike to not have the temp cycling ALL year but only cycle in the winter. If they had a bypass they could have started with the right temperature in the first place, but I think the 158° is a crutch to compensate for the bad behavior of not having bypass flow.

So the next discussion is – Why a 195°F thermostat instead of a 158°? Because hotter is better until it causes items to decrease in life. The KLR oil is notoriously cold in the winter, hotter only helps get more heat into the oil which helps get rid of contaminants that enter the oil. I've dealt with a few engine designers over the years and they've said if mileage and engine life was their primary design goal, they'd probably use a 220° or 230°F thermostat. Current materials / design seem to be around 195°-210°F on the exit side of the engine, and for the cars that actually have the thermostat on the inlet side of the engine controlling the inlet temperature, they control at 180°-195°F, which results in very similar exit temps for both designs.

I have done a lot of oil temp testing on the KLR. The KLR takes quite a while to heat its 2.5 quarts of oil, and is, generally speaking, too cold in most applications. Raising the thermostat temperature of the coolant is one way to get more heat into the oil when it's cool outside. You want the oil to get up around 200° minimum to boil out the water vapor that gets in the oil as a standard result of engine operation.

4) 195° vs. 180°...

Simple. Read the answer above and you'll see that either way, the bike will run 190°-210° in the summer, so it won't matter, but in the winter the bike will run 180° instead of 195°, getting less heat into the oil when you need it most. So the only time it will drop the temperatures is when you don't want it to. Use the 195°!

5) Since the bypass never closes, doesn't this make the engine run hotter in the peak of Summer?

Great question - so I tested a Thermo-Bob setup with the bypass open and closed and found the open bypass to only run 2 to 3 degrees warmer on a 115°F day than it being closed. Here's why the temps barely rise with some coolant bypassing the radiator: it relies heavily on the fact that the coolant is A LOT hotter than the air that is cooling it...

The factory setup has a high coolant flow rate, which results in a low temp gain across the engine (~10 degrees) and thus a low temp loss across the radiator (that same ~10 degrees when you're at steady state - remember the black line in the plots on page 1 of this FAQ). If you bypass, say, 10% of the coolant

around the radiator, the coolant slows down 10% in the radiator, and (this is key) because the delta in temps between the air and the coolant is really high, (over 100°F), the coolant temp drop across the radiator almost goes up that exact same 10% because it's in the radiator for 10% more dwell time with a high delta from the air driving it. If the air was only 30 degrees above the temp of the coolant, this argument would not be valid.

Anyway, you then have 90% of the flow now with a 11.1 degree loss (if you will, instead of a 10.0 degree loss), and 10% flow with a 0 degree loss because it went through the bypass. That turns out to be the same BTU loss in the coolant as 100% flow with a 10 degree loss. Because that argument is not quite perfect, I see a tiny gain, on the order of 2 or 3 degrees in the summer over a stock bike.

To design this as a close-off bypass would have required a larger housing to accommodate a close-off thermostat and so on for those 2-3 degrees, so I stuck with the full-time bleeding setup as it would be less expensive for the end user and almost identical in performance.

6) "I thought hotter was worse"

I hear this occasionally from the over-generalizers. They get on a "hotter is worse" thread because we all know that 300°F is worse than 250°F. And based on experience, 250° is worse than 230°. But is 170° worse than 130°? No, it's better. Engines are designed to run in a certain operating range... 140° stinks, 150° is better, 160° is better still, etc. You want to be in that 190°-220° range all year to keep clearances right and to keep your lubricating oil free of water.

Bottom Line – This hasn't raised peak temps at all – but has raised minimum temps when you're riding and it's below 80F outside. Even here in the desert, that's the majority of my year. In a lot of places, that's the entire year.

If you're still not buying all my chatter, here's some hard data: I've had a 195°F Thermo-Bob on my KLR from the beginning and currently have 180,000 miles. I have never rebuilt the cylinder head, or installed a new piston and rings. I did install an Eagle doohickey and torsion spring back at the beginning, and that's it. There is a separate link at this site that documents oil usage since the beginning. I do occasionally find other guys with high mileage - but more often than not, they tell me of their valve job and different piston, and the ring job, etc. Finding guys with this kind of mileage on all stock components is unheard of.

7) "I don't need a Thermo-Bob because I don't live in Arctic conditions"

We see this over-generalization on the forums every so often. Read the last paragraph of the previous question - I live in one of the hottest towns in the world.

8) Will my fan run more now?

No. The fan is not controlled by engine exit temperature. Although it is true that the coolant exiting the engine is always 195°F with a Thermo-Bob (the temp gauge on the dash reads this temp), the switch that turns on the fan is measuring temp on the "cold" side of the radiator, which is cooler - usually by a lot.

During most of the year, the Thermo-Bob is limiting flow to the radiator to hold engine temps UP at 195°F, and that slow coolant flow through the radiator results in a large temperature drop of the coolant... so the bottom of the radiator is much colder, where the fan switch is measuring temperature.

Even in the summer when the 'stat is wide open, the coolant exiting the engine will have to get up to around 215°-220°F before the bottom of the radiator will hit 203°F to turn on the fan. That's about 2 to 3 needle-widths above center on the gauge, no matter if the bike is a Gen I or a Gen II.

9) Your testing was done on a pre-2008 model. Does your data apply to the 2008 and newer bikes?

It definitely applies. I know this will sound like a typical sales-guy pitch, but the '08 and newer bikes actually need the bypass even more because the radiator is more effective than the Gen I bikes, and thus has a better ability to try and hold temps down at the 158°F factory level at the engine exit. This in turn keeps the inlet coolant even colder and more of your year will see the hot/cold/hot/cold inlet coolant temp cycling. I have a KLX250s as well, and it has dual radiators that do a much better job cooling the coolant than, say, an '02 KLR650. From the factory, the KLX stays very cold on the inlet because the radiators are so effective. So yes, the testing applies to the '08 and newer bikes, and you'd find that the blue line in the stock setup (page 1 of this FAQ, lower left corner) would be even worse (colder) than my testing shown on that plot which was tested on a pre-'08.

10) What coolant should I use?

Traditional

This subject can be tricky, like an oil discussion.... there are tons of opinions. Overall, I'm a believer for using distilled, not tap water with my coolant, and changing it every 2 years. The bike only holds barely over a quart, so it's cheap insurance in my opinion. I've seen cooling systems that were ignored, and it's not pretty.

Some people will comment about avoiding silicates: the shop manual says nothing about silicates. Page 5-3 of the Shop Manual states to use: "Permanent type of antifreeze (soft water and ethylene glycol plus corrosion and rust inhibitor chemicals for aluminum engines and radiators)". In the base manual, they specify the color as "green". As of 2014, Green Prestone does not have silicates. I've run green Prestone with distilled water in almost everything I own, including my KLR and haven't had any obvious issues.

Some people feel safest by purchasing Honda HP coolant, or "Toyota Red", and use it in their KLR. There's nothing wrong with that! You only need a little over a quart of coolant so it's just not that pricey.

One other option is Prestone Extended life coolant, which is silicate free as well. I see no downside to using it other than a small increase in cost over green Prestone. But again, at just over one quart, we're not talking big money.

Alternate

Some owners ask about alternate coolants, such as Water Wetter, Engine Ice, and Evans Waterless Coolant.

Distilled Water (DW) is a more effective coolant than Ethylene Glycol (EG), so you'll find that changing the ratio from 50/50, to say, 20/80 EG/DW, will lower peak temperatures. I have a separate article on this about improving cooling margin that discusses this. So if you were running 100% distilled water as your coolant, the addition of Water Wetter would help as it is a surface tension reducer. But if you're using a mixture of Ethylene Glycol and distilled water, even 20/80, the addition of Water Wetter will not make any notable improvement as the Ethylene Glycol already has surface tension reducers in it, making Water Wetter an exercise in spending money.

I have not tested Engine Ice but assume it follows the same basic recipe: a higher concentration of water than a 50/50 mix of EG/DW – with of course a surface tension reducer, rust inhibitors and anti-corrosives. You're dealing with similar peak temp drops around 10 degrees F.

Evans Waterless Coolant, with it's poor thermal properties is advertised very cautiously to avoid telling you its downside: it RAISES operating temperatures, usually around 20 to 40 degrees on most vehicles. Their advertising relies on people reading the words "doesn't boil over" to mean that it runs cooler. It does not. It's just that it boils at 375°F. If you had a really large radiator on your vehicle, then yes, it would be able to hold temps at the thermostat's rated temperature... but the KLR radiator is already undersized and the thermostat is already wide-open in the summer – resulting in 20 to 40 degree hotter coolant temps on a KLR. Steer clear.