Fan System Diagnostics for Two-Valve K Bikes

By Jeff Dunkle

The K web site contains some good suggestions from Jon Diaz, Rob Lentini, and Tom Coradeschi about the K cooling system. Do review this material first if you're having a fan system problem.

It seems lately that I've had the "opportunity" to help several K owners trouble shoot their fan system. Here's some things I've picked up in the process. I'm synthesizing things from the web site, other posts I've seen and stuff I stumbled on to.

System Function:

All BMW K motorcycles have electric fans mounted behind the radiator. The fan motor is controlled by a system that detects coolant temperature and energizes the fan motor only when necessary. The following is a discussion of the control system on the L-Jetronic, two-valve models. The four-valve, Motronic bikes have a somewhat different circuit configuration. The system works by getting a signal from a temperature probe in a standpipe located on the front, top, left corner of the engine. As the temperature of the coolant goes up, this probe's resistance goes down. This variable resistance goes to the fan relay (BMW I think calls this unit a "fan switch) located in the electrical box under the rear of the gas tank. When the resistance corresponds to a temperature of 217 degrees F, the fan is switched on. At 232 degrees F the over temperature warning light is switched on. That's it. It is possible to do some fairly simple testing on each component except the relay. The Clymer manual suggests a test which I've not tried, but which would include the relay in the functional check of the system.

System Parameters:

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Clarence Dold summarized the following for us, according to the 93 K75S Owners' Manual:
Thermostat starts to open at 85 C                (185 F)
Fan Cut-in at 103 C                              (217 F)
Overheat Warning Light at 111 C                  (232 F)
Pressure relief valve opens at 120 C/1.1 bar     (248 F/16 psi)
Vacuum relief (return valve) opens at -0.1 bar   (-1.45 psi)
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System Maintenance:

Spin the fan once in a while:

The fan motor is not the most robust unit I've ever seen. Jon Diaz and others frequently remind folks to simply reach in and spin the fan with your finger from time to time when the bike's parked to assure that it rotates freely. The bushings in this motor are vulnerable to grit and stuff getting in. If the fan doesn't turn freely, the motor will eventually fail.

Clean Connectors & Apply Dielectric Grease:

One bike we worked on got fan system function restored when the temperature probe electrical connector was removed, the contacts cleaned a bit, and dielectric grease was applied. Having restored a dysfunctional speedometer by doing the same thing to a connector in the system, I've become a great believer in using dielectric grease most any time I've got a connector apart.

Idle Test:

The simplest test of the system is to start the bike, let it idle, and listen for the fan to come on. My experience is that if it's going to work, the fan will come on at about 8 to 10 minutes of normal idle. This worked for me testing K75S and one K100. I'd be uncomfortable doing this longer than 15 minutes. One bike I saw that was left to idle for about 25 minutes (and was subsequently was found to have a bad fan circuit) "blew it's guts" after about 25 minutes of idling by spewing half it's coolant out of the over flow tank filler.

Tests that can be run from the relay connector under the tank:

The fan relay (switch per BMW?) is located in the "relay box" under the rear of the gas tank, in the middle of the right side. Its a whitish color. Remove the mount screw, lift the relay and disconnect the connector plug on the base. There's a contact chart on the side of the relay that corresponds to the tabs on the base of the relay. The following is a chart for the connector using the same numbers, mirror imaging connector chart from the relay/switch. These connection labels correspond to those on the Owners Manual wiring chart. I've confirmed most of these connections with wiring checks.

```
Female connectors plug

               (molding ridge)------\
                                    ^
                          ___________________
     Key:                |                    |
                         |  |(E)    []    (9)| |
     | (female           |                    |
         connector)      |                    |
                         |         (15)       |
     []  (empty slot)    |  |(A2)   __   (A3) | |
                         |                    |
                         |         (31)       |
                         |  []     __      [] |
                         ----------------------
```

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Components attached to each connector:
E  - temperature sensor
9  - goes somewhere that looks eventually like fuse #6
A2 - fan motor
15 - fuse #7
A3 - Overheat light
31 - ground
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These tests can be run by using a multi-meter and/or jumper wire on the various connector terminals to the relay/switch for the fan.

Temperature probe "test":

Measuring the resistance between E and 9 will read the resistance of the temperature probe. "Normal" cold bike readings I've seen are (+-) 2,200 ohms. On colder days, closer to 3,000 ohms. If

you warm the bike up, quickly remove the tank and take a reading, expect to see about 520 ohms. Readings in this range cold and hot seem to confirm normal temperature probe function.

Over Temperature Warning Light test:

With the key turned on, touching a jumper wire to connectors 31 and A3 should turn on the over temp. warning light. If not, check fuse 7, the light itself, then wiring between it and the relay box.

Fan Motor Test:

With the key turned on, touching a jumper wire to connectors 15 and A2 should turn on the fan motor. If not, further test of the fan is needed. What I've done in the past is unmount the radiator enough to expose the fan and loosen the connector plug. First measure the resistance through both leads in the fan connector. You should see a very low reading, about 3 or 4 ohms or so. Next jumper 12 volts to the colored wire connector and ground the brown connector wire. The motor should run. If not, it's probably burned out or has damaged brushes. I saw one motor with the brush housing totally melted.

If it does run, next measure the voltage coming out of the plug supplying the fan. To do this, turn on the key, put a jumper from connectors 15 and A2 at the relay plug, then connect your multi-meter to the fan power plug, red to colored wire connector, black to brown wire. You should read 12 volts. If not, you have a wiring problem or blown fuse. Start by checking for 12 volts at connector 15 (thanks to Dimitri Likissas for this tip).

Clymer suggests testing the fan/system by disconnecting the temperature sensor plug and jumpering the connectors. With the key on, this, they say, should turn on the fan motor. I've not done this test yet and cannot speak to it's validity. It would introduce a zero resistance into the sensing circuit in the "relay", which is probably OK. This would test both the relay, fan, and associated wiring. It's much easier to remove the tank and get to the relay box than access the temperature probe.

Access/Removing the fan:

It seems that you need to remove the radiator on any bike I've worked. Remove any fairing parts necessary. Drain the coolant at the small plug on the water/oil pump. Disconnect all radiator hoses. Remove the mount screw on the top middle of the radiator. Lift off. It simply hooks to two rubber bushings on the bottom. Disconnect the fan lead plug. Unbolt the fan. The replacement fan comes as a complete unit, motor, fan and shroud. Jon Diaz reminds us that this is an ideal time to inspect all the hoses, clamps and fittings. After reassembly, be sure to check for leaks after the system is up to operating temperature and pressure.

Accessing/Removing the Temperature probe:

Either remove the air box or the radiator. The connector to the temp probe requires a little judicious prying to get the wire snap connector free. In either case, you'll have to drain the coolant as the probe penetrates fairly low in the system plumbing. The easiest tool I found for removing the

probe, if that's necessary, is a 19 mm box wrench. Other tools don't fit in the available space. I did find one bike where the connector to the probe was corroded enough to fail the system. Some contact scraping and a couple of dabs of dielectric grease got things working again.

I stove top tested one probe by putting about an inch or so of water in a pan, putting a wrench socket, large end down, in the water, and sitting the probe in the square drive hole. I measured the probe resistance cold and got 3,200 ohms. When the water boiled, the resistance was 480 ohms. The test was fun to do, but I'd only go this far if you didn't get some expected resistance readings at the relay connector. Getting the probe in your hand requires draining the radiator and takes about 45 minutes work getting to the unit.

Parts:

K Fan Control/Relay (I believe BMW fiche calls it a "switch")
BMW Part Number: 61.31-145009
approximate price: $75

Temperature Probe
BMW Part number: 61.31-1459197
approximate price: $40

Temperature probe manufacturer's numbers:
Bosch 649
0280 130 032

Fan
BMW Part number: 17.40-1460427
approximate price $90

Please let me hear about any suggestions or corrections to this material.