Keeping the engine temperatures down

I spend much of my time in the Nevada desert and during the summer see quite a bit of outside ambient temperatures in excess of 100 degrees. I saw engine temperatures exceed 210 degrees getting close to 220 degrees going along at 70 MPH at high altitudes (5000-6000 feet) or going up a grade. If the outside ambient temperature was under 80 degrees the temperature would be normally about 190 with the same driving conditions.

The radiator was changed after a small leak developed and the core was replaced with a high efficiency core. The thermostat was changed to the latest design from Cummins. Unfortunately this combination resulted in an increase of operating temperatures, so I set out to find out why.

I changed the thermostat back to the original and the temperatures were back to the nearly the same level that I had been running. It appears that Cummins had changed the design of the thermostat to reduce the response time and it looks like the opening was reduced at the same time. In any event, going up the same grade at the same ambient temperature, resulted in an increase of nearly 15 degrees. I was now running 220 degrees going along at 70 MPH with the outside ambient of 90 degrees. Changing back to the original thermostat resulted in 195 at 70 MPH, ambient of 90 degrees. At 100 degrees outside, the engine temperature would climb to 205 degrees. (old thermostat)

I had also noticed that on a long trip where I had been on some very dusty back roads the engine compartment was filled with dust and dirt, obviously, the engine fan was drawing a lot of road surface air into the engine area and perhaps thru the radiator even thou there are two side openings for engine cooling air. I placed some yarn “tuffs” around the air intakes and noticed that the air was coming out of the air intakes instead of going in!!

This started the next set of modifications!

Original side openings:

Outside

Inside

I increased the opening area by removing the inside portion of the “z” metal that forms the grill:

Half modified from outside view

Half modified looking at the inside

Notice how much area is picked up by removing the inside flats?

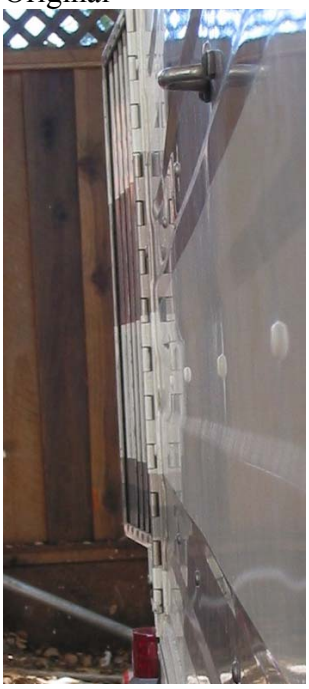
Fully modified grill:

Outside view modified

Inside view modified

I noticed that the outside portion of the grill wasn't exactly positioned to collect air as the flats were pointing inward and probably why the air was being drawn out rather then in so I modified these by twisting them toward the outside to be more in the air stream:

Original



After modification

This change alone netted a 10 degree drop in running temperature at cruise speed. For the final change I added two fans in the opening to help draw or force air in when the coach was operating at low speeds.

Fan mounted on the inside of the grill

Looking in from the outside

Even thou the addition of the fan will create an obstruction for normal air flow without the fan running, the temperatures were down to nearly the same without them installed. I have added a thermostatic switch so that when the engine coolant temperature reaches 195 the fans come on.

On the last trip into Nevada and running more then 2000 miles, the engine room was noticeably cleaner then before and the temperature never exceed 200 degrees even on a long pull up a grade in 4th gear over a 7400 foot pass.

I placed tuffs on the rear radiator opening and found that air flow was much higher at the very bottom of the radiator and very low in the middle, probably because the fan is a larger diameter fan with short blades. The turbo intercooler does not go all the way to the bottom of the radiator either so there is no restriction at the bottom allowing an unbalance of airflow. I am considering a “puller fan” in the middle of the radiator on the outside to assist airflow and balance the cooling across the entire opening. For now thou it appears that I have reached my goal.

The original design of the rear air inlets from the factory is very good looking but not functional at all, by changing the design I have been able to create a positive pressure with air well above the road surface which will be much cooler then that drawn up thru the engine compartment from the road surface. Now that there is an additional source of clean air being forced in to the engine compartment, the amount of dust and dirty being thrown up by the wheels and drawn up from the road will be much lower.

Further research will be continued next year on out trips back into the Nevada desert areas.

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