Engine Cooling

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Proper oil changes and adequate cooling are the two maintenance items that can allow you to drive a Corvair to some amazing mileage accumulations. This article may help contribute to that as far as cooling is concerned. Keep in mind that the Corvair engine expanded from 80hp to 180hp with very little addition to the cooling capacity.

Some improvement items require major engine work and would be on a list of things to do when that occurs; others are easily completed. Previous owners may have done strange things so be thorough. The more you can accomplish the better the engine will perform and the longer it will last. One caveat: it is difficult to properly cool a worn out engine with high blow-by.

Installing a head temperature gauge would be useful if you are interested in watching progress as you make lots of little changes (or a big change or two). CCP sells gauges, you can find VDO gauges on eBay Motorcycles (310-901), or even an old Stewart Warner (366-LW). Dakota Digital sells a 0-750 for about $150. Aircraftspruce.com has a Swift dual gauge 0-700 for $68.75. And you can use an infrared thermometer to good advantage checking on the exact same spot each time.

First, simply make sure your engine cooling system is functioning properly in its stock condition: The most common causes of significant overheating is a mouse nest on top of the head or cylinders under the top cover, along with original excess flashing that has been accumulating dirt and debris for 50 years. GM shop manuals did not mention cleaning the air slots between the fins for the first four years. Finally, in the ’64 manual they show a picture and state: ***Inspect the cylinder head for restrictions in the air circulating passages formed by the cooling fins. Casting flash or a build-up of other foreign material that could decrease cooling efficiency can be easily removed from the air passages using the J-21308 Fin Cleaning Tool***.

If you have never had the top cover off, this is an absolute must; you may find shop rags, tools, bolts, pieces of belt, melted plastic bags, and dead mice along with the dog food they brought in. I have found all of those things and more. **If you clean up after mice, wear a respirator!**

De-flashing and cleaning the heads can be done by removing the top shroud and lower heater shrouds, putting a light on the floor and using a long drill bit, key hole saw and other tools to remove dirt and aluminum flashing from the finned head areas. The 140 heads are of particular concern because of fewer and smaller passages. If you have the heads off, you can remove the valves and clean up the runners in both intake and exhaust areas with rotary burrs. If you are

rebuilding the engine and using oversize pistons, you may want to consider using cylinder spacers to bring the compression back to the original number.

Lots of little things can add up:

- Keeping the belt on and adjusted correctly; check for proper belt length, correct pulley diameter (3" alt/gen), and fan bearing height: lay a straight edge across the fan pulley and measure down to the head next to the carburetor; it should be exactly 6" for '62-'69, and 5/32" more for original '60-'61.
- Lower shroud exhaust air doors must work properly – check that they do not hang up on sheet metal and that the thermostats allow for full opening. Doors start to open at 200-205 degrees, and the thermostats are designed to fail open. Unless you come off the highway and look quick, the doors will probably be shut at idle or after around town driving. Also, it is normal for the left side to open quicker and close later due to the longer exhaust manifold and oil cooler located on that side.
- All the engine cooling sheet metal must be in place and you should seal any leaks around the top cover at the heads.
- All of the engine to body seals must be in place to keep exhausted air (and exhaust) from recirculation.
- Check for proper spark plug boots, dipstick grommet, and '63-'69 vent tube seal.
- The fresh air duct does not reduce cooling if all parts are functional and you do not have the "air" function on when it is 95 degrees outside. Be sure on late model cars that the hidden hose is not broken or you lose cooling air over #5 cylinder.
- All vent tubes must be clean and you must use the correct size of fixed orifice or correct PCV valve. Too large an opening is just a vacuum leak that leans out the mixture and can cause a rise in operating temperature.
- Use the correct weight of clean oil in the crankcase. When deciding what oil to use, you should do research covering your specific requirements, keeping in mind that a combination of operating temperature, engine clearances and driving conditions will all need to be taken into consideration for oil selection.
- Air baffles must be in place under the cylinders. The cylinders fins have a tapered profile to keep operating temperatures even through the length of the cylinder. The baffles are part of that process as well as directing the majority of cooling air across the head fins.
- Heat shields should be installed between all mufflers and valve covers, and aluminized mufflers do reduce heat.
- Oil cooler cover should be in place over the (clean) cooler and side plates installed on the 12 plate. End covers are also available for the 8 plate or you can make them (except folded fin which have them built in).
- Recirculation plate should be installed for summer if applicable (or block the recirculation holes).
- For automatics, the access cover on the top of the converter housing needs to be installed for proper converter cooling. Only a small item but all the little things add up.

- Check for bent exhaust pipes or loose baffles in mufflers. A restricted exhaust causes heat build up as well as poor performance.
- Check the air inlets from the outside on Greenbriers for loose insulation blocking the flow of outside air to the engine compartment.

Carburetor work. The carburetors must be balanced off idle to insure that one carburetor does not lead the other when accelerating or cruising. Out of balance will cause pinging, overheating and poor mileage. Use a UniSyn or a vacuum gauge with a T and hoses hooked to the choke pull-off ports. Correcting out of balance conditions may include replacing or repairing the cross shaft, down links, throttle shaft holes and look for loose throttle shaft ends where they are peened. Check that there are no vacuum leaks to include base gaskets, balance tube hoses, vacuum advance ports, vacuum modulator hoses, choke pull-offs and PCV hoses. Disassemble carburetors to match venturi clusters and re-jet carburetors to 0.052- 0.055 depending on your preference. A richer mixture will lower engine temperature slightly. Be sure all parts match between both carburetors and that the specs match. If you have hot idle valves, be sure they are open at idle and closed off idle.

Distributor work. Look for a worn distributor shaft inside the distributor cam (where you are supposed to place grease). Check the pivots, weights and springs for wear and lube everything that moves. Check the breaker plate pivot for wear; a common cause of pinging and loss of power. Check the vacuum advance. All of the distributor curves are published in pamphlets and you can use a tachometer and timing light to check your distributor performance. Distributors can be a significant cause of overheating if they do not function properly for your engine.

Oil coolers. Installing a 12 plate cooler on an engine without one would be a good upgrade. It does require sheet metal modification (cutting on late models and some welding on early models) and the 12 plate cooler uses a longer bolt, bigger cover, and end plates that keep the air directed out of the engine compartment. If you already have a 12 plate, be sure you have the end plates installed (you can make and install end plates on an 8 plate, except folded fin).

Additional cooling items.

- Removing lower shrouds in the summer does lower engine temperature. I checked my FC engine temperature on a two way highway run with heater shrouds on and shrouds off. My temperature gauge showed an almost 40 degree difference. Others have reported a 25 – 70 degree drop. The initial warm up time is longer but in the heat of the summer I would think the gain in lower operating temperature would easily be worth the tradeoff if you live in a hot zone or have A/C. Be sure your choke coils are tight if you remove the shrouds in case a rivet is missing. Leaving shrouds off when not absolutely necessary reduces the benefit of an air cooled engine's quick warm up (less oil dilution and engine wear).
- I also like to avoid extended tip spark plugs because they start the flame front closer to the piston (some agree and some disagree). The engineers would have used an extended tip if they thought it was a good idea – which they never did.
- If you have an air conditioned car, be sure and clean the condenser. I have a '66 style condenser so I extended the air cleaner intake with a hose to pick up air from in front of the condenser. The modification included relocating the vent tube hole so I could turn the air cleaner. Adding the hose puts cooler air into the carburetors and adds available air

for cooling that is not being sucked in to the air cleaner. Might be hard to prove that last one but it sounds good.

- Not a cooling factor itself, but be sure the inlet fuel line on the left side of the engine is not touching the head; the additional heat added to the fuel can cause vapor lock.
- For those not familiar, air cooled engines run hottest under a load in high gear on the highway and coolest while driving slow or idling (they do not overheat in a parade!). If your Temp/Press light comes on at a traffic light and goes off when you accelerate, the problem is either the sending unit, thin oil from gas dilution, or the wrong weight of oil.
- Information from numerous sources would confirm that the 61-63 fan moves the most air (7% more according to the late Bob Bellew), but the 64-69 uses the least power and is easier on belts.
- There are other things: finned pans, valve covers, special paint, modified heads, remote oil coolers, etc.
- As I understand the paint situation, convection cooling such as our fans blowing over the motor work best with unpainted rough surfaces. Radiation cooling, such as valve covers, oil pan, etc. may benefit from black paint. Driving down the road produces some air flow over those items so there is some convection cooling also.
- There were three different "snap" temperature switches used; the first was set for 500 degrees and had smooth hex head flats and coarse threads, the second was set for 575 degrees, had a notch in the flats, coarse threads and was used for all engines except 140 & 180. Those engines in a Corsa had a Thermister located in the left head for the dash gauge, and a temperature switch in the right head with fine threads, two notches in the flats and was set for 575 degrees. The 140 Monza vehicles had a snap switch only with fine threads.
- Continuing to drive a Corvair with no belt (or severe overheating from other issues) will pull head studs, loosen valve seats, release steel fan bearings from the aluminum cover, release the aluminum cam gear from the steel cam, scuff pistons as they expand in the iron cylinders and other bad things. You can actually turn a perfectly good engine into junk.

The following information is extracted from the CORSA Technical Guide

140 Engines: The change to the larger valves necessitated fewer and smaller air slots. Add this to the increase in performance and it is easy to see why a 140 will run hotter than the 80-110 engines. Milton Binon submitted an article for the Tech Guide in which he took the time to count and measure the air cooling slots and compare the difference between the 140 and 95 heads. This is what he documented:

Number of air slots		*Length of air slots*	
95:	*62*	*95:*	*39 inches*
140:	*58*	*140:*	*29 inches*

"There is a large air hole in the fins that cools the back side of the combustion chamber. On a 95 this hole is almost square and is big. On a 140 there is only a narrow slot. Measured in square inches, the air hole is 40% smaller on a 140."

Based on the above information, it is obvious that you would need to be especially diligent with cleaning and de-flashing a 140. I currently have two 140 engines with Powerglide transmissions that are driven regularly and they work just fine after completing all of the above.

Learn all you can about your waterless wonder: get a copy of the SAE Papers 140C and enjoy lots of historical perspective on how our cars were created. There is a section on cooling which may provide technical answers to any questions about the cooling system design, and the other two SAE Papers, 313B and 531A, provide equally fascinating information on the FC vehicles and the turbo engine. Reprints are available from CCP.

Below is a chart that was submitted to Corsa by the late Bob Helt, taken from original GM testing results.

EFFECT ON OPERATING TEMPERATURE

Change	speed in mph	Change in oil temperature °F	Change in head temperature °F
A.I.R. option	80	+22	+22
Air conditioning in 100°F ambient with 1966 style condenser	60	+30	+36
	80	+23	+30
	W.O.T.	+28	+35
Early model 1850 cfm fan	60	-9	-15
	80	-11	-13
	W.O.T.	-4	-5
12 plate oil cooler instead of 8 plate	80	-16	—
Oil cooler side shields	80	-7	-10
Louvers in lower shrouds	60	-7	-14
	80	-9	-13
Remove lower shrouds	60	-14	-24
	80	-18	-28
	W.O.T.	-18	-24