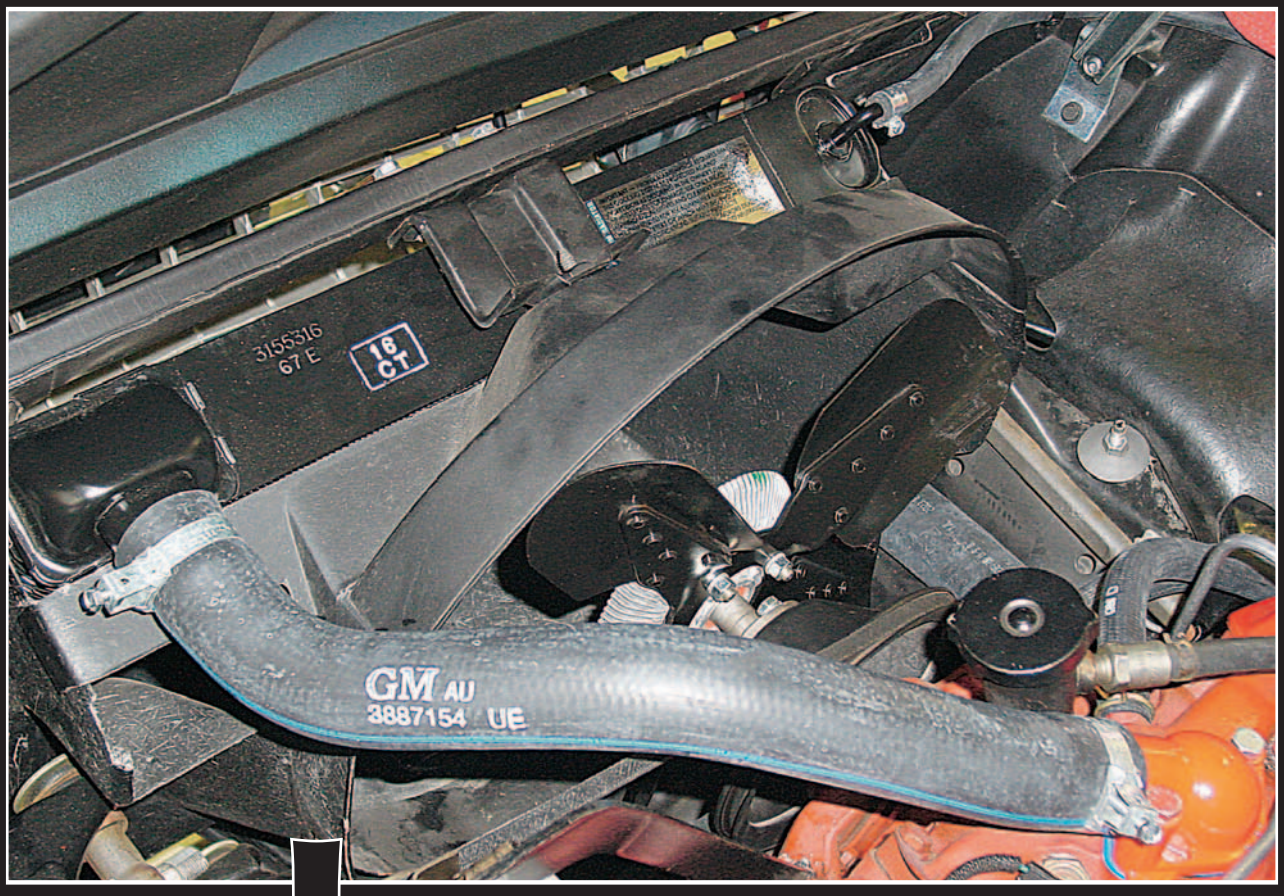
Out with the HOT, In with the COOL!

How driven Corvettes and the NCRS can co-exist

BY JOHN HINCKLEY



In the September issue, we went into the design and operating characteristics of the Corvette cooling system and discussed some diagnostic and troubleshooting techniques for those of you who have various cooling problems. Most cooling problems in older Corvettes, especially those with aged original radiators or those that have had the original radiator replaced with one that was less costly (and has less heat-rejection capability), simply don't have adequate cooling capacity to dissipate the heat carried to it by the coolant. There's only one cure for that problem – a new radiator with at least the same heat-rejection capability as the original.

The objective of this article is to take you through a radiator replacement and to share some tips and techniques that will simplify the job and ensure a reliable and leak-free installation. The car in the photos is a '67 327/300 with a relatively new "look-alike" copper/brass replacement radiator which was designed to look like the original Harrison aluminum radiator, but had far less cooling capacity. Diagnostics and I.R. gun studies verified that the engine was running at 195°-200° at freeway speeds, and would creep up to 210°-220° in slow traffic on an 85° day, with correct shrouding and a new fan clutch.

The "while it's apart" syndrome took hold, as it always does, so we replaced the radiator hoses, heater hoses and clamps as well, with judging-correct parts. The choice of a radiator was simple – a DeWitt's reproduction of the original GM #3155316 Harrison stacked-plate aluminum radiator, dated and detailed to pass NCRS judging. Don't even bother to start this project with anything that has less cooling capacity than

1 Here's what you'll have on the floor after you complete the removal procedure, plus the radiator. The shroud can stay loose in the car.

2 Here are the new clamps – radiator hose at the top, expansion tank outlet on the left, radiator-to-expansion tank on the right, heater hose Corbin clamps in the middle. Radiator lower mount donuts are at the bottom.

3 Right side view after completion; note Corbin clamps at tee and metal snap-clamps holding the two hoses together.

4 Here's the plastic radiator fill funnel with 1/4" holes drilled around the bottom end.

5 The funnel in place in the thermostat opening. It stands up by itself, and the holes provide for coolant flow and level monitoring while filling the system.

6 The Craftsman "Handi-Cut" is a safe and efficient tool for making clean and square cuts in the heater hoses; also works nicely on radiator hoses.

the original radiator, or you'll be doing it again later – once is enough.

DRAINING COOLANT: Start by draining the old coolant. Plastic gallon milk jugs (you'll need four) make good storage containers until you can take them to your local recycling center for proper disposal. Don't stop at the petcock drain at the bottom of the radiator – that will only drain about two-thirds of the coolant. Remove the drain plug on each side of the block, centered just above the pan rail, to drain the water jackets around the cylinder walls. You need to remove both of them, as they aren't cross-connected, and they hold a *lot* of stagnant coolant. Use a six-point socket to remove them, and when you replace them, use a bit of anti-seize on the threads so they're easy to remove next time (as we discussed in September, you should drain and replace your coolant every two years so the inhibitor package continues to protect your radiator from corrosion, its worst enemy). Don't be surprised if nothing comes out when you remove each plug – that area collects lots of corrosion and crud, and you may need to poke up into the hole with an awl or screwdriver to loosen the accumulated crud to break it loose. Be sure and have a pan handy, as the coolant will *pour* out once the opening is clear.

FAN AND CLUTCH REMOVAL: Next, remove the fan and clutch as a unit (leave the fan attached to the clutch). It's much easier to loosen the bolts that attach the clutch hub to the water pump (through the water pump pulley) if you leave the fan belt in place until you've loosened the four bolts, then remove the fan belt, then remove the four bolts and pull the

7 The horns either have to be removed or loosened and rotated to get tool access to the lower bolts at the front of the radiator support for both sides of the shroud.

8 Essential tools for the hoses. A box knife to "slit-and-peel" the old hoses for removal, especially at the heater core pipes, and Corbin clamp pliers with swiveling jaws to make quick work of removing and installing those wire clamps.

9 The DeWitt's reproduction Harrison stacked-plate aluminum radiator, identical to the original. Note the absence of end tanks as compared to the "look-alike" copper/brass replacement radiator in the adjacent photo. The DeWitt's radiator restores the original cooling capacity and extra cooling margin you need.

10 This is the "look-alike" copper/brass radiator we removed. Note the conventional core and end tanks. This radiator was made to look like the original when the shroud was in place, but has 30%-40% less cooling capacity than the original Harrison aluminum radiator.

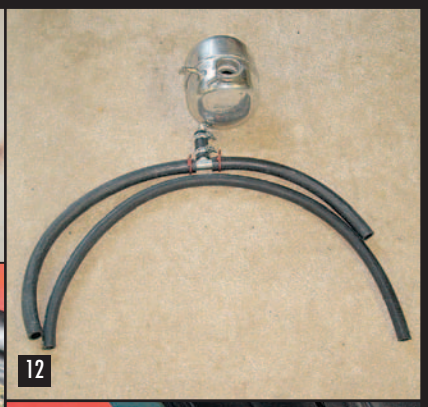
fan/clutch assembly. At this point you can decide if the fan and clutch need to come apart for cleaning/detailing.

RADIATOR HOSES: The radiator hoses come off next. If you have the tower-style clamps, loosen the screw at least half its length, place a 3/8" or 7/16" deep-well socket over the screw so it bottoms out on the "tower" of the clamp, and give it a couple of light raps with a hammer to expand the clamp and move it out of the way. If you're careful here, you may be able to re-use the clamp (more on tower clamps later). The easiest way to remove the old radiator hoses is to slice them lengthwise with a box knife and "peel" the two edges of the cut away from the neck (assuming you're replacing the hoses). Remove the thermostat housing and thermostat, remove the old gasket, and clean up the mating surfaces and the offset surface where the thermostat seats. We'll put the thermostat housing back on with a new gasket later on while we're refilling the cooling system.

HEATER HOSES AND EXPANSION TANK: Next on the list are the heater hoses and the expansion tank (if you have one). This system is best removed as a unit (rather than one piece at a time) so you can lay it out on the floor and cut all the new replacement hoses to the exact length as the old ones before you reinstall everything over the fender. Tip: Don't go nuts trying to remove (or install) the original round wire "Corbin" clamps with a pair of pliers – those clamps will fight your pliers every inch of the way. Go to your auto parts store and get a pair of spring-loaded ratcheting Corbin clamp pliers with swiveling jaws – they grab the ends of the round wire securely and make the job a piece of cake. Caution: Be sure and use the "slice and peel" technique to remove the old heater hoses from the heater core pipes, and do it gently. If you just pull or twist them off, chances are excellent that you'll crack the solder joints at the other end of the pipes and end up with a heater core leak, which can cost you carpets as well as the grief of replacing the heater core. The same caution applies for the ¾" hose that connects to the lower outlet from the expansion tank. It's aluminum, and you don't want to damage the pipe or its joint to the tank. Two more screws and two clamps and the expansion tank and its inlet hose from the radiator are out, and the whole system can come out and park on the floor. Now you can think about cleaning up the tank and the two retaining straps.

FAN SHROUD: Now the fun begins – some shrouds can be removed without trauma, but most can't (especially C3s). My original '67 327/300 fiberglass shroud is relatively fragile, but doesn't have to be completely removed – just pulled back and out of the way, at a weird angle, to provide clearance to pull the radiator out vertically (you can always tell the ones Bubba removed – they're broken and have pop-rivet or Bondo repairs and/or missing chunks). The '67 shroud is attached with four bolts from the front side of the radiator support, through holes in the support, into U-nuts on the edges of the shroud, and a bolt-on bracket at the top. Small hands and skinny arms (neither of which I have) are helpful to get to the bolts, and both horns have to be either removed or loosened and rotated out of the way, as the horn brackets block access to the lower two shroud bolts. Just work slowly, be patient, take a beer break occasionally, and you'll be able to get the shroud out of the way without damaging it.

RADIATOR: The small-block radiator has two pins on the bottom plate with rubber donut isolators on them that nest in holes in brackets on the bottom of the radiator support, and a center retaining bracket and rubber isolator at the top with two bolts through the top of the radiator support. Big-blocks (and most C3s) have welded saddles with rubber cushions at the bottom and bolt-on saddles with rubber cushions at the



11 The cleaned-up expansion tank and new heater hoses, cut to the same length as the old ones, sub-assembled as a unit, ready for installation.

12 All the old hoses and the expansion tank after removal. Keep them together as a unit to simplify making up the new system off the car.

13 Left side view of the shroud, pulled back for radiator removal clearance.

14 Right side view of the shroud pulled back. Handle it gently – it's fragile, and you don't want to force it or break it (Bubba may have done that already).

15 This 5/8"-long 5/16"-24 stud will eliminate a lot of frustration by aligning the holes in the water pump hub, pulley, and fan clutch flange so you can get the fine-thread bolts started.

top. Remove the upper attachments, set the pieces aside, and you're ready to remove the radiator. A helper is recommended, as the radiator must come up vertically without hanging up on the radiator support or shroud, and it's pretty awkward (and heavy, if it's a copper/brass radiator), and still has some coolant in it that will dribble as you maneuver it out and set it aside. Now you can get a good look at the bottom of the radiator support and check it for cracks or corrosion damage and paint it if necessary.

This is also the time to inspect the condition of any foam or flap rubber seals you may have (or which may be missing) between the shroud and radiator, radiator and support, or support and hood, and replace them. If you need them, "Dr. Rebuild" has the most comprehensive selection of replacement seals, made from the correct materials to the original drawings.

Not to worry – it's all downhill from here.

RADIATOR: Now just reverse the process, using new rubber isolators and cushions, with cleaned-up or freshly-painted mounting brackets (the new DeWitt's radiator is a thing of beauty, and will make old mounting hardware look pretty ugly). The new radiator will most likely be lighter than the old one, so it's not as awkward to maneuver into place, but be *very* careful not to snag its plates and fins on anything as you position it. You'll also note that it has an aluminum drain petcock instead of brass, to eliminate a possible source of galvanic corrosion from dissimilar metals. Once it's secure, it's fan shroud time again.

FAN SHROUD: Carefully maneuver the fan shroud into position against the radiator support, being careful not to force it or break it. If it won't move, find out why and clear the problem before proceeding. Be particularly careful in the area around the neck for the upper radiator hose – the shroud is very fragile there. Reinstall the retaining bolts through the radiator support and upper radiator retaining bracket, reposition and secure the horns, and the major stuff is done.

FAN AND CLUTCH: Positioning the fan/clutch assembly and water pump pulley over the water pump hub and getting the three-piece sandwich of holes for the fine-thread bolts aligned so you can start the bolts into the hub "blind" can be time-consuming and frustrating, as you don't have much room to work in. Tip: This task is simplified by using a stud (cut the head off a fine-thread 5/16"-24 bolt so you have a 5/8"-long stud – any longer, and you won't be able to remove it). Insert the stud into one of the bolt holes in the hub, install the pulley over the stud and center pilot, followed by the fan clutch hub, and start three of the four bolts (the stud aligns all three holes in the "sandwich"); then remove the stud and replace with the fourth bolt, and tighten the four bolts.

RADIATOR HOSES: Make up a 50-50 mix of water and anti-freeze in a cup, and brush it on the inside of the ends of the hoses just before you install them – makes them easier to position, and avoids putting undue stress on the radiator's inlet and outlet necks (slide your clamps over the ends of the hoses first). Once the hoses are properly oriented, tighten the clamps. Position the thermostat housing (and clamp) at the engine end of the upper hose and trial-fit it to the intake so the bolt holes line up, tighten the clamp, and push it aside for now (we're going to fill the system through the thermostat hole in the intake later).

A NOTE ABOUT TOWER CLAMPS: Original production tower clamps were made by Wittek, and were of very high quality. Wittek went out of business many years ago, and someone is reproducing "correct" dated Wittek tower clamps, which are not manufactured with the

same materials or to the same standards as the originals, although they "judge well." I have not had good luck with these reproductions, and prefer to use genuine NOS ($$) Wittek tower clamps; if originality is not an issue for you, screw-type worm clamps work just fine.

HEATER HOSES AND EXPANSION TANK: Using the old system you laid out on the floor as a unit as a pattern, cut your new heater and expansion tank hoses to the correct length, and sub-assemble the new system out of the car. I used all new Corbin clamps, and here again, the Corbin clamp pliers are well worth their cost. If you're using reproduction hoses and are into judging, rotate the hoses into position so the markings and ribs will show when the system is installed. The 5/8" hose goes from the nipple on the intake manifold to the lower heater core pipe, and the ¾" hose goes from the nipple on the water pump to the expansion tank tee to the upper heater core pipe. Take the sub-assembled system to the car, install the expansion tank straps, and make the connections to the nipples at the engine end and to the heater core pipes. Using the 50-50 mix of water and anti-freeze you made up earlier for the radiator hoses, apply some inside the heater core end of both heater hoses so they slide on without much pressure. As I noted earlier during disassembly, you *don't* want to apply undue force on those two core pipes. Tip: When you cut the hoses to length during sub-assembly and if you need to trim them a bit when you make the final connections, the Craftsman "Handi-Cut" is a terrific tool – it cuts them easily, squarely and neatly with hardly any effort at all. Using a box knife to cut hoses in awkward areas can inflict some really nasty injuries if you're not careful.

COOLANT FILL: Get two gallons of name-brand ethylene glycol-based anti-freeze. I prefer the conventional "green stuff" (Zerex, Prestone, etc.), although you can use the new Dexcool-type "red stuff" if you like. You should thoroughly flush and back-flush the cooling system if you plan on using the Dexcool-type coolant to get rid of traces of the old "green" anti-freeze, as the inorganic salts deposited by the "green" coolant reduces the effectiveness of the long-life organic inhibitor package in the Dexcool coolant, and you'll need to change either one every two years anyway. The "long-life" feature only works in brand-new cooling systems (you'll find that disclaimer in small print on the Dexcool-type coolants). I don't recommend using the *propylene* glycol-based "environmentally-friendly" coolants ("Sierra", etc.), as OEM tests have shown they have about 10% less heat-transfer efficiency than ethylene glycol-based conventional coolants at the same concentration, and you don't need 10% less cooling capacity in a Corvette. While you're out, get two gallons of distilled water at the grocery store to mix with it; tap or well water contains dissolved minerals that will tend to reduce the effectiveness of the coolant's anti-corrosion inhibitor package and increases the rate of accumulation of scale deposits in the cooling system.

Before you start, make sure the radiator drain petcock is closed tight, the two block drain plugs are in place, and make sure you have the correct RC-26 expansion tank cap (it's unique to the aluminum radiator cooling system to prevent galvanic corrosion due to dissimilar metals). It's also a good idea to take the cap to your auto parts store when you get your anti-freeze and have them check it on their cap tester to make sure it seals and holds it rated 15# pressure. If it won't seal properly or hold its rated pressure, you'll lose the boil-over protection it provides, especially during "heat-soak" after engine shutdown. While you're there, get one of the plastic radiator fill funnels and drill a bunch of ¼" holes near the small end (see photo) when you get home. I'd also recommend buying a Robertshaw #330-180 "balanced flow" thermostat (180° rating); it's much more accurate than the generic types, and won't ever fail closed.

Now that we have all our materials, let's fill the cooling system – this method will avoid creating any air pockets in the system, and won't require "burping" the system to get rid of them. We'll do the initial fill through the thermostat opening in the intake manifold, install the thermostat and housing, then top it off through the expansion tank fill opening.

Place the funnel with the drilled-out end in the thermostat opening. The end of the funnel will bottom out in the coolant passage, and it will stand up straight by itself. Carefully pour the first gallon of anti-freeze into the funnel, and follow with the first gallon of distilled water. Then half-fill the empty water jug or empty anti-freeze container with anti-freeze from the second gallon, and fill it up the rest of the way with distilled water. Pour this 50-50 mix into the funnel, watching as the level rises in the bottom of the funnel. When it stabilizes near the top of the opening, stop pouring, install the thermostat, gasket, and housing, and torque the housing bolts. Tip: Fel-Pro makes a great molded plastic gasket with a molded-in silicone seal bead (#35562T), and GM has a similar one (GM #10105135). Neither requires any sealer. Now continue filling the system with a 50-50 mix at the expansion tank until the tank is half full, and just place the cap on the neck (don't turn it down tight – the system must be open to purge any air).

Check for any leaks at the hose connections and drains – if OK, start the engine and let it run until the thermostat opens (the upper hose will get hot in a hurry when it opens). Then let it idle for another five minutes or so, and check the level in the expansion tank occasionally as the system purges any air while you monitor the hoses for leaks and correct them. Add more 50-50 mix as necessary to keep the tank at least half full while it purges. When the level stabilizes, shut off the engine and turn the cap on tight – you're done! Check the level in the tank the next morning when the system has cooled down, and add 50-50 mix if necessary to the half-full mark.

THE BOTTOM LINE: Now you can take it out and drive it, and observe the temperature gauge, comparing the readings under different conditions to what you were seeing before with the old radiator. You'll be amazed at the difference! Mine simply sits at 180° all the time, whether on the freeway, in traffic in town, or just sitting at idle in the driveway – it never varies. With your Corvette's original cooling capacity and extra cooling margin restored, you can watch the scenery as you drive instead of the temperature gauge, and not worry about engine temperature at all any more. Maintenance? Just change the coolant every two years, and your new radiator will last longer than you will. ■