TECHNICAL SERVICE BULLETIN

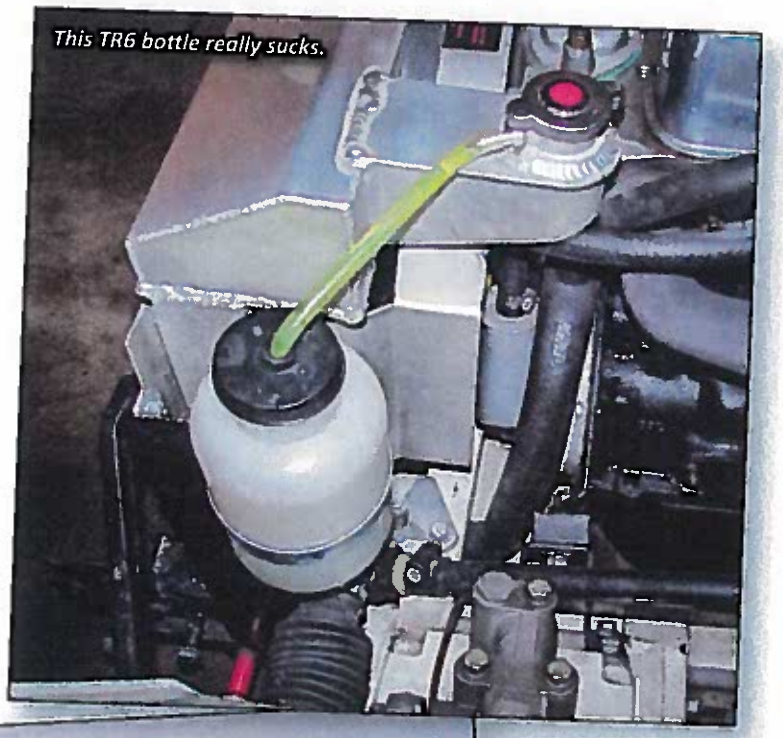
The So-Called Cooling System

Mike McPhail, Dripping Springs, Texas, Gulf Coast Healey Club

Memorial Day weekend usually signals the start of summer here in the Colonies, and warm weather can be expected. If your Healey is in reasonable nick, then you shouldn't have much trouble with overheating as long as:

1) your cooling system is full of 2-to-1 mixture of water and antifreeze
2) you have installed a 160 degree thermostat and the proper radiator cap
3) the fan belt is tightened properly
4) all the radiator ductwork and overflow/recovery system is in place
5) an uprated fan has been installed

Regarding antifreeze, most garage kept vehicles don't have to worry about the radiator turning into a block of ice, even in January. The anti-corrosion properties are what should concern us most. A 2-to-1 water/antifreeze mixture is fine for preventing rust in our cast iron (aluminum is another story) engines, and transfers heat noticeably better than a more concentrated mix. Distilled water should be used for best results.



This TR6 bottle really sucks.

Some engines won't warm up in cold weather with a 160 thermostat, but it is worth the trouble to swap to the cooler stat once hot weather arrives. Thermostats have changed over the years. Most Austin Healeys, like the Sprite, 100-6, and AH3000 have a bypass in the cylinder head for coolant circulation before the thermostat opens. These engines originally came with a special stat with a sleeve that blocked the bypass after the engine warmed up and the stat opened. These stats are available once again from Moss, but most folks just use the modern version. However, some cooling action will be lost if the bypass is not blocked off. A sleeve (Moss again!) is available to get this done, but at least in the Sprite, a plug in the bypass hose works as well. Most modern thermostats do not have a vent like they did in the old days. I always drill a

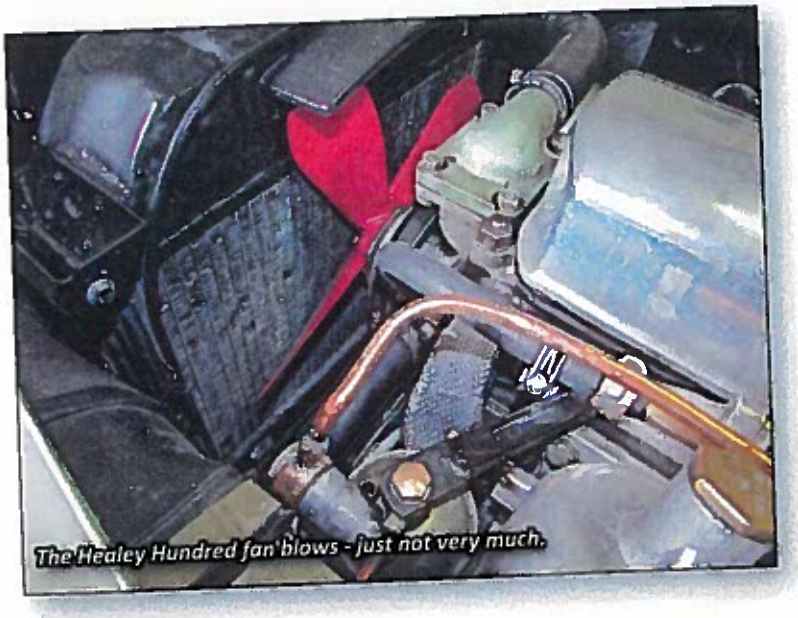
Thermostats past and present.

The long and the short of radiator caps.

3/16 inch hole in the flat part of the thermostat to make filling the system easier and prevent pressure build up. Caps have changed, too. Older ones are a little taller, and there are several pressure ratings, so order the correct one for your vehicle. Arbitrarily ising the pressure is a good way to blow a hose or a freeze plug!

Everybody knows the risk of poor charging due to a loose fan belt not spinning the generator, and the same thing can happen with the water pump. A new belt will almost certainly stretch and should be checked often.

When you are stuck at a traffic light the engine temperature may rise alarmingly. Some increase is to be expected, but can be minimized if everything is in order. While driving at highway speeds, your engine should be running at its coolest. If the temp jumps only at low speeds, you may have low coolant level, an antiquated fan, or missing/damaged ductwork. The ductwork/ radiator shroud prevents the hot air in the engine compartment from being pulled around to the front of the radiator when the car is moving slowly. It is very important that only outside air is pulled through the radiator. My 100 had no radiator shroud, and fabricating one cured its low speed overheating problem.


The Healey Hundred fan blows - just not very much.


1275 fan (yellow) and alloy radiator.

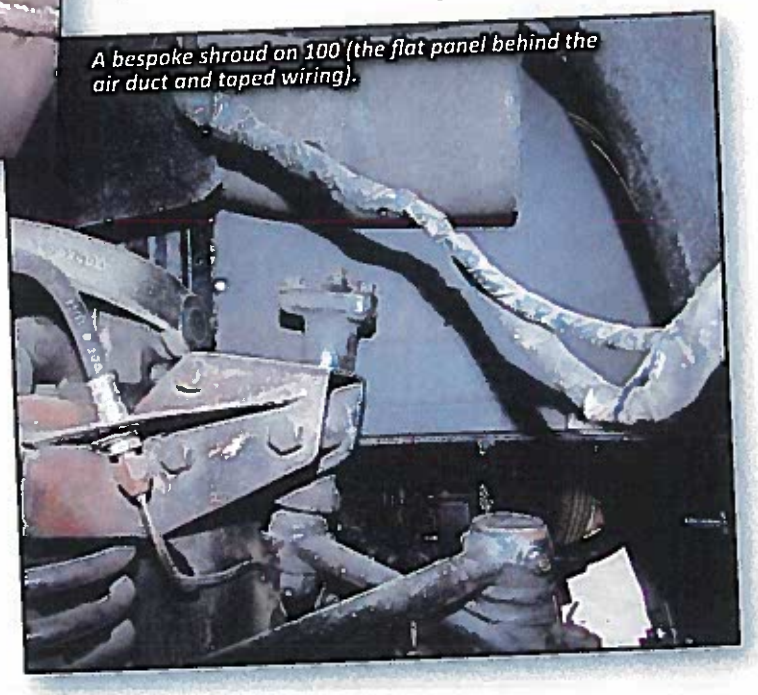
An overflow bottle will allow the maximum amount of coolant to be in the radiator. When hot, the excess will overflow, only to be recovered when the engine cools down. This action also allows the air in the system to be purged. Rust in the system can be detected by looking for sediment in the bottom of the bottle. A reliable source claims that filling the system with white vinegar before flushing with water cleans better than over-the-counter remedies.

Older Sprites lack some of the more modern engineering found on the 1968+ cars. Lots of these improvements can be retrofitted to these little guys! For instance, a late 1275cc Sprite cross flow radiator, ductwork and fan will bolt right on an early car. A Triumph TR6 overflow bottle and bracket will fit just about anything. On the 3000, just set the bottle in the hole on the right side of the engine compartment. Aftermarket "Texas Cooler" high performance fans are available (you guessed it, Moss!) for six-cylinder Austin-Healeys. The original 100 fan moves plenty of air, unlike the factory fans on other models. A handy fellow can easily fabricate a radiator duct, if a new one is not available. A new radiator is not all that expensive and probably more cost effective than a trip to the radiator shop.

Barring a bad head gasket, or some other dire problem, you should expect to run between 160-190 degrees Fahrenheit, regardless of the outside temperature. As a last resort, Wizard Cooling has modern, all aluminum radiators for all our cars. My go-fast Bugeye with aluminum radiator cools so well, that it needs a 180 thermostat, even in August!

In my opinion, electric fans are of little use, unless they are specifically designed as a replacement for the original fan. They also put quite a load on the charging system, so forget about using an electric fan on a car with a generator.

Don't trust that temperature gauge, either. Laser thermometers are reasonably priced (Harbor Freight) and using one for a second opinion may prove that your engine isn't so hot after all! Of course…that's what we suspected all along. HM


A bespoke shroud on 100 (the flat panel behind the air duct and taped wiring).

THE THERMOSTAT, FOR EFFICIENCY AND RELIABILITY

Matt Parrish
Fort Smith, Arkansas

The earliest cars were developed without a thermostat in the cooling system. However, as boilovers became a constant problem, thermometers came into use to at least provide an early warning system for the driver. The thermometer provided information but it did not provide regulation, and the driver merely watched until the engine started to get too hot and then had to stop to give it a chance to cool off. Therefore, to increase efficiency and reliability, the thermostat was one of the first automotive developments to aid in these factors.

An engine that is too cool does not burn the fuel as efficiently nor as cleanly as one that has "warmed up"; and it will also allow the oil to leave deposits on the heads causing reliability problems over time. To limit this, the thermostat interrupts or bypasses the flow of the coolant from the water jacket back into the radiator. This traps the heat in the engine, causing it to reach operating temperatures sooner. Once the preset temperature has been reached, the thermostat valve begins to open. The coolant flows through the radiator and begins cooling the engine, and this keeps the engine from becoming too hot and causing thermal breakdown in the oil, keeping it from lubricating properly. As temperatures in the engine vary, the valve responds by varying the amount of coolant allowed to go through the radiator keeping the engine in the optimal temperature range.

Most automotive thermostats are of the pellet type. This means that the valve is controlled by the expansion of a wax pellet against a spring. The spring holds the valve shut, and as the wax heats it forces the valve to open. Being wax, it is also moving to its melting point, and this is why when an engine overheats it is a good idea to replace the thermostat, whether it was to blame or not.

Thermostats are rated according to the temperature at which they begin to open. While common thermostats are available in a range of five-degree increments from 160 to 210 degrees F, all Austin-Healeys use a special design thermostat that incorporates a sleeve to control the bypass hole in the thermostat housing. This allows the coolant to continue flowing, just not to the radiator. This limits choices to the 160, 180, and 210 degree thermostats off the shelf. Experimenting will allow the owner to find the right one for their climate.

Some owners feel that the restriction in the coolant flow, which thermostats produce, causes backpressure that robs power just as a exhaust will, and so some owners have removed the thermo- However, most people I interviewed for this article thought this was a bad idea, as it allowed the engine to be over-cooled and kept engines temperatures in a range where the fuel was not efficiently burned and the oil left deposits on the head. At the same time, many owners have had no such trouble with the system after the removal of the thermostat, but once again, due to the bypass in the Austin engines, a blanking sleeve is required. This seals the bypass hole, forcing all the coolant to circulate through the radiator. Most of the applications for doing this seem to be in the racing area, rather than for daily driving. One mechanic I interviewed still thought it to be a bad idea, and offered that more power would be freed by using an electric fan, pre-cooler, or one of the new electric water pumps. This last option would not only free power from the engine, but also negate any backpressure in the cooling system.

The cooling system relies on basic physical properties. Heat transfer is proportional to the product of a heat transfer co-efficient, the transfer unit area, the temperature difference between the heat source and the coolant, and the fluid flow rate. This is expressed in the following formula:

$$Cp * A * Mdot * (Ts - Tc) = Q$$

Where

Cp = Transfer coefficient
A = Transfer unit area
Mdot = Fluid flow rate
Ts = Temperature source
Tc = Temperature coolant
Q = Total heat transfer of the system

Remember this applies both to the coolant in the water jacket taking heat from the engine, as well as in the radiator where the air takes heat from the coolant. *The thermostat can only directly affect the fluid flow rate.* So all other factors being the same, removing the thermostat will merely increase that factor alone. Some feel that this will allow the flow rate to increase beyond the transfer coefficient, thus causing a loss in the efficiency of the cooling system. Even if it did, the system would still remove the heat from the engine. The amount of heat would still transfer, only the temperature would be lower in the coolant.

Temperature is the average of the heat energy in a given system. Increasing the flow, in essence increases the amount of coolant looping through the system in a given amount of time this would lower the total temperature of the coolant for the same amount of heat energy being transferred from the system. The trouble lies more in the system doing its job too well, cooling the engine too much with nothing to limit the flow and raise the temperature back into the range for efficient operation.

The thermostat is a control for a very important process in our engines. It increases *efficiency* and *reliability* by maintaining the proper temperature range of engine operation.

Broken Stem – Heater Control Tap

Broken Stem – Heater Control Tap

Heat in a Healey is something we usually do not lack. Hot coolant circulating through the heater in the summer is something I try to avoid but it is nice to have in early spring or late fall. A common affliction of a big Healey (100-6 and later) is that the brass handle on the heater control tap often breaks. This brass plug valve is found on the right side of the engine above and rear of the oil filter. The brass handle often breaks where it is screwed into the plug body. Opening or closing the valve then can be done only with locking pliers which are not very brass friendly. Given the high cost of a replacement valve ($120), why not just replace the handle? Mine came from Autofarm, Ltd., for about $5 plus shipping. Removing the tap is easy after draining sufficient coolant – just two 7/16 hex bolts attach it to the engine.

Disassembly is straightforward – just be careful when you remove the cotter pin so that the contained spring and washer don't go flying into your face or a dark-and-never-to-be-found place. You'll need to remove (drill) the broken part of the stem and then use a tap to renew the threads before screwing in the new stem. Be sure to grease the plug before reinserting it into the body. While the valve is out of the engine, you might want to clean and polish it. The shiny brass looks great against Healey engine green. Exercising the tap by opening and closing it every month or so should prevent future handle breakage problems. A side curtain Healey with a working heater makes for a wonderful spring ride!

This entry was posted in Heater on March 28, 2014 [http://www.austin-healey-stc.org/tech-articles/heater] by stevebt7.

Mechanicals

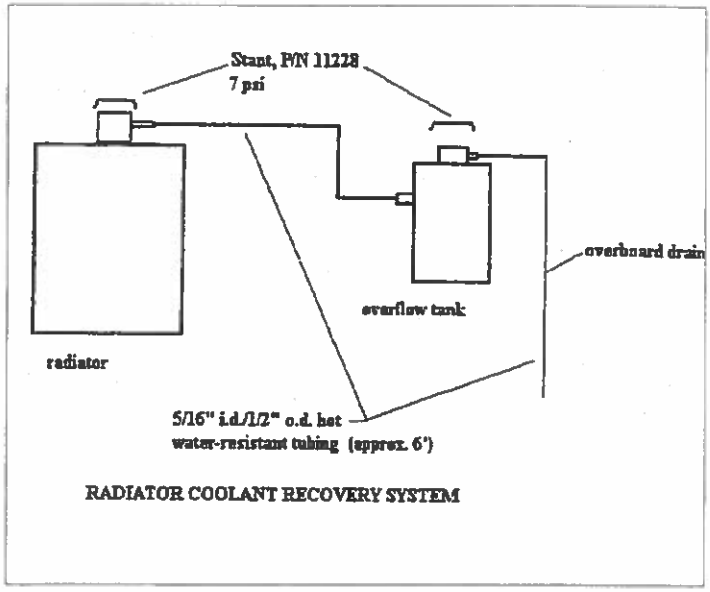
Coolant Recovery System

By Steve Byers
Havelock, NC

I have struggled with the problem of high engine temperatures in my Big Healey (BJ8) ever since I bought the car in 1984. In an effort to make the engine run cooler, I have: Designed, built and installed a radiator shroud to ensure all the air flow is through the radiator core; tried several different fans with five and six blades; installed a new radiator; mechanically and chemically cleaned the cooling passages of the engine block during the engine rebuild and used Red Line's Water Wetter. Still, in the summertime my engine likes to run at 200–212° F on the gauge. That doesn't give much margin when having to stop for a traffic light or getting caught in traffic.

Is the gauge inaccurate? I don't think so. During the two different trips to cooler climes up north last summer, I noticed that the engine ran at a more reasonable 180–190 consistently, then returned to its usual 200–212 as I approached home. I came to the conclusion that the cooling system on the cars is so marginal that it cannot cope with the temperatures frequently into the mid to high '90s during the summer where I live, on the coast of North Carolina. Finally, I got tired of watching the coolant wasted as the hot engine belched out a pint or so each time I stopped for gas or at a rest stop. Then, having less coolant, it wanted to run hotter, belch out more coolant during stops, etc., until it was low on coolant. I resolved to do something about it – to install a coolant recovery system such as modern cars have.

From a local junkyard, I obtained a brass coolant recovery tank from an MG Midget (I also have a '73 Midget with the tank, which is what gave me the idea. I also like the fact that the tank from the junkyard is vintage British!) The MG tank is from a 15 psi cooling system, while the Healey uses a 7 psi system. Next, I obtained two 7 psi radiator caps from the local auto parts store (Stant, part number 11228). These caps fit the necks of both the Healey radiator and the Midget overflow tank, but they seal only the overflow tank. The length of the spring on the cap is too short to seal off the overflow vent tube in the neck of the Healey radiator, and that is good. We are going to transfer the scaling function from the radiator cap to the overflow tank cap.



RADIATOR COOLANT RECOVERY SYSTEM

I removed the rubber overflow tube from my Healey radiator and obtained about six feet of clear plastic tubing (5/16" inside diameter and about ½" outside diameter hot water resistant) at a home improvement store. The tubing is attached at one end to the overflow outlet of the radiator and the other end, about three feet away, is attached to the inlet tube of the Midget overflow tank. A separate length of tube serves as the overboard vent for the overflow tank. The tube connection to the inlet of the overflow tank is secured with a small hose clamp, but the small clearance between the radiator overflow outlet and the top of the header tank precluded using a clamp there. I used a small piece of stainless steel safety wire twisted with a pair of pliers to secure this end of the tube to the radiator (using care not to cut the tube by over-twisting the wire). I located the tank in the space that would be occupied by the brake and clutch master cylinders on a right-hand drive car. The tank just sits in the space and doesn't need to be firmly attached. I routed the overflow tube for the tank down past the brake booster, to vent onto the pavement below. It is possible in relation to the radiator, but the underbonnet area of the Healey doesn't leave many options in that regard. The location I chose for the tank is just a convenient one and keeps the tank secured enough not to need a mounting bracket.

The overflow system works as intended. It does not contribute much to keeping the engine cool, because when the engine is hot the flow is all from the radiator to the tank. When the engine cools, a slight vacuum from the radiator pulls the coolant back out of the overflow tank into the radiator. However, a year after installing the system, I have yet to have to add coolant. The total cost of the overflow tank ($20), tubing ($2) and two radiator caps ($5 each) was about $30 and only required about 15 minutes for the installation, not including painting the junkyard overflow tank black.

Any suitable overflow tank can be used, and I have seen overflow systems for sale in auto parts stores. But if anyone wants to use the Midget tank and cannot find one locally, I have an extra one available.

Overheating Solution

by Ronald Stergas
Johnstown, NY

I would like to share with you my findings on the overheating of my 1964 Austin-Healey MkIII.

I have always had a problem with overheating, and in one of your technical articles there was a piece on the metal shroud addition to the backside of the radiator which would help direct the flow of air through the radiator. I installed this to my radiator and found some improvement, but I was still overheating.

In talking with a friend who is a mechanic, he indicated that water would dissipate heat better than antifreeze mixed with water. I drained the entire cooling system and added water only. I found that I did drop the running temperature. My own thinking is that if water would drop the running temperature (having used well water), then using distilled water would drop the running temperature even further. Again, I drained the entire cooling system and used distilled water. For the past couple of years I have noticed considerable improvement in the overheating problem.

This I do in the summer; in the winter I remove the distilled water and use an antifreeze mix.

Radiator Rebuild Aids Cooling

by Stewart Gillmor

Northeast Region AHC

About eight years ago I had my BJ8 engine completely rebuilt. It was reinstalled with the addition of a six-blade fan and an oil cooler. With the new engine I noticed its tendency to overheat and boil over when crawling in traffic on a hot day (sound familiar to any Healey owners?). I never blew a radiator hose, but the radiator had a leak or two around the top. I fixed the radiator leak and had it cleaned out—still tended to overheat. Adjusted the engine timing all sorts of ways—still tended to overheat. Changed thermostats, checked radiator flow rate—still tended to overheat. Didn't seem to be any obstruction in the engine. All sorts of schemes were mentioned to me; but I decided on a radiator capacity enlargement, keeping the outside width and height the same, but thickening the core and utilizing new radiator technology.

I drove to Weymouth, MA, to Central Auto Radiator Sales (800-637-0080), a manufacturer and fabricator of automotive radiator cores, to discuss possibilities for my radiator. My original Healey radiator had a 2 3/16" thick core with 12 fins per inch (non-louvered), in four staggered rows of 1/2" tubes, of 24 tubes per row for a total of 96 tubes. Several types of rebuild could be accomplished, but I wished to have the width and height remain the same, use the same top and side rails, etc. It's hard to describe the copper radiating geometry, but the design and materials used today are more efficient than in the 1960s. In the end, I chose a design which would increase the number of tubes from 96 to 140, with 16 louvered fins per inch in four rows of 1/2" in-line tubes. The resultant core was thickened to 2 5/8". The rebuilt radiator looks virtually the same as the original, and it was reinstalled by me a couple of weeks after visiting the Central shop. With the additional tubes and louvering, I have increased the radiator's capacity by more than 50%, while retaining the original top and frame.

It's been exactly four years since the radiator rebuild, and things have run nicely since. I've just returned from a 2,000 mile, 10-day jaunt with a Northeast Region club tour of Nova Scotia. My BJ8 used no oil, lost no coolant, and never boiled over. If you're going to have your old radiator boiled out, why not think about the new designs and technology and have it enlarged?

100 Radiator Funnel

by Len Cannizzaro

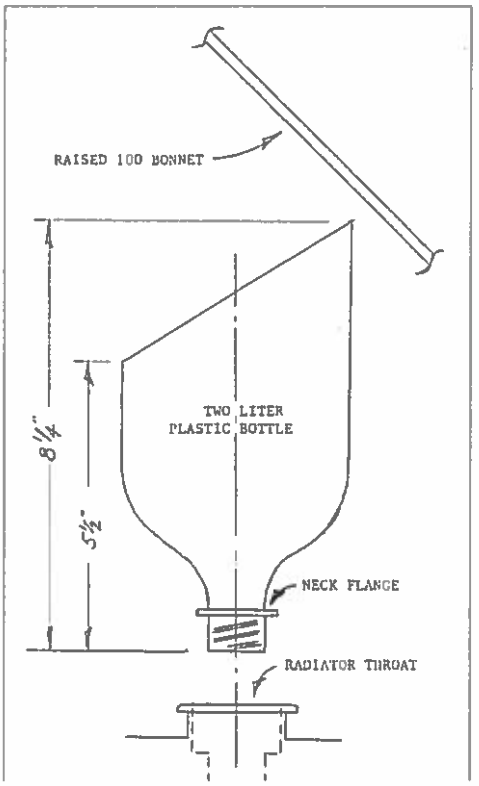
Northeast Region

For those of you who own a 100 BN1 or BN2, you are well aware of how the front-hinged bonnet impedes direct pour-in access to the radiator tank. Well, when it's time to flush your cooling system and add fresh antifreeze, here's a little helper that you can easily make. It is the best funnel I've ever found for the job.

Go to your local market and buy a 2-liter plastic bottle of your favorite soft drink. Note that immediately under the cap is a neck flange designed to aid in carrying the bottle. You may also note that some brands have larger flanges than others. Most are about 1½" in diameter.

When you empty the bottle (save the screw-on cap!), wash it out, dry it, and turn it upside down on a table and measure up 8¼" on one side and mark it with a felt with the marker and cut, rounding the high side and the low side. That's it! Insert the funnel in the tank throat with the high side against the bonnet, and you will see that the screw cap end fits snugly into the lower opening and the flange fits perfectly into the upper part and rests flat on the seal ledge. Note that the funnel is very stable and doesn't need to be held while pouring. Also, should your initial pour be a little hasty, the high back side will capture the flow.

Another benefit is that the funnel tail does not reach down into the fluid, so that when you remove it there is no worry about drips. Replace the screw-on cap, store with the open end down, and you have no concern about dirt getting inside the funnel bowl before the next use. While this funnel works particularly well in the 100 models, it will, of course, be helpful on any Healey.



Cooling - Installing an Auxiliary Fan in a Big Healey

-Steve Jekogian

Hot! Hot! Hot! That's what it often gets in A Big Healey. You know the feeling everything is fine, the car is running great, the traffic is moving and the Temp gauge is at a nice 180 degrees.

But them it happens, a little traffic, a couple of red lights, a slow driver in front of you and your eyes start to stare at that temp gauge and it starts is momentous rise up, up, up. Where it will stop no one knows. Yea you start to rev the motor and hope, hope, hope. But even if it doesn't boil over you worry, worry, worry.

An overheated Healey is really why I fell in love with the car. How? Well it all started around 1964 when we were coming back from the Jersey shore on a hot summer Sunday evening. Stuck in traffic in my Dad's 1961 Dodge Dart (no A/C) on the highway leading to the bridge into Philadelphia. We crept along and then I saw them, the setting sun light shinning off their beautiful Silver Blue paint. Two Healey's with the hoods open and the owners talking. What a great looking car and look at the friends you can make. Little did that teenager know they were stuck there? But in my dreams I knew I wanted that car. Zoom ahead 20 or 30, OK 40, years and now I am at a traffic light staring at the &^%#)@*&& temp gauge. While my car never "boiled over" I do worry when the Temp goes up.

So this year I installed an electric auxiliary fan. The 10" model I installed is reversible which means it can be set up to push the air through the radiator, or pull it if installed on the inside of the radiator. I decided to put it in front of the radiator and keep the standard four blade fan.

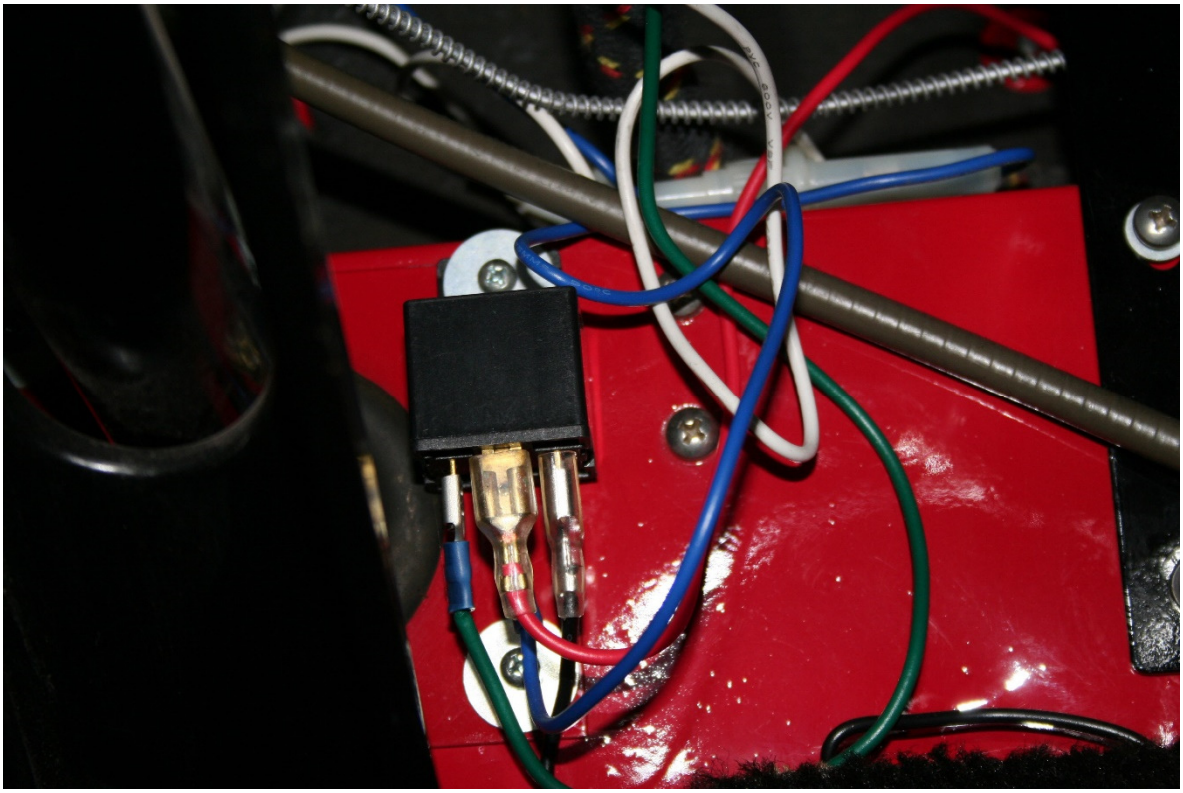
Installation was really easy there were 4 kind of "wire ties" with a fat head that slipped through the radiator core and attached the fan to the front of the radiator.

First I positioned it low to not block the air flow But I realized the front frame cross member would not allow me to attach the bottom ties. So up I moved it. Prior to installing it I painted some of the silver on the fan black to conceal it even further.

Bob Pense suggested I install an electric relay along with the switch and I mounted it on the air vent bulkhead as it was easy to run the wires through the firewall.

It is not noisy and now I do not worry about traffic lights or really hot days.

Aux. Fan



Fan Relay