Radiator pressure caps

Following fitting a replacement radiator in his early MGBGTV8, Mike Dunlop decided he would also do a routine replacement of the radiator pressure cap. He checked out two online spares sources and noted "both companies give the psi rating for their caps as 10psi. I have always believed the pressure rating of the original cap fitted to the V8 was 15psi – in fact my original cap definitely has 15psi stamped on it. My question to you is, can I fit the 10psi cap without causing any cooling problems to the car? As you know the V8 cooling system just about copes with modern motoring so I would not want to make it worse." Tony Lake provides this useful note on cooling, what is so "hot" it could be regarded as overheating and the importance of a correctly pressurised cooling system.

I believe the term "hot" is defined by the maximum design temperature at which the cooling system will operate reliably. In the case of the MGBGTV8 that maximum temperature is 129^{O} C at sea level and in the same way "cold" refers to -35^{O} C. I don't think MG would have referred to 129^{O} C as an overheating condition. To achieve this value requires a full radiator using a 50/50 Glycol/water mix as the coolant, expansion tank filled to the line, both checked when the engine is cold, with a working 15 psi pressure cap and no leaks. This high temperature condition can be maintained with the engine running at full load without distress. Overheating will occur if the cooling capacity is compromised because something is wrong, the radiator is not full, the pressure cap leaks, the expansion tank coolant level is low, the water pump is malfunctioning or some coolant leaks occur, now the engine begins to get hotter and hotter under load and there is a risk of cylinder component damage if the engine is not stopped or the load reduced. There is the same volume of ram air through the radiator matrix but the reduced volume of coolant simply can't carry the heat away. The temperature gauge shows a steady increase when it would normally reach equilibrium even with increasing load and vehicle speed.

The lower temperature is the value achieved when a 50/50 Glycol/water mix is used and really represents the lowest air temperature at which the mixture remains fluid and will still circulate to provide cooling.

In the real world the engine would have to be at full load for a long time for the coolant to actually reach 129^{O} C, and then the air temperature would have to be very high as well. I guess it is a hypothetical figure that can be achieved in laboratory conditions but is pretty rare for most V8s on the road, but I expect the racing community could readily identify with the circumstances.

The pressure increase results from expansion of the antifreeze mixture with increasing temperature. It is a valuable feature that with a sound cooling system allows the coolant to do its job under extreme conditions. The pressure of 15psi is like a relief valve setting, it is a value used in the industry which experience shows is within the sealing capability of commercially available radiators, gaskets, housings, hoses and hose clips. If however a leak occurs then a vicious cycle develops where the coolant can begin to boil at a lower temperature because the volume of air in the system becomes so great that a high pressure cannot be generated. Perhaps the worst case scenario might then can arise - a big leak develops because a hose has burst. We are now in "frying mode" and a head gasket failure or engine seizure is imminent. To reach that situation you really have to be working the engine pretty hard and ignoring the instruments.

In the '50s the quest for low engine noise, low oil consumption and generally improved performance led to much tighter piston clearance and improved piston ring configurations which, whilst evaluated in development, had not always been run as abusively as might occur in an owner's hands. It was possible for the delivery drivers of one major manufacturer to leave the factory in a brand new car and drive flat out on the autobahn sometimes with quite disastrous results. So the Cologne or Hot Scuff Test was born. Piston and ring designs would only be signed off if a blueprinted engine were run in, then restarted from cold and run immediately at maximum power whilst combustion gas leakage past the rings was monitored for whatever the test period was. If that test were successful, the same engine would be run at maximum power whilst the coolant was dumped. The engine had to run for one minute before gas leakage started to increase or piston seizure took place. I'm sure Buick and later Rover had similar test regimes to prove that power cylinder components would not misbehave at the designed "maximum temperature". The Hot Scuff test illustrates the point well, to actually make an otherwise healthy engine seize it has to be grossly abused by removing the coolant and then it all happens very quickly.

Minimum pressure for a cap

The issue of a minimum pressure value is interesting. The system pressure depends on engine load, ambient temperature and ram air due to forward speed. This assumes a correctly filled cooling system outlined earlier. That is why even at quite high engine loads and high road speeds, say around 100mph, the coolant temperature remains normal and under control, and system pressure is probably about 6psi. However if round the next corner there are road-works that cause a halt, then ram air is zero, the engine is hot soaking, and even more heat goes to coolant because radiated heat from the block is reduced as the temperature under the bonnet starts to climb because the exhaust dumps its heat as well. Now one sees the temperature gauge climb, the system pressure increases but thankfully the cooling fans run as the Otter switch on a V8 senses 95 ^{O} C coolant temperature. If it is a really hot day then 15psi might be reached but only at idle speed and no load. The GRC110 15psi pressure cap, used on the BMC Mini engine, will fit the GTV8 engine expansion tank. A 10psi pressure cap should not be used because useful high temperature margin is removed. Regular checks on coolant levels are as important as oil level checks

Health and Safety warning

Do not remove the pressure cap from the expansion tank when the engine is hot. If something untoward has happened to raise the temperature then steam and boiling coolant will cause injury. Equally do not attempt to remove the screw cap from the radiator. Let the engine cool down and to be safe cover the pressure cap with a thick cloth before removal. The pressure cap has a two step removal technique, first twist anti-clockwise, it is now loose, then push down to finally remove from the tank.