ESCORT COSWORTH/MIKE RAINBIRD

KEEPING COOL

Whether you use your car hard on the road or out on the track, Mike explains why you need to sort out the engine's cooling system.

WHEN you modify your engine to a power level that is more than double that of the original output the car came equipped with, the existing cooling system will be found wanting. However, as logical as this would seem, it is amazing how many modified cars rely on the original cooling system, when this is simply not adequate for the task in hand.

The problem with increasing the output of the engine is that this extra power creates extra heat, and as good as the Cosworth system is, once you get on track, you soon become aware of any inadequacies. In view of this I thought I would use this month to give you an idea of how to improve the cooling of your car to suit varying budgets and engine specifications.

The first stage is to improve the existing set-up

The first stage is to improve the existing set-up. The easiest way to do this is to change to an alloy header tank.

These tanks run a higher pressure cap, which as your O Level chemistry will tell you, the higher the pressure, the higher the boiling point. The popular cap to use is the blue VW item that comes as standard fitting with the Bailey, Pro Alloy and Spec-R header tanks — this ups the pressure from the standard 0.75 bar to 1.3-1.4 bar, increasing the boiling point from 125°C (assuming 55 per cent glycol mix) to 135°C.

The standard radiator is able to take the increase without any issues (unless it has been previously weakened by a head gasket failure and given a 'smiley face' — where the bottom of the radiator bows out in a Joker-like grin! This is adequate for normal off-the-shelf chip conversions (up to around 350 bhp), but if your water temps exceed 110 on track, then you know that this isn't sufficient.

Monster 65 mm-deep intercooler is boxed in


"No, it's a T4 turbo, fool!"

You can also give the cooling system a fighting chance, by removing the water-cooling part of the turbo. The T series of turbos are able to run without water, as this was only added to help speed up the warming process of the oil as well as help protect the bearings upon shutting down. So, as long as you follow a proper warming up and cooling down process, it won't affect the reliability of the turbo. If you've ever seen a turbo glowing red hot, you will know how much heat the water system has to cope with on track.

BOX CLEVER

The next area of improvement is the same as the first stage, but can be taken further by boxing the radiator in. Using aluminium sheets to surround the radiator ensures that the airflow is forced through it and cannot flow around the outside; air always takes the path of least resistance. This maximises the efficiency of your existing system, and can offer significant improvements for minimal outlay if done properly. Again if temps are still exceeding 110°C, then you need to consider the next option.

This comes in the form of a radiator from one of the well-known Cosworth alloy product suppliers. However, I cannot stress enough that it is pointless buying a cheap item off the Internet from an unknown company, as invariably the cores are of such poor quality, that not only is the fit and finish pretty poor, but the efficiency can actually be worse than the standard item (this applies to intercoolers as well)!

As you will know from my previous articles, I usually have a tried and tested option and for this aspect the lads at Pro Alloy Motorsport do a 50 mm radiator that is exceptional quality as well as offering a 7-degree improvement over standard on track. In normal running the thermostat will keep the water temps at around 87 degrees, so no improvement is gained at normal speeds.

Unfortunately, with this set-up and combined with the 65 mm intercooler that I also run and the limited space that an Escort affords, I had to ditch the original fans for a pair of the Pro Alloy slim line items, which use two SPAL 12 inch fans. These move 1770 ft of air a minute, giving an improvement on the original items.

To get the best from this set-up, I've also boxed in the radiator to ensure that the air flows through it. As I have an RS500-style intercooler, I did this by sealing the radiator to the back of the intercooler; the air has no choice but to go through and not around it.

as 120°C! Due to the pressure the system is run at, it wasn't boiling the water, but there would have been super-heated hot spots around critical parts of the engine, so it wasn't ideal.

SPACE SAVER

Given the limited space in the Escort, I wasn't sure what I could do to improve things, until I had a brainwave about using a supplementary radiator. As many of you will know there are small additional radiators available that have been specifically designed for cooling the water from the turbos, which sit on top of the

Due to the thickness of the intercooler, I was still suffering from high temps on track

Unfortunately, on track the high ACTs from constant high boost running mean that the air going into the radiator is secondary air; it has been heated up by the exchange process in trying to keep the charge temps down after travelling through the intercooler. This is obviously a big downside of fitting an intercooler of this type, but once you get to a certain power level, you really don't have a lot of choice.

Due to the increased thickness of the intercooler I am running (65 mm as opposed to the normal 50 mm), I was still suffering from high water temps on track. When the ambients got to 30°C, my water temps climbed to as much

existing radiator between the intercooler inlet and outlet pipes and although I didn't need this facility, due to having removed the water cooling from my T4, I knew I could utilise the space for something similar.

Having an Escort Cosworth also meant that this originally had a chargecooler arrangement that was cooled by the engine coolant, which lent itself to be connected to a radiator. With this is mind, I commissioned Pro Alloy to fabricate a twin pass radiator that connected to the original chargecooler pipework. A twin pass arrangement means that the core is in the shape of a U laid on


Washer bottle is relocated to boot, along with water injection kit

Much-needed supplementary twin-pass radiator sits on top of the main item

With all this in place, I'm hoping you won't see me lose my cool

it's side, with the inlet and outlet both at one end. With this supplementary radiator in place, temperatures took a dramatic drop and it was now impossible to exceed 110°C, no matter what the weather.

OIL TEMPERATURES

The next problem I faced was the oil temps. The ideal is to maintain these at around 110°C, any less and any condensation that occurs in the constant heating and cooling down process would not burn off and could cause the oil to sludge up and reduce its protective properties.

With the old engine, the standard modine arrangement didn't have any problems maintaining temps at this level, but the new one with its increased rev range saw peaks of 123 on track at the Nürburgring, and that was only at 1.5 bar! I didn't want to remove the modine completely and replace it with a separate air-to-air oil cooler, as the Ford system is very efficient and in tests is actually equivalent to a 13-row air-to-air cooler. Given the space constraints, it would be very difficult for me to fit an oil cooler of sufficient size to improve upon this, without affecting efficiency of the intercooler (as that is the only place for an oil cooler that would be large enough to improve on the existing set-up).

In view of this, I took the supplementary route again, and have added a 16-row Setrab air-to-air cooler, that sits behind the nearside fog light grille. This uses a sandwich plate that connects in between the oil filter and 4x4 remote extension arrangement. Doing it this way has the benefit of not needing this to be thermostatically controlled, as the original modine arrangement, which has this control, is still retained.

It's not just the water around the engine that needs cooling

This brings its own issues, and in this case the windscreen/headlight washer reservoir has had to be relocated to the boot. However, this has removed a considerable amount of weight from the front of the car. The Escort reservoir has a huge capacity, so 10 kg has been moved to the back of the car, which has improved the distribution.

COOL AIR

It's not just the water around the engine that needs cooling, but also the air going into the engine. I wanted to have the best intercooling I could achieve, so I commissioned Pro Alloy to make me an intercooler that would utilise every mm of available space. As mentioned earlier, the depth of the intercooler was increased from the standard RS500 norm of 50 mm to 65 mm. However, I also asked them to increase the overall frontal area as well, and the intercooler is a huge 140 mm wider than a standard RS500 item. I also requested that plates be welded to the bottom and sides of the intercooler to help ensure that as much airflow went through the core (and therefore the radiator as well) as possible.

Sometimes even this isn't enough in extreme conditions and a full Group A water injection kit has also been fitted to supplement this arrangement. This consists of two 0.6 mm jets (for better atomisation) and a Flowjet 6.8 bar pump filling the supply duty. So, with all this in place, I'm hoping that one thing you won't see me doing this year is losing my cool — apart from in the car, where I had to remove the air conditioning to accommodate all of the above — d'oh!

CONTACT

PRO ALLOY
0845 2267561
www.proalloy.co.uk

R&B MOTORSPORT
01508 557822
www.randb motorsport.co.uk