Do not flog around endlessly through a practice session with a misfiring or rough running engine. Come in and fix it. If you can't fix it—park it. All you are going to achieve on the track is a graphic advertisement of your ignorance and the annoyance of everyone who can hear you or who has to pass your moving chicane.

Moisture causes corrosion. Corrosion is one of the major causes of engine wear. After the race remove the plugs, crank the engine and spray a little WD 40 into each cylinder. By removing the plugs and cranking for awhile when next you want to fire it, you will remove the residual oil. Seal the intakes and exhaust and put it on the trailer.

CHECKING

A visual check of rod and main bearing condition at infrequent intervals will go a long way toward preventing bottom end failure. The best indication of the condition of rings, ring lands, valve seats and valves—short of a tear down—is a cylinder leak down test done when the engine is warm. Sun makes a very good cylinder leak rater (not to be confused with a compression gauge which is useless).

Your engine builder will give you a good idea of the expected life of self destructing components such as timing chains, pistons, distributor drive gears, valve lifters, valve springs, rod bolts, rods and the like. Check and replace these items on a schedule—it is cheaper and more convenient than ventilating an engine and losing a race.

Despite our best efforts and intents, every so often everyone scatters an engine. Unless you want to scatter the replacement, thoroughly clean all of the oil lines, fittings and coolers. Throw the filter away.

NOISE vs POWER

There apparently exists a large body of racers who confuse noise with power and who quite sincerely believe that the faster an engine is turned, the more power it puts out. There are legitimate cases of brute force and bloody ignorance triumphing over science and skill but this is not one of them. The rotational speed at which an engine produces its maximum power is determined by a multitude of factors including ratio of stroke to piston area, valve area, port configuration, valve timing, intake and exhaust system design, etc. Once upon a time metalurgy imposed limits that prevented some if not all engines from safely reaching the rpm at which they would produce peak power. This is no longer the case. Most racing engines are now reliable to several hundred rpm over their power peak. A quick look at your dyno sheet will convince you that once the power stops going up, it comes down—in a hurry. A close inspection of the dyno sheet will show you at what point you want to shift and to what rpm you want to run the engine in top gear. Shift a couple of hundred rpm over the power peak so as to retain the greatest area under the curve and run to the power peak in top.

FEEDING THE ENGINE—FUEL

That pretty much covers the care of the engine—now for the feeding. Basically we feed our engines with gasoline, which tends to vary in octane rating, moisture content and revapour pressure—a lot. The best commercially available automotive gasoline is Sunoco 260. If you live in an area where it is available you are looking good. Buy from a dealer who does a large volume and try to buy right after he has had a delivery. How you store and transport it is up to you. If you discover a safe, economical and legal way, let me know.

Pure or Union race gas is slightly better and is available in some locations—mainly major race tracks and usually to professionals only.

Except for Pure and Union, track gas is almost guaranteed to be stale and contaminated and is suitable for tow cars only. If you cannot obtain Sunoco, Pure or Union, then go to your local airport and find a lineboy who will sell you 110/130 AvGas. This is not strictly legal, but except for its light green color (yes, that's what they make red analine dye for) it is undetectable. It is about 104 octane and is pretty highly aromatic which means that you are going to lose about 5% of your fuel mileage. It is not notably more expensive than the trash that you can buy at your service station since the Energy Crisis was invented. Storing and transporting fuel is no fun at all but it is preferable to spending the weekend trying to tune on bad gas—or burning your engine down.

Whatever gas you use, chamois it into the car (through a real chamois skin which will remove all of the sediment and most of the water) and don't store it for more than a month.

FEEDING THE ENGINE — OIL

We also feed the engine with oil. No street oil will get the job done simply because the service conditions are totally different. The same goes for the aircraft oils. I personally do not believe—yet—in the multi grade racing oils—but I am anxious to be proven wrong. So far the oil gauges and the engine bearings have proven me right every time I have tried the multi-grades. Do not be mislead by claims. Use what your engine builder recommends or what the good guys are actually using (which may not be the same stuff they claim to be using). Unless you are getting a lot of blow by there is no need to change racing oil more than every 1000 miles or so. Free oil is not going to save you money unless it is also good oil. Any and all additives are a No No!

FEEDING THE ENGINE — WATER

We also feed the engine with water. Water system schematics are show in Figures (82) and (83). Hopefully the engine will not consume any water at all. It will, however, regurgitate some. If it regurgitates enough water we will get an air lock in the system and instant overheating will result. The reason for all this is a combination of thermal expansion and the phenomenon known as "heat soaking".

We set out from the pits with the water system bled and full. We have pressure checked the system and it has no leaks. The pressure cap is in place and wired. As the engine heats up the coolant water expands and pressurizes the system. When the pressure within the system reaches the limiting pressure of the relief cap, the excess water with which we filled the system is bled past the cap and into the catch tank or onto the track. The system is now full at operating temperature and everything is fine. Now we come into the pits with a hot engine and shut it down. Or we don't shut it

Figure (82): Water System Schematic—Single Radiator

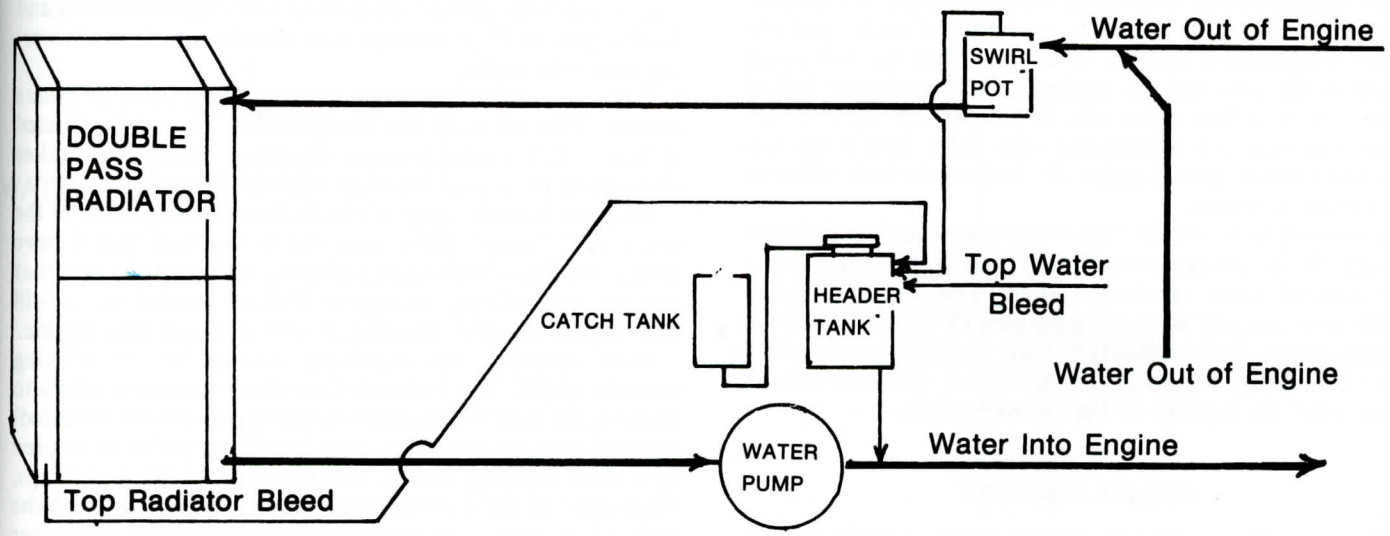
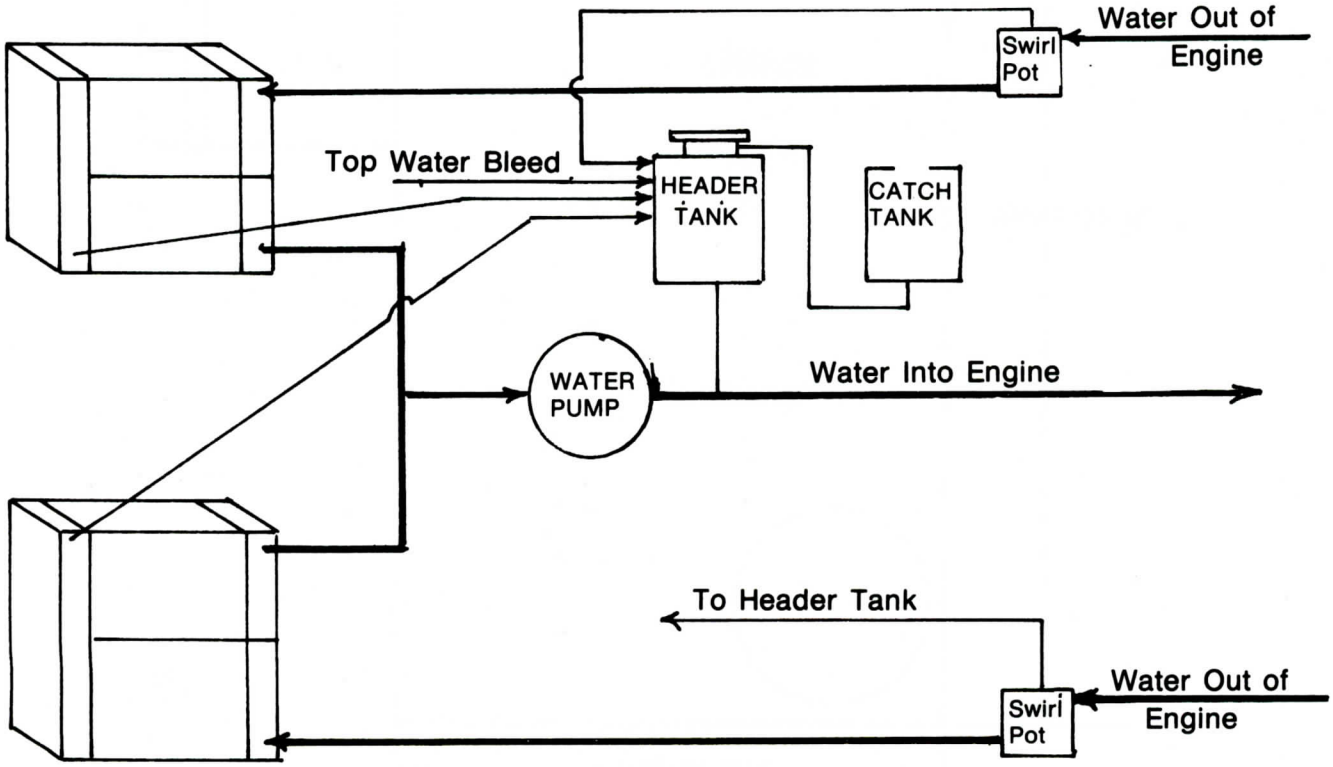


Figure (83): Water System Schematic—Twin Radiators



down. In either event, air is no longer passing through the radiator which is now a radiator rather than a water to air heat exchanger. If we shut the engine down, water is no longer circulating. Engine temperature goes up due to lack of cooling, the coolant expands, the pressure cap kicks and more coolant is lost. Eventually we go back out, the coolant circulates, the radiator starts to function again and the water temperature returns to normal. But we lost some water in the pits and the header tank is no longer full of water—now it has some air. If the header tank is too small—or even if it is marginal—the water level is too low and the coolant system gulps air. Instant air lock followed by instant overheat.

The solution is simple. Use a big header tank and mount it high. Better yet use a moderately sized header tank and a commercial water recovery system. You have to have a catch tank anyway so it costs nothing in weight to run the closed system. It is necessary to start with some water in the overflow bottle, however, and the bleed from the header must enter the bottom of the recovery tank.

STEAM POCKETS

If your engine makes its own air locks—usually by forming steam pockets in the heads—you may have to bleed the rear of the heads to the header tank as well as top water. If the engine persists in this behavior, a swirl pot as illustrated in Figure (84) will usually solve the problem.

FEEDING THE ENGINE — DIRT

We do not wish to feed dirt and dust to the engine. At best this will accelerate bore and valve wear, dent the valve seats and put abrasives in the oil. At worst a stone may hang the throttle open. However, race tracks are traditionally dusty places and other drivers are forever running off the road and forcing you to drive through dust clouds as well as showering you with rocks.

Step one is to incorporate a stone screen in your air intake system. This will keep the boulders out. It must be located at least 1-1/2 intake trumpet diameters above the intakes themselves or it may interfere with airflow.

Step two is a thin layer of plastic foam to keep most of the grit out. "Filtron" filter material is the best that I have found. All this will take some playing with to make sure that you are not robbing the engine of much needed air. It will also require frequent cleaning. It will also save your engine.

Slide throttles are especially susceptible to sticking because of dirt. The Formula One teams have now taken to starting the race with a nylon stocking (source not revealed) over the cold air box inlet. This ingenious device is secured by a piece of string leading to the cockpit. After 4 or 5 laps, when most of the dust has been blown off the track and the early off course excursions have mainly happened, the driver pulls on the string and the stocking is discarded. Very clever—and very cheap. What happens when the driver immediately behind wears the stocking around his Bell Star or in one of his air intakes, I don't know.

Figure (84): Water Swirl Pot for De-Aeration