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AERODYNAMIC UPGRADES AND COOLING SYSTEM ABSTRACTION OF "ENGINES"

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ABSTRACT

*The **automotive industry in India** is one of the largest automotive markets in the world. It was previously one of the fastest growing markets globally, but it is currently experiencing flat or negative growth rates. In 2009, India emerged as Asia's fourth largest exporter of passenger cars, behind Japan, South Korea, and Thailand over taking Thailand to become third in 2010. As of 2010, India was home to 40 million passenger vehicles. More than 3.7 million automotive vehicles were produced in India in 2010 (an increase of 33.9%), making India the second fastest growing automobile market in the world (after China). India's passenger car and commercial vehicle manufacturing industry recently overtook Brazil to become the sixth largest in the world, with an annual production of more than 3.9 million units in 2011. From 2011 to 2012,*

There are a number of different types of car engines in today's road and race cars, and the number is growing especially with emerging technologies like Hybrids .so in this paper discuss the Aerodynamic Upgrades and Cooling System abstraction of "Engines"

Keyword: Cooling System, Aerodynamic, Spoiler, Fins.

I. INTRODUCTION

Most cars these days use what is called a four-stroke combustion cycle to convert gasoline into kinetic motion. This four-stroke approach is known as the the Otto cycle, in honor of Nikolaus Otto who invented it in 1867.

- **Intake stroke-** air and fuel are taken into the cylinder as the piston moves downwards.
- **Compression stroke-** where the air and fuel are compressed by the upstroke of the cylinder.
- **Combustion stroke-** compressed mixture is ignited and the expansion forces the cylinder downwards.
- **Exhaust stroke-** waste gases are forced out of the cylinder.

The intake and outlet ports open and close to allow air to be drawn into the cylinder and exhaust gases to be expelled. As in fig given below fig (vi)

So we understand that the engine is effectively a device which sucks in air, compresses it, ignites it and then blows the air out again to create power to the road wheels. In terms of the performance gains possible, there are a vast multitude of different techniques and technologies. First of all lets get a understanding of the different types of engine layouts commonly found in cars today. As Engines can come in an array of different designs, including Straight/Inline, V Type, Boxer, Rotary Wankel and even Diesel:

II. STRAIGHT/ INLINE ENGINES

In-line engines have the cylinders arranged, one after the other, in a straight line. Almost all four cylinder engines are A straight/Inline engine is considerably easier to build than an otherwise equivalent Boxer or V type engines because the cylinder bank and crankshaft can be milled from a single metal casting and it requires fewer cylinder heads and camshafts. This ultimately means lower production and maintenance costs. Also due to their smaller and more lightweight construction, this is the preferred Engine design for FF cars (Front Wheel Drive). The design can be extremely fuel efficient compared to V type, Boxer and Rotary engine designs

.There are some five and six cylinder Straight/ Inline design engines, which are mainly found in European cars from the likes of Audi and BMW for example. Reasonable performance can be achieved with performance levels in the 0'9 Ford Focus RS around 300 BHP. This is mostly due to Turbo Charging and boost pressure used, but it is common for a 2.0 Litre 16 Value inline 4 to produce 200 BHP plus.The engines are not generally thought to be as smooth as the V type and Boxer engine designs and the structure has it's limitations in terms of durability and strength. Inline engines can sometimes be a little rough in lower revs, but work well for smaller cars and do respond well to Tuning. As in fig given below fig (i)

III. V TYPE ENGINES

The V-type of engine has two rows of cylinders set normally at a ninety degree angle to each other. Advantages include it's short length, great rigidity of the block, its heavy crankshaft, and attractive low profile. This is a tried and tested engine design with huge performance potential.

In sports applications, having the engine as low to the floor as possible increases the car's handling characteristics, as it will naturally have a lower centre of gravity. Also having a strong engine with built in rigidity can mean the difference in endurance races, making the V type engine design an ideal choice for Motorsport applications. With this type of engine it is possible to have a very high compression ratios, without block distortion under load. This makes it a strong and robust design for high performance applications and is used in F1 for instance. Also with it's resistance to torsional vibration, the engine characteristics produce a smooth and refined engine.

Another attribute for this compact engine design is a shorter car length without losing passenger room. In 1914, Cadillac was the first company in the United States to use a V-8 engine in its cars. From there America has fallen in love with the V type engine and the 50's and 60's produced some of the best Muscle cars. As in fig given below fig (ii)

IV. BOXER/ FLAT ENGINES

In 1896, Karl Benz invented the first internal combustion engine with it's horizontally opposed pistons. This Boxer/Flat engine is an design with multiple pistons that all move in the horizontal plane. The most popular and significant layout has cylinders arranged in two banks on either side of a single crankshaft, generally known as "boxers". This is because the two pistons join together in the middle of TDC (Top Dead Centre). This is similar to two boxers touching gloves at the beginning of a bout and is the origins of the name appointed to the engine

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design. Flat engines have a lower center of gravity than any other common configuration, so vehicles using them should benefit from better stability and control during cornering. But they are also wider than more traditional configurations and the extra width causes problems fitting the engine into the engine bay of a front-engine car. Subaru have been producing AWD front engine cars for some time now, so where there's a will they is a way. Boxer engines are one of only three cylinder layouts that have a natural dynamic balance; the others being the Straight/Inline 6 cylinder and the V12 design. This makes for a smooth and harmonious engine at idle As in fig given below fig (iii).

Boxer/Flat engines tend to be nosier then other designs due to the lack of air boxes and other components in the engine bay. They have a engine characteristic of smoothness throughout the rev range and when combined with a mounting position immediately ahead of the rear axle, offer a low center of gravity and largely neutral handling characteristics.

V. WANKEL/ ROTARY ENGINES

The Rotary Wankel engine was an early type of internal-combustion engine in which the crankshaft remained stationary and the entire cylinder block rotated around it.

The Rotary/ Wankel engine has no pistons, it uses rotors instead. This engine is small, compact and has a curved, oblong inner shape. Its central rotor turns in one direction only, but it produces all four OTTO strokes (intake, compression, power and exhaust) effectively.

The only production car to still have a Rotary/ Wankel engine design in production today is the Masda RX-8 and previous RX-7 models. The Rotary/ Wankel engine is limited by its inherent restriction on breathing capacity due to the need for the fuel/air mixture to be aspirated through the hollow crankshaft and crankcase, which directly affected its volumetric efficiency, also low torque levels are a known problem and the engine has design limitations. Turbocharging this engine is one of the easiest ways around these deficiencies and was seen in the RX-7.

The rotational forces of the mass of the Rotary/ Wankel engine's weight produce a powerful gyroscopic flywheel effect. This smooths out the power delivery and reduces vibration. Vibration had been such a serious problem on conventional piston engines that heavy flywheels had to be added to the overall engine design to help counteract the effects. The cylinders themselves functioned as a flywheel, Rotary engines gained a substantial power-to-weight ratio advantage over more conventional engines. Another advantage was improved cooling, as the rotating cylinder block created its own fast-moving airflow, even at standstill.

Dispensing with separate cylinders, pistons, valves and crankshaft, the rotary engine applies power directly to the transmission. It's construction allows it to provide the power of a conventional engine that is twice its size and weight and that has twice as many parts.

The Rotary/ Wankel burns as much as 20% more fuel than the conventional engine and is potentially a higher polluter, but its small size allows the addition of emission-control parts more conveniently than does the piston engine. As in fig given below fig (iv)

The basic unit of the rotary engine is a large combustion chamber in the form of a pinched oval. Within this chamber all four functions of a piston take place simultaneously in the three pockets that are formed between the rotor and the chamber wall. Just as the addition of cylinders increases the horsepower of a piston-powered engine, so the addition of combustion chambers increases the power of a rotary engine. Larger cars may eventually use rotaries with three or four rotors.

Mazda have had numerous successes with this design, especially with the RX-7 and RX-8 models. By adding a turbocharger as discussed previously, the torque deficiencies are some what overcome and also engine power greatly increased. This combined with the lower weight made a effective and competitive performance package.

VI. DIESEL ENGINES

The Diesel engine was first invented by Rudolf Diesel, of German ethnicity born in Paris. Although quite similar in design to petrol internal combustion engines, Diesel engines use compression to ignite the compressed fuel to air mixture prior to injecting it into the combustion chamber, without the need for spark plugs. As in fig given below fig (v)

6.1 Advantages over Petrol Engines

- 45% efficiency in converting fuel into mechanical energy compared to Petrol at 30%.
- Engine life expectancy is twice as long compared to petrol engines, due to the stronger internal design to cope with higher pressures under combustion.
- No need for HT leads, spark plugs and coils, meaning greater reliability especially in damp environments.
- Diesel engines are immune to vapour lock and the fuel is not explosive like petrol.
- No proportionate decrease in fuel efficiency compared to petrol engines, at higher engine loads.
- Produce less heat in cooling and exhaust.
- Produce less carbon monoxide and can be used in underground applications.
- Can accept turbo/supercharging with out risk of detonation, unlike petrol engines at higher pressure levels.
- Higher torque lower in the rev range.
- Diesel fuel is denser then petrol and contains roughly 15% more energy.

6.2 Disadvantages over Petrol Engines

- Lower power to weight ratio then petrol engines, due to the increased internal component strength.
- Lower power and rev band range compared to petrol engines, although turbo/ super charging has helped to combat this in the last decade.
- Normally noisier and rougher in operation compared to petrol counter parts, although diesels are almost on par with technological advancements.
- More expensive to purchase and run compared to petrol alternatives, due to increase in stronger components and more regular service schedules.

Fig (i) Straight/ Inline Engines

Fig (ii) V Type Engines

Fig(iii)Boxer/Flat Engines

Fig (iv) Wankel/ Rotary Engines

Fig (v) Diesel Engines

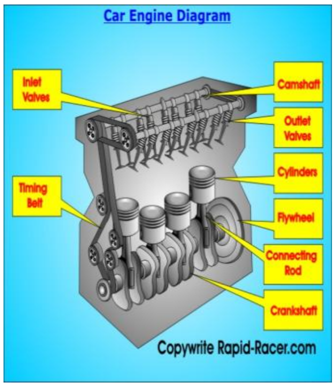

Fig (vi) Engine Process

VII. AERODYNAMIC UPGRADES

Aerodynamic upgrades come in many different forms and have evolved mostly from the early days of ground effects, deployed by lotus and Colin Chapman and used to win many F1 races. These technologies dramatically changed the face of racing forever and aerodynamic upgrades are still at the very top of Motorsports team abilities to win races. Read on to find out about the various components and how they affect race and road cars ability to keep on the tyres planted on the tarmac and maximizing traction.

- **Front Wing**

The main function of a front wing is to create down force that enhances the grip of the front tires. This aids turning ability in fast corners normally above 60 MPH and can amount to up to 25-30% of total down force, depending on the regulations for that given season. The front wings especially in F1 and other open-wheeled cars undergo constant modification and race developments due to data gathering from race to race. Adjustments to fine tune the angle of these devices to create less or more down force is needed to suit each race course. In most series, the wings are even designed for adjustment during the race itself when the car is serviced on a pit stop. Following Driver instruction and tyre/ tire wear considerations or the demands of the race course. There can be in car adjustments to maximize top speed and aerodynamic down force, especially if a race car is fully loaded with fuel at the beginning of a race. The car will be lower to the ground, as the race progresses and more and more fuel is consumed. The car will slowly raise it's ride height at the front, normally creating under steer. With a in car adjustable front wing, this helps to counter act this troublesome problem and the associated handling imbalances this might cause.Another problem engineers face is the fact that front wings are designed to

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function properly with clean undisturbed air, F1 for example has struggled in recent years with this problem, when the car behind has decreased down force levels when following a lead car. This reduced down force and associated drag is good for slip streaming and top speed, but totally unsettles the car for fast sweeping corners. Figures suggest that this could be up to 70% reduction at a distance of 20m behind the lead car.

The basic design of a front wing has evolved over the years, but is generally a aerofoil suspended from the from nose cone, with movable flaps incorporated in the design to adjust the angle of attack (down force setting). End plates are also mounted at either end to help the airflow to be forced over or under the wing, also to help with the turbulences generated by the front wheels. The design of the front wing is critical in controlling the flow of air over the rest of the car and is constantly being refined in a given race series to yield a competitive edge over the competition.

- **Canards**

Carnards are small wings which are attached to the front of the bumper in a aid to increase downforce and air flow dynamics. They can create vortices, these can been normally seen on fighter jets wing tips during flight. These are basically spiraling jets of low pressure air. With Carnards located at the front of the car, it is possible to generate Vortices which run along the length of the vehicle, helping in reducing drag and making for a more slip stream design. Normally only seen on high performance modified road cars or race series, they will not create huge amounts of downforce, but are useful in improving front to rear aerodynamic balance.

They also generate a small amount of down force by directing airflow upwards over the front of the car aiding in it cutting through the air. Strategically placed, they can also aid in clearing high drag areas on kit cars or open wheelers, or by helping to increase aerodynamic efficiency on cars not designed specifically for for Motorsport use and from stock origins.

Carnards are normally constructed of Carbon Fibre reinforced plastics, due to the high strength to weight ration. Normally designed in a flat triangle shaped, but sometimes with a curved edge to aid airflow direction. Sometimes supplied in two sets, one smaller and one larger, the smaller is normally located lower and the larger above.

- **Front Splitter/Air Dam**

The main aim of a front splitter and air dam is to aid in the optimization of the flow of air to the rest of the car and reduce drag, while creating negative lift (down force). The main balance is to achieve minimum drag and maximum down force, aiding the front tyres to get more grip and reduce under steer tendencies.

The front splitter is attached to the bottom of the air dam, it serves to increase the amount of down force at the front of the car. Air flow is brought to stagnation above the splitter by an air dam, causing an area of high pressure. Below, the front splitter redirects air away from this stagnation point and accelerates air under the car, which in turn causes a low pressure. High pressure over the splitter caused by the air dam, and low pressure by the airflow under the car creates downforce by ways of Bernoulli's effect. (high pressure is drawn to low pressure areas).

This helps to minimise the affects of understeer and gives the front end more turn in response on entering corners at speed. Like most racing applications, adjustable angle of attacks maybe possible to adjust for different applications and tracks.

Some bodykits can also generate downforce, but most are just cosmetic. Some of the top brands do go through Research and Development and offer a fully functional aerodynamic package. After market manufacture packages are a good example (BMW'S M sports kits), or fitting a higher spec bodykit from with in the same family of vehicle.

In a standard stock car or in modifications for specialist race series, cars will undergo dynamic development to help increase these downforce levels. Normally lowering the car to a certain ride height level as well as a lower frontal area will help to increase the desired downforce requirements.

Also it is generally known that a increase in front downforce while entering the turn in for a corner will help to combat understeer. This can help to balance a car more and having more grip to maximise steering inputs to hit the apex. letting you come on the power more quickly, producing better lap times.

A front splitter and air dam combination is normally added to help in this situation and can be made from a number of different materials, including fibre glass, carbon fibre and plastics.

- **Rear Diffuser**

The rear diffuser has a lot of jobs to do, firstly it acts as a way of speeding up airflow (lowering pressure) and then slowing down airflow (increasing pressure), in an aid to create downforce and smooth out turbulent air exiting the rear of the car, matching the outside high pressure air while minimising drag.By providing what is essentially an expansion chamber at the diffuser's exit, the airflow has to flow and expand back to ambient pressure in the diffuser.

The faster you drive, the more downforce is generated. The easiest way of looking at this is to think of fast moving air being generated by the diffuser and then slowed down at the rear creating a vacuum effect, sucking the underbody to the ground. The faster you drive, the more downforce is generated.By incorporating the exhaust system into the rear diffuser, you can also help extract the air from the rear of the car more effectively .The exhaust gasses produced effectively energise the airflow, helping to raise the low pressure air .This fast moving air flow returning back to the ambient atmospheric pressure at the exit of the diffuser, reducing drag levels. Hot exhaust gases also aid in expansion, again aiding in the airflow speed transition between fast moving underbody air and slow moving ambient air. Resulting in higher vacuum effect, more downforce and reduced drag.

The diffuser is rather sensitive to engine speed, so if the driver lifts off the throttle, lose of downforce is experienced (as a result to speed and exhaust gases). The exhaust flow is greatly reduced off throttle and makes the diffuser less effective, robbing the downforce generation effect. This can cause handling issue where the rear of the car might become twitchy and prone to more lift off oversteer , on throttle release. Engine mapping can overcome this by pumping more air out even when off throttle.

Rear diffuser design is evolving constantly and some application don't even require the exhaust system integration to yield beneficial downforce. Also you might of noticed earlier Supercars of the 80's always had big rear wings to generate downforce, but modern designs can generate sufficient required levels without such devices. F1 in 2009, there was also a introduction of the double decker rear diffusers in use, the performance increase was some half a second a lap advantage and was be banned for 2011 season. It goes to show how much increase in performance can be had from what might appear to be a device of little significance.

- **Chassis/Under Body**

While largely hidden from view, chassis and underbody aerodynamics are the secret weapons in an arsenal of aerodynamic features for generating down force on racing cars. The bodies are designed to slice through the air and minimize wind resistance or drag. In every day driving this will help keep your fuel/gas bills down as well as provide a better top speed. If you can imagine all the nooks and cranny's normally expose on a cars under body, by creating a smooth boxed in under tray, drag can be greatly reduced. Maximization of a cars aerodynamic potential can be achieved with these along with the other aerodynamic devices already discussed.

Detailed pieces of bodywork can be engineered to allow a smooth air flow to reach the down force-creating elements (wings or spoilers, and underbody tunnels). In recent times more and more work has been undertaken on the underside of the body, similar in shape to an inverted wing (first used by Colin Chapman's Ground Effects racecars).

The main principal works by the front of the car (splitter/ airdam) creating low pressure fast moving airflow to the underbody of the car. Then the rear of the car's diffuser creates a expansion area, made to slow down the faster moving air, as a result creating additional downforce and vacuum effect (a giant venturis, high pressure air presses down on low pressure air). The Diffuser also aids in smoothing out the airflow at the back of the car, reducing drag and improving aerodynamic efficiency.

- **Side Skirts**

The main goal of side skirts is to create an area of low pressure between the car and the track, generating increasing pressure as the car increases in speed making the car stick to the road. Lots of different aids have been designed around this area, including side skirts to increase downforce.

These are a way of channeling the cars low pressure to the rear of the car and directing it to the rear diffuser. It also prevents high pressure air from around the car interfering with the low pressure air underneath the car. Linked closely to the performance of the whole aerodynamic package.

- **Turbo Side Skirts**

Colin Chapman is the founder and designer of Lotus and also the pioneer of Ground Effects in modern motor racing. In 1972 he designed the radical Lotus 72, featuring shovel nose cone in the shape of a wedge, also the radiators were located in the sidepods. Winning both drivers and constructors championships titles that Year. This lead to the Lotus 78, with true side skirt introduction, creating a vacuum effect, sucking the car onto the floor with higher speeds. This lead to another World Driver champion shipped with the driver Mario Andretti.

- **Vortex Generators**

Vortex generators were firstly developed for the aircraft sector, this technology has made it's way into Motorsport and car design. The main function of this device is to delay air flow separation.

Air flow separation is when the airflow of a object detaches from the surface and creates eddies and vortexes. This basically means that the car will result in more drag and will reduce top speed and potentially downforce due to the turbulent air entering other aerodynamic device (rear wing for example) and the wake of air left behind the car.

So by positioning vortex generator over the rear of the roof, you effectively help to reduce drag and increase downforce via the rear wing. This will have the effect of reducing the overall drag created by the car travelling through the air at speed and the faster and faster you drive the more effect this device will have. Especially effective in speeds in excess of 60 mph (100 KMP) speed ranges.

- **Rear Wing**

The flow of air at the rear of the car can be affected by many different influences. This causes the rear wing to be less aerodynamically efficient than the front wing, due to the the disbursed airflow. But typically it must generate more than twice as much downforce as the front wings in order to maintain the handling to balance the car, but this depend on the type of automobile and it's application.

In car designs with the power being delivered via the rear wheels, this is especially vital and the rear wing will not only add acceleration and braking abilities, but also cornering grip.

Generally speaking, when the aim of top speed is the main consideration, race engineers will reduce the angle of attack to minimise drag. Also on some designs, rear wing construction are less pronounced then on F1 for example, due to the need for a more slippery design.

The rear wing can typically have a larger aspect ratio or angle of attack then would be seen on the front of the car and often uses two or more sections. In a aid to create the amount of downforce needed. Just like the front wings, each of these can often be adjusted when the car is in the pit stop for a race, or via small allen keys to adjust the required downforce. But from 2011 F1 cars will have adjustable rear wings to aid top speed and overtaking abilities.

In the future the idea of active aerodynamic devices will probably raise their heads again and having the ability of these devises to adjust on the go via computer calculations, would yield huge performance gains.This would help to increase fuel economy, while giving maximum performance levels.

- **Spoilers**
- **Rear Spoiler**

On normal production cars there is a lot of confusing with rear wings and spoilers. Spoilers are designed to help the flow of air at the back of the car, but normally don't create positive downforce and are primarily deployed for increased fuel efficiency and reducing lift. The bad flow of air at the rear of the car becomes turbulent and a low-pressure zone is created. Increasing drag and instability through the Bernoulli effect. Some synergy can be made to spoilers and Vortex generators and the advantages of fitting these devices are similar.

Adding a rear spoiler creates a longer, gentler slope or angle of attack from the roof to the aerodynamic aid. This will help delay flow separation of the fast moving air and increase the flow dynamics of the rear airflow. This decreases drag, increases fuel economy, and also can helps keep the rear window clean when rear wipers are not fitted.

DRS/ Drag Reduction System A drag reduction system (DRS) or rear movable wing as some might know it, is a way in which the rear wing's angle of attack can be adjusted for better straight line speed. Essentially a lever which controls one of the rear wing flaps, normally operated during the straights, it's one of the ways in which F1 has adopted new design rules to spice things up in the 2011 season.

The greater the rear wing's angle of attack, the more downforce is generated. By reducing this angle of attack, the wing reduces downforce and drag levels, increasing top speed as a by product and aid overtaking.In F1 this system is controlled electronically via a FIA approved ECU system and is normally permitted when the leading

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car is with in a 1 second gap. Speeds of up to 12km per hour are suppose to be the limit of this device, but arguable tracks with more downforce settings could reap larger gains.

VIII. COOLING SYSTEM

The cooling system is a integral part of the engine and helps to achieve the following in a normal combustion engine:

- Cooling the engine block, via the radiator with internal water vanes running through the cylinder head and block.
- Cooling the engine oil to help keeps it lubricating and protective properties.
- Heating the internal passenger compartment.

It is critical to keep the extreme heats generated the combustion chamber in check, as overheating will have a huge impact on the ability for a engine to work under pre-defined safe working specifications.

Modern cooling systems are pressurized allowing the temperatures inside to exceed the coolant boiling point, without it turning into steam. For these reasons it is vital to never work on a engine which has been running without due care and attention.

The set up for for a normal cooling system comprises of the following components:

- **Radiator.**
- **Water or coolant pump.**
- **Radiator Fan.**
- **Thermostat.**
- **Expansion Tank.**

It is vital to understand that as we increase the engines power during various tuning upgrades, the car's ability to remain cool will have a huge effect on the engines reliability under hard working conditions. It is important to keep up with regular service intervals and also make sure the coolant levels and mixtures are right for the given working environments.

- **Radiator.**

The Radiator is essentially a a device which has a hot water/ coolant inlet and cold water/ coolant outlet, which then recirculate through the cooling system. The hot water is forced to travel though small vanes, as it is pushed along by the water/ coolant pumped. These small vanes have small gaps spaced in between them, allowing air to run over the surface of the metal. As the air travels across the metal surface, it cools the hot water and reduces ambient temperatures with in the vanes. Airflow from the front of the car, when travelling at speed helps keep things cool and also accelerate this process.

- **Water or Coolant Pump.**

The Water/ Coolant pump is responsible for the flow of liquids through the cooling system, cooled water from the radiator is circulated into the middle of the pump and the centrifugal forces and spinning fins push the water/ coolant to the outsides of the housing. There is a outlet pipe which then pumps this water to the head cylinder and engine block, to absorb the heat generated there. Water is then taken from there back to the radiator, ready to be cooled again and continue the cycle.

The pump is normally connected via a auxiliary belt to the crankshaft and operational when the engine is running. Regular inspection is needed to make sure these belts do not become damaged, on scheduled service schedules as over heating of the engine will occur if the belts snap.

- **Radiator Fan.**

The Radiator Fan is used when the vehicle is stationary and there is not enough flowing air going through the radiator through normal driving conditions. It is normally activated via the sensor in the engine and engine management system. It is a critical part of the cooling system and vital especially in traffic jams or slows moving speeds.

- **Thermostat.**

The thermostat is normally made from a wax pellet and it is heat sensitive, once it reaches a pre-define temperature; it will open allowing water/ coolant to enter the radiator and begin the cooling process. The thermostat will modulate during different driving conditions to make sure the engine is always in the peak operating range.

It is important when a engine first starts to quickly heat up the water/ coolant levels to firstly avoid hotspot heating in the cylinder head and engine block. Also to stop the cooling process via the radiator with the thermostat in a closed position, as the engine itself needs to reach optimum operating temperatures. Once this level is achieved then the thermostat can open and water coolant will enter the radiator.

- **Expansion Tank.**

The expansion tank acts as a reservoir for the cooling system as the systems water/ coolant expands due to heat. Normally a run of pipe is located in the radiator with a pressure reducing valve fitted, this activates under certain conditions to relieve the pressure build up. The tank normally also has a blow off valve fitted just in case critical pressure exceeds pre-defined safe levels.

What out for any oily deposits or creamy foam as this could be a sign of engine issues, also remember to keep fluids topped up and at the correct levels for any service intervals.

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