DOWNLOAD PDF WORKING PRINCIPLE OF 6 STROKE ENGINE

Chapter 1 : Six-stroke engine - Wikipedia

Working of the 6 Stroke engine. In the suction stroke, the piston will be at the top and it moves towards the bottom of the cylinder. Actually, the negative pressure is going to be created here as the piston moves down.

The spark plug fires twice as often in a two-stroke engine -- once per every revolution of the crankshaft, versus once for every two revolutions in a four-stroke engine. This means that a two-stroke engine has the potential to produce twice as much power as a four-stroke engine of the same size. The two-stroke engine article also explains that the gasoline engine cycle , where gas and air are mixed and compressed together, is not really a perfect match for the two-stroke approach. The problem is that some unburned fuel leaks out each time the cylinder is recharged with the air-fuel mixture. See How Two-stroke Engines Work for details. It turns out that the diesel approach, which compresses only air and then injects the fuel directly into the compressed air, is a much better match with the two-stroke cycle. Many manufacturers of large diesel engines therefore use this approach to create high-power engines. The figure below shows the layout of a typical two-stroke diesel engine: At the top of the cylinder are typically two or four exhaust valves that all open at the same time. There is also the diesel fuel injector shown above in yellow. The piston is elongated, as in a gasoline two-stroke engine, so that it can act as the intake valve. The intake air is pressurized by a turbocharger or a supercharger light blue. The crankcase is sealed and contains oil as in a four-stroke engine. The two-stroke diesel cycle goes like this: When the piston is at the top of its travel, the cylinder contains a charge of highly compressed air. Diesel fuel is sprayed into the cylinder by the injector and immediately ignites because of the heat and pressure inside the cylinder. This is the same process described in How Diesel Engines Work. The pressure created by the combustion of the fuel drives the piston downward. This is the power stroke. As the piston nears the bottom of its stroke, all of the exhaust valves open. Exhaust gases rush out of the cylinder, relieving the pressure. As the piston bottoms out, it uncovers the air intake ports. Pressurized air fills the cylinder, forcing out the remainder of the exhaust gases. The exhaust valves close and the piston starts traveling back upward, re-covering the intake ports and compressing the fresh charge of air. This is the compression stroke. As the piston nears the top of the cylinder, the cycle repeats with step 1. In the diesel version, only air fills the cylinder, rather than gas and air mixed together. This means that a diesel two-stroke engine suffers from none of the environmental problems that plague a gasoline two-stroke engine. On the other hand, a diesel two-stroke engine must have a turbocharger or a supercharger , and this means that you will never find a diesel two-stroke on a chain saw -- it would simply be too expensive.

Chapter 2 : Petrol Engine: How A 4 Stroke Petrol Engine Or Spark Ignition Cycle Works?

A four-stroke engine (also known as four-cycle) is an internal combustion engine in which the piston completes four separate strokes which comprise a single thermodynamic cycle. A stroke refers to.

Single-piston designs[edit] These designs use a single piston per cylinder, like a conventional two- or four-stroke engine. A secondary, non-detonating fluid is injected into the chamber, and the leftover heat from combustion causes it to expand for a second power stroke followed by a second exhaust stroke. Griffin six-stroke engine[edit] The Kerr engine at the Anson Engine Museum In , the Bath -based engineer Samuel Griffin was an established maker of steam and gas engines. He wished to produce an internal combustion engine, but without paying the licensing costs of the Otto patents. His solution was to develop a "patent slide valve" and a single-acting six-stroke engine using it. These were double-acting, tandem engines and sold under the name "Kilmarnock". The key principle of the "Griffin Simplex" was a heated exhaust-jacketed external vapouriser, into which the fuel was sprayed. This fractional distillation supported the use of heavy oil fuels, the unusable tars and asphalts separating out in the vapouriser. Hot-bulb ignition was used, which Griffin termed the "catathermic igniter", a small isolated cavity connected to the combustion chamber. Only two known examples of a Griffin six-stroke engine survive. One is in the Anson Engine Museum. The other was built in and for some years was in the Birmingham Museum of Science and Technology , but in it returned to Bath and the Museum of Bath at Work. A dozen more similar patents have been issued since. Extracts the additional power from the expansion of steam. Bajulaz six-stroke engine[edit] The Bajulaz six-stroke engine is similar to a regular combustion engine in design. There are, however, modifications to the cylinder head, with two supplementary fixed-capacity chambers: The combustion chamber receives a charge of heated air from the cylinder; the injection of fuel begins an isochoric constant-volume burn, which increases the thermal efficiency compared to a burn in the cylinder. The high pressure achieved is then released into the cylinder to work the power or expansion stroke. Meanwhile, a second chamber, which blankets the combustion chamber, has its air content heated to a high degree by heat passing through the cylinder wall. This heated and pressurized air is then used to power an additional stroke of the piston. Patent 4,, and U. The Bajulaz six-stroke engine features claimed are: The valve overlaps have been removed, and the two additional strokes using air injection provide for better gas scavenging. Arun Nair and Mr. Thus, waste heat that requires an air or water cooling system to discharge in most engines is captured and put to use driving the piston. The weight associated with a cooling system could be eliminated, but that would be balanced by a need for a water tank in addition to the normal fuel tank. The Crower six-stroke engine was an experimental design that attracted media attention in because of an interview given by the year-old American inventor , who has applied for a patent on his design. Beare head[edit] This design was developed by Malcolm Beare of Australia. The technology combines a four-stroke engine bottom end with an opposed piston in the cylinder head working at half the cyclical rate of the bottom piston. Functionally, the second piston replaces the valve mechanism of a conventional engine. Please help improve this section by adding citations to reliable sources. Unsourced material may be challenged and removed. It was granted patent nr by the Polish Patent Office. The air load change takes place in the two-stroke section of the engine. The piston of the four-stroke section is an air load exchange aiding system, working as a system of valves. The cylinder is filled with air or with an air-fuel mixture. The filling process takes place at overpressure by the slide inlet system. The exhaust gases are removed as in the classical two-stroke engine, by exhaust windows in the cylinder. The fuel is supplied into the cylinder by a fuel-injection system. Ignition is realized by two spark plugs. The effective power output of the double-piston engine is transferred by two crankshafts. The mechanical and thermodynamical models were meant for double-piston engines, which enable to draw up new theoretical thermodynamic cycle for internal combustion double-pistons engine. Other two-piston designs[edit] Piston-charger engine[edit] This section may contain excessive or inappropriate references to self-published sources. Please help improve it by removing references to unreliable sources , where they are used inappropriately. January Learn how and when to remove this template message In this engine, similar in design to the Beare head, a "piston charger" replaces the valve system. The piston charger charges the main cylinder and simultaneously regulates the inlet and the outlet aperture, leading to no loss of air and fuel in the exhaust. Fuel injection can take place in the piston charger, in the gas-transfer channel or in the combustion chamber. It is also possible to charge two working cylinders with one piston charger. The combination of compact design for the combustion chamber together with no loss of air and fuel is claimed to give the engine more torque, more power and better fuel consumption. The benefit of fewer moving parts and design is claimed to lead to lower manufacturing costs. Good for hybrid technology and stationary engines. The engine is claimed to be suited to alternative, fuels since there is no corrosion or deposits left on valves. The six strokes are:

Chapter 3 : what is working principles of the six sroke engine in automobiles? | Yahoo Answers

Crower six-stroke engine. In a six-stroke engine prototyped in the United States by Bruce Crower, water is injected into the cylinder after the exhaust stroke and is instantly turned to steam, which expands and forces the piston down for an additional power stroke.

So do a lot of motorbikes, lawnmowers, snowblowers and other mechanical equipment. But there are still a lot of 2 stroke engines about in smaller motorbikes, smaller lawnmowers, leaf-blowers, snow blowers and such. The difference between the two stroke and four stroke engine types is the number of times the piston moves up and down in the cylinder for a single combustion cycle. A combustion cycle is the entire process of the suck, squeeze, bang and blow sucking fuel and air into the piston, pressurizing it, igniting it and expelling the exhaust Working principle of a 4 stroke engine 4 stroke engines are typically much larger capacity than 2 stroke ones, and have a lot more complexity to them. Rather than relying on the simple mechanical concept of reed valves, 4 stroke engines typically have valves at the top of the combustion chamber. The simplest type has one intake and one exhaust valve. More complex engines have two of one and one of the other, or two of each. The valves are opened and closed by a rotating camshaft at the top of the engine. The camshaft is driven by either gears directly from the crank, or more commonly by a timing belt. The following animation shows a 4 stroke combustion cycle. As the piston red retreats on the first stroke, the intake valve left green valve is opened and the fuel-air mixture is sucked into the combustion chamber. The valve closes as the piston bottoms out. As the piston begins to advance, it compresses the fuel-air mix. As it reaches the top of its stroke, the spark plug ignites the fuel-air mix and it burns. The expanding gasses force the piston back down on its second stroke. At the bottom of this stroke, the exhaust valve right green valve opens, and as the piston advances for a second time, it forces the spent gasses out of the exhaust port. As the piston begins to retreat again, the cycle starts over, sucking a fresh charge of fuel-air mix into the combustion chamber. They do exist in some off-road motorbikes but they have such a thump-thump-thump motion to them that they require some large balancing shafts or counterweights on the crank to try to make the ride smoother. They also take a little longer to start from cold because you need to crank the single piston at least twice before a combustion cycle can start. Any more than one piston and the engine gets a lot smoother, starts better, and is nowhere near as thumpy. Apart from the increased capacity, more cylinders typically means a smoother engine because it will be more in balance. Operation of 2 stroke Engines Working principle of a 2 stroke engine The 2 stroke engine is different from a 4 stroke engine in two basic ways. First, the combustion cycle is completed within a single piston stroke as oppose to two piston strokes, and second, the lubricating oil for the engine is mixed in with the petrol or fuel. In some cases, such as lawnmowers, you are expected to pre-mix the oil and petrol yourself in a container, then pour it into the fuel tank. In other cases, such as small motorbikes, the bike has a secondary oil tank that you fill with 2 stroke oil and then the engine has a small pump which mixes the oil and petrol together for you. The simplicity of a 2 stroke engine lies in the reed valve and the design of the piston itself. The picture on the right shows a 4 stroke piston left and a 2 stroke piston right. The 2 stroke piston is generally taller than the 4 stroke version, and it has two slots cut into one side of it. These slots, combined with the reed valve, are what make a 2 stroke engine work the way it does. The following animation shows a 2 stroke combustion cycle. As the piston red reaches the top of its stroke, the spark plug ignites the fuel-air-oil mixture. The piston begins to retreat. As it does, the slots cut into the piston on the right begin to align with the bypass port in the cylinder wall the green oblong on the right. The receding piston pressurises the crank case which forces the reed or flapper valve purple in this animation to close, and at the same time forces the fuel-air-oil mixture already in the crankcase out through the piston slots and into the bypass port. This effectively routes the mixture up the side of the cylinder and squirts it into the combustion chamber above the piston, forcing the exhaust gas to expel through the green exhaust port on the left. Once the piston begins to advance again, it generates a vacuum in the crank case. The reed or flapper valve is sucked open and a fresh charge of fuel-air-oil mix is sucked into the crank case. When the piston reaches the top of its travel, the spark plug ignites the mixture and the cycle begins again. For the same cylinder capacity, 2 stroke engines are typically more powerful than 4 stroke versions. The downside is the pollutants in the exhaust; because oil is mixed with the petrol, every 2 stroke engine expels burned oil with the exhaust. If, like me, you grew up somewhere in Europe where scooters were all the rage for teenagers, then the mere smell of 2 stroke exhaust can bring back fond memories. The other disadvantage of 2 stroke engines is that they are noisy compared to 4 stroke engines. Typically the noise is described as "buzzy".

DOWNLOAD PDF WORKING PRINCIPLE OF 6 STROKE ENGINE

Chapter 4 : Diesel Engine: Working Principle of Four Stroke Diesel Engine- Engihub

But nowdays the latest Engine have the Exhuast valve to increase the efficiency of the engine. Here 2-Stroke means: Piston going up and then going Down. In which ones a compression and once expansion with one power stroke in one cycle. First Stroke: The first stroke is also known as compression stroke.

A piston moving up and down within a cylinder is connected by a connecting rod con-rod to a rotating crankshaft. The piston is forced downwards by the expandng gases of a fuel-air mixture burning in the cylinder space above it. This causes the crankshaft to rotate. The momentum of the rotating crankshaft then forces the piston back up again, allowing the next cycle to occur. Often, a heavy flywheel is attached to the crankshaft, to maintain the momentum of rotation. Four-Stroke Engines The complete cycle of an internal combustion engine is easiest to understand by referring first to a simple four-stroke petrol gasoline engine with a conventional carburettor and ignition system. Air is drawn into the engine through the carburettor, where fuel is added. The resultant fuel-air mixture is then ducted to the top of the engine, ready to be drawn into the cylinder. The four strokes are: Compression - the inlet valve closes and the piston moves upwards, compressing the fuel-air mixture, which causes it to become quite hot. As the piston approaches the top of the stroke, known as Top Dead Centre TDC , an electrical discharge from the spark plug ignites the fuel-air mixture. As it burns, the mixture produces very hot gases, which expand because of the heat. Exhaust - an exhaust valve opens and the piston moves upwards again, pushing the spent gases out of the cylinder. At the end of the exhaust stroke, the exhaust valve closes and the inlet valve opens, ready for the next induction stroke. Less formally, the four strokes are sometimes called "Suck", "Squeeze", "Bang", "Puff". The schematic diagram shows a four-cylinder engine, for simplicity, but you can have any number of cylinders from one upwards. For engines with only one cylinder, the momentum of a heavy flywheel attached to the crankshaft keeps the crankshaft turning during the "non-power" strokes. Bigger engines also have flywheels, which help to keep the rotation smooth. The inlet and exhaust valves are opened and closed by a series of rods connected to a camshaft, which makes the mechanics of the four-stroke engine slightly more complicated. And all these moving parts must be lubricated, necessitating a system for pumping oil to them and adding even more to the complexity. So, although the four-stroke engine is a simple concept, it is mechanically complex. Two-Stroke Engines The two-stroke engine is mechanically very simple. There are no valves, camshafts, etc. Lubrication is achieved by mixing oil with the fuel, the resulting mixture then bathing all the moving parts. However, the complete cycle takes only one upstroke and one downstroke of the piston, so some elements of the four phases of operation must occur simultaneously. The fuel and air are mixed in the carburettor in the usual way, but instead of going directly to the top of the cylinder, the mixture enters the sealed crankcase, i. The crankcase is connected to the combustion chamber in the cylinder by an inlet port, sometimes known as a transfer port. Opposite the inlet port there is another port, the exhaust port. Both the inlet and exhaust port are uncovered by the piston in the bottom part of its stroke, thus replicating the function of the valves in the four-stroke engine and allowing gases to enter and leave the cylinder. In the top part of the stroke both ports are covered, sealing the cylinder. This allows compression to occur at the top of the upstroke and allows the power of the expanding gases to be harnessed at the top of the downstroke. The descending piston has increased the pressure in the crankcase, so the fuel-air mixture is being pumped from the crankcase via the transfer port into the combustion chamber. In some engines not in a Vire 7 there is a valve between the carburettor and the crankcase which stops any tendency for some of the fuel-air mixture to blow back through the carburettor. The inlet and exhaust ports are both covered, so the fuel-air mixture in the combustion chamber is being pressurised and is heating up. At the same time, a vacuum is developing in the crankcase, so a fresh charge of fuel-air is being drawn into the crankcase from the carburettor. As the piston rounds TDC, a high voltage discharge from the spark plug ignites the mixture in the combustion chamber. The pressure in the crankcase is already rising. Later in the downstroke the exhaust port will be uncovered, allowing the spent gases to escape. The moving image is flawed. The skirt of the piston is drawn too short, so that the ports are shown uncovered underneath the piston as it rises. Close this page to return to the previous page.

Chapter 5 : Working Principle of Internal Combustion Engines

In Two-Stroke Diesel Engine that air only is introduced into the engine cylinder prior to the injection of fuel oil, an additional departure from two-stroke petrol engine practice is that, instead of using crankcase compression, a rotary blower is utilized to charge the cylinder with low-pressure air.

What is an Engine? This is common for both petrol and diesel engines alike. An engine is a power generating machine which converts potential energy of the fuel into heat energy and then into motion. It produces power and also runs on its own power. The combustion process involves many sub-processes which burn the fuel efficiently and results in the smooth running of the engine. The suction of air also known as breathing or aspiration. Igniting the air-fuel mixture either with a spark petrol engine or by self-ignition after raising the temperature of the air by compressing it diesel engine. How does an Engine work? The expansion of heated gases and their forces act on the engine pistons. The gases push the pistons downwards which results in reciprocating motion of pistons. This motion of the piston enables the crank-shaft to rotate. How Does Petrol Engine work? It was named after German engineer Nikolaus Otto who invented, developed and patented first Four-Stroke petrol engine. The Four-Stroke petrol engine works on the following cycle which includes â€” 1. Suction Stroke â€” With pistons moving downwards and the opening of the inlet valve creates the suction of air-fuel mixture. Petrol Suction Stroke 2. Compression Stroke â€” With the closing of Inlet valve, it closes the area above the piston. The piston moves up resulting in compression of the air-fuel mixture in a confined space. Petrol Compression Stroke Combustion Process - At this stage, the spark-plug fires the spark which results in instantaneous burning of petrol causing in an explosion. This causes heat to release which generates expanding forces known as power. Petrol Combustion process diagram 3. Power Stroke â€” Furthermore, these forces again push the pistons downwards resulting in their reciprocating motion. Petrol Power Stroke 4. Petrol Exhaust Stroke Thus, this cycle repeats itself until the engine is turned off, resulting in the continuance of its running. However, it still uses the spark-plug for igniting the petrol which was the case in the earlier generation petrol engines.

Chapter 6 : Basic Working Principle of 2-Stroke Marine Diesel Engine - MarinerSpotted

Working Principles Of The 2 Stroke And 4 stoke Engines And Their Differences â€¢ 2 Stroke Engine, 4 stroke Engine, Automobile maintenance, Engine types, Engines Operation of 4 stroke Engines Almost every car sold today has a 4 stroke engine.

These people might better know the working principle of a diesel engine as well as a car engine. You just have to read the full article. A diesel engine is widely used in automotive industry, auto industry, and car manufacturers. It can also be used in diesel generator and on ships. Nowadays agriculture pump is also run by small diesel engine. If you are a diesel mechanic or wish to be a diesel service technicians and mechanic, this post is for you. In a diesel engine, diesel oil, light, and heavy oil are used as fuel. This fuel is ignited by being injected into the engine cylinder containing air compressed to a very high pressure. The temperature of this compressed air is sufficiently high to ignite the fuel. Hence there is no spark plug used in the diesel engine. This high-temperature compressed air used in the form of very fine spray is injected at a controlled rate. So, that the combustion of fuel proceeds at constant pressure. The power is generated by completing working stroke. Working strokes of Diesel Engine Suction Stroke In this stroke, the piston moves down from the top dead centre towards the bottom dead centre. As a result, inlet valve opens and the air is drawn into the cylinder. After sufficient quantity of air with pressure is drawn, a suction valve closes at the end of the stroke. The exhaust valve remains closed during this stroke. Compression Stroke In this stroke, the piston moves up from bottom dead centre to top dead centre. During this stroke, both inlet and exhaust valves are closed. The air drawn into the cylinder during suction stroke is entrapped inside the cylinder and compressed due to upward movement of the piston. Constant Pressure Stroke In this stroke, the fuel is injected into the hot compressed air where it starts burning, at constant pressure. When the piston moves to its top dead centre, the supply of fuel is cut off. It is to be said that the fuel is injected at the end of the compression stroke and injection continues until the point of cut-off, but in actual practice, the ignition starts before the end of the compression stroke to take care of ignition tag. Working or Power Stroke In this stroke, both inlet and exhaust valve remain closed. The hot gases which are produced due to ignition of fuel during compression stroke and compressed air now expand adiabatically, in the cylinder pushing the piston down and hence work is done. At the end of a stroke, the piston finally reaches the bottom dead centre. Exhaust Stroke In this stroke, the piston again moves upward. The exhaust valve opens, while inlet and fuel valve is closed. A greater part of the burnt fuel gases escapes due to their own expansion. The upward movement of the piston pushes the remaining gases out through the open exhaust valve. Only a small quantity of exhaust gases stay in the combustion chamber. At the end of an exhaust stroke, the exhaust valve closes and the cycle is thus completed. As there is some resistance while operating in inlet and exhaust valve and some portion of burnt gases remains inside the cylinder during the cycle, resulting in the pumping losses. These pumping losses are treated as negative work and therefore subtracted from actual work done during the cycle. This will give us network done from the cycle. Actually, all these strokes are performed at such a fast speed; you cannot see it step by step but it happens in every four stroke engine. Besides this information, you are suggested to read something more from below Engineering Books.

Chapter 7 : Two-Stroke / Two-Cycle Engines - How they work

Fig.2 Principle of two-stroke cycle diesel engine Four-Stroke Spark Ignition Engine: In Four-Stroke Spark Ignition Engine gasoline is mixed with air, derelict up into a mist and partially vaporized in a carburettor.

Working Principle of 6 Stroke Engine 5. This engine adds a second power stroke and is more efficient as well as result in less pollution. In fact, the mechanical design of the 6 stroke engine is similar to the actual internal combustion engine. The only difference is in its thermodynamic cycle and cylinder head that contains two supplementary chambers. There are six strokes including suction, compression, ignition, exhaust, air suction and air exhaust. In addition to this, there are four valve suction, air inlet, exhaust and air exhaust valves. Working of the 6 Stroke engine In the suction stroke, the piston will be at the top and it moves towards the bottom of the cylinder. Actually, the negative pressure is going to be created here as the piston moves down. Due to this, the air-fuel mixture will be sucked in the cylinder as the suction valve is open at this point. The next is compression stroke, where the piston will move from the bottom to the top cylinder. In fact, all the four valves are closed here which results in the compression of the air-fuel mixture. In the ignition stroke of the 6 Stroke Engine, the fuel mixture is totally compressed and all valves are in closing position. Here, the piston is on the top of the cylinder and a spark plug is present in the center. This spark plug will create combustion in the air-fuel mixture present inside the cylinder. This compression creates a pressure on the top of the piston which will push the piston down. Now the piston will be on the bottom of the cylinder in the exhaust stroke and it moves toward the top. Here, only the exhaust valve remains in open position which pushes smoke outside toward the atmosphere after the ignition. The fifth stroke is Air Suction and here the piston will be on the top of the cylinder and moving towards the bottom. Actually, in this 6 Stroke engine, the air suction valve is the only valve that is open. And the pure air will be sucked towards the cylinder from the atmosphere. The final and last stroke is the air exhaust stroke. In this, the piston will be at the bottom in the beginning and moves toward the top. Here, the air exhaust valve is open and as the piston moves toward the top, the air pumps out.

Chapter 8 : Diesel Engine: How A 4 Stroke Diesel Engine OR Compression Ignition Cycle Works? - CarBik

Six stroke engine is considered more efficient than the present 2&4 stroke engine. It is simiar to 4 stroke but in last two stroke,water is injected which turns into steam and adds to power stroke and the last stroke is again exhaust of steam.

Working Principle of Internal Combustion Engines written by: Otto in the year The principle of operation of the spark ignition SI engines was invented by Nicolaus A. Otto in the year ; hence SI engine is also called the Otto engine. The principle of working of compression ignition engine CI was found out by Rudolf Diesel in the year , hence CI engine is also called the Diesel engine. The principle of working of both SI and CI engines are almost the same, except the process of the fuel combustion that occurs in both engines. In SI engines, the burning of fuel occurs by the spark generated by the spark plug located in the cylinder head. The fuel is compressed to high pressures and its combustion takes place at a constant volume. In CI engines the burning of the fuel occurs due to compression of the fuel to excessively high pressures which does not require any spark to initiate the ignition of fuel. In this case the combustion of fuel occurs at constant pressure. Both SI and CI engines can work either on two-stroke or four stroke cycle. Both the cycles have been described below: In the four-stroke engine the cycle of operations of the engine are completed in four strokes of the piston inside the cylinder. The four strokes of the 4-stroke engine are: In 4-stroke engines the power is produced when piston performs expansion stroke. In case of the 2-stroke, the suction and compression strokes occur at the same time. Similarly, the expansion and exhaust strokes occur at the same time. Power is produced during the expansion stroke. In 4-stroke engines the engine burns fuel once for two rotations of the wheel, while in 2-stroke engine the fuel is burnt once for one rotation of the wheel. Hence the efficiency of 4-stroke engines is greater than the 2-stroke engines. However, the power produced by the 2-stroke engines is more than the 4-stroke engines.

Chapter 9 : Four-stroke engine - Wikipedia

The working principle is called the Diesel Cycle.. In diesel cycle, fuel is added to combustion chamber; then it is compressed which results in ignition. This is different than Otto cycle which is used in petrol engines wherein a spark plug is used to ignite the mixture of air and fuel.

Exhaust The maximum amount of power generated by an engine is determined by the maximum amount of air ingested. The amount of power generated by a piston engine is related to its size cylinder volume , whether it is a two-stroke engine or four-stroke design, volumetric efficiency , losses, air-to-fuel ratio, the calorific value of the fuel, oxygen content of the air and speed RPM. The speed is ultimately limited by material strength and lubrication. Valves, pistons and connecting rods suffer severe acceleration forces. At high engine speed, physical breakage and piston ring flutter can occur, resulting in power loss or even engine destruction. Piston ring flutter occurs when the rings oscillate vertically within the piston grooves they reside in. Ring flutter compromises the seal between the ring and the cylinder wall, which causes a loss of cylinder pressure and power. If an engine spins too quickly, valve springs cannot act quickly enough to close the valves. At high speeds the lubrication of piston cylinder wall interface tends to break down. This process is called porting , and it can be done by hand or with a CNC machine. A large part of the waste energy is in the form of heat that is released to the environment through coolant, fins etc. Many methods have been devised in order to extract waste heat out of an engine exhaust and use it further to extract some useful work, decreasing the exhaust pollutants at the same time. Use of Rankine Cycle, Turbocharging and Thermo electric Generation can be very useful as a waste heat recovery system. Though waste heat recovery systems are being used frequently among all the devices but still some issues like their low efficiency at lower heat supply rates and high pumping losses remain a cause of concern for the researchers. Supercharging[edit] One way to increase engine power is to force more air into the cylinder so that more power can be produced from each power stroke. This can be done using some type of air compression device known as a supercharger , which can be powered by the engine crankshaft. Supercharging increases the power output limits of an internal combustion engine relative to its displacement. Most commonly, the supercharger is always running, but there have been designs that allow it to be cut out or run at varying speeds relative to engine speed. Mechanically driven supercharging has the disadvantage that some of the output power is used to drive the supercharger, while power is wasted in the high pressure exhaust, as the air has been compressed twice and then gains more potential volume in the combustion but it is only expanded in one stage. A turbocharger is incorporated into the exhaust system of a vehicle to make use of the expelled exhaust. It consists of a two piece, high-speed turbine assembly with one side that compresses the intake air, and the other side that is powered by the exhaust gas outflow. When idling, and at low-to-moderate speeds, the turbine produces little power from the small exhaust volume, the turbocharger has little effect and the engine operates nearly in a naturally aspirated manner. Thus, additional power and speed is expelled through the function of this turbine. Turbocharging allows for more efficient engine operation because it is driven by exhaust pressure that would otherwise be mostly wasted, but there is a design limitation known as turbo lag. The increased engine power is not immediately available due to the need to sharply increase engine RPM, to build up pressure and to spin up the turbo, before the turbo starts to do any useful air compression. The increased intake volume causes increased exhaust and spins the turbo faster, and so forth until steady high power operation is reached. Another difficulty is that the higher exhaust pressure causes the exhaust gas to transfer more of its heat to the mechanical parts of the engine. Rod and piston-to-stroke ratio[edit] The rod-to-stroke ratio is the ratio of the length of the connecting rod to the length of the piston stroke. A longer rod reduces sidewise pressure of the piston on the cylinder wall and the stress forces, increasing engine life. It also increases the cost and engine height and weight. A "square engine" is an engine with a bore diameter equal to its stroke length. An engine where the bore diameter is larger than its stroke length is an oversquare engine, conversely, an engine with a bore diameter that is smaller than its stroke length is an undersquare engine. Valve train[edit] The valves are typically operated by a camshaft rotating at half the speed of the crankshaft. It has a series of cams along its length, each designed to open a valve during the appropriate part of an intake or exhaust stroke. A tappet between valve and cam is a contact surface on which the cam slides to open the valve. In other engine designs the camshaft is in the crankcase , in which case each cam usually contacts a push rod , which contacts a rocker arm that opens a valve, or in case of a flathead engine a push rod is not necessary. The overhead cam design typically allows higher engine speeds because it provides the most direct path between cam and valve. Valve clearance[edit] Valve clearance refers to the small gap between a valve lifter and a valve stem that ensures that the valve completely closes. On engines with mechanical valve adjustment, excessive clearance causes noise from the valve train. A too small valve clearance can result in the valves not closing properly, this results in a loss of performance and possibly overheating of exhaust valves. Most modern production engines use hydraulic lifters to automatically compensate for valve train component wear. Dirty engine oil may cause lifter failure. The use of a Turbocharger in Diesel engines is very effective by boosting incoming air pressure and in effect, provides the same increase in performance as having more displacement. Modern engines are often intentionally built to be slightly less efficient than they could otherwise be. This is necessary for emission controls such as exhaust gas recirculation and catalytic converters that reduce smog and other atmospheric pollutants. Reductions in efficiency may be counteracted with an engine control unit using lean burn techniques. Some potential solutions to increase fuel efficiency to meet new mandates include firing after the piston is farthest from the crankshaft, known as top dead centre , and applying the Miller cycle. Together, this redesign could significantly reduce fuel consumption and NOx emissions. Starting position, intake stroke, and compression stroke. Ignition of fuel, power stroke, and exhaust stroke.