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Chapter 1 : Two-stroke engine - Wikipedia

This project was done while I was in school for mechanical design. The blueprints for this model are in the book "Beginner's Guide to SolidWorks - Level 1" Here is a link to download the book that has the blueprints in it.

This section does not cite any sources. Please help improve this section by adding citations to reliable sources. Unsourced material may be challenged and removed. September Main article: Two-stroke diesel engine Diesel engines rely solely on the heat of compression for ignition. In the case of Schnuerle ported and loop-scavenged engines, intake and exhaust happens via piston-controlled ports. A uniflow diesel engine takes in air via scavenge ports , and exhaust gases exit through an overhead poppet valve. Two-stroke diesels are all scavenged by forced induction. Some designs use a mechanically driven Roots blower , whilst marine diesel engines normally use exhaust-driven turbochargers, with electrically driven auxiliary blowers for low-speed operation when exhaust turbochargers are unable to deliver enough air. Marine two-stroke diesel engines directly coupled to the propeller are able to start and run in either direction as required. The fuel injection and valve timing is mechanically readjusted by using a different set of cams on the camshaft. Thus, the engine can be run in reverse to move the vessel backwards. September Learn how and when to remove this template message Most small petrol two-stroke engines cannot be lubricated by oil contained in their crankcase and sump, since the crankcase is being used to pump fuel-air mixture into the cylinder. Over a short period, the constant stream of fuel-air mixture would carry away the lubricating oil into the combustion chamber while thinning the remainder with condensing petrol. Traditionally, the moving parts both rotating crankshaft and sliding piston were instead lubricated by a premixed fuel-oil mixture at a ratio between As late as the s, petrol stations would often have a separate pump to deliver such a premix fuel to motorcycles. Even then, in many cases, the rider would carry a bottle of their own two-stroke oil. Two-stroke oils which became available worldwide in the s are specifically designed to mix with petrol and be burnt in the combustion chamber without leaving undue unburnt oil or ash. This led to a marked reduction in spark plug fouling, which had previously been a factor in two-stroke engines. More recent two-stroke engines might pump lubrication from a separate tank of two-stroke oil. The supply of this oil is controlled by the throttle position and engine speed. The technology is referred to as auto-lube. This is still a total-loss system with the oil being burnt the same as in the pre-mix system; however, given that the oil is not properly mixed with the fuel when burned in the combustion chamber, it translates into a slightly more efficient lubrication. Some companies, such as Bombardier, had some oil pump designs have no oil injected at idle to reduce smoke levels, as the loading on the engine parts was light enough to not require additional lubrication beyond the low levels that the fuel provides. In addition, this method requires extra mechanical parts to pump the oil from the separate tank, to the carburetor or throttle body. For example, a two-stroke engine in a motocross bike pays major consideration to performance, simplicity and weight. Chainsaws and brush cutters must be as light as possible to reduce user fatigue and hazard, especially when used in a professional work environment. Two-stroke cars such as those that were popular in Eastern Europe in the midth century were in particular danger and were usually fitted with freewheel mechanisms in the powertrain , allowing the engine to idle when the throttle was closed, requiring the use of the brakes in all slowing situations. Large two-stroke engines, including diesels, normally use a sump lubrication system similar to four-stroke engines. Two-stroke reversibility[edit] For the purpose of this discussion, it is convenient to think in motorcycle terms, where the exhaust pipe faces into the cooling air stream, and the crankshaft commonly spins in the same axis and direction as do the wheels i. Some of the considerations discussed here apply to four-stroke engines which cannot reverse their direction of rotation without considerable modification , almost all of which spin forward, too. Regular gasoline two-stroke engines will run backwards for short periods and under light load with little problem, and this has been used to provide a reversing facility in microcars , such as the Messerschmitt KR , that lacked reverse gearing. Where the vehicle has electric starting, the motor will be turned off and restarted backwards by turning the key in the opposite direction. Two-stroke golf carts have used a similar kind of system. Traditional flywheel magnetos using contact-breaker points, but no external coil worked equally well in reverse because the cam controlling

the points is symmetrical, breaking contact before top dead center TDC equally well whether running forwards or backwards. Reed-valve engines will run backwards just as well as piston-controlled porting, though rotary valve engines have asymmetrical inlet timing and will not run very well. There are serious disadvantages to running many engines backwards under load for any length of time, and some of these reasons are general, applying equally to both two-stroke and four-stroke engines. This disadvantage is accepted in most cases where cost, weight and size are major considerations. The problem comes about because in "forwards" running the major thrust face of the piston is on the back face of the cylinder which, in a two-stroke particularly, is the coolest and best-lubricated part. The forward face of the piston in a trunk engine is less well-suited to be the major thrust face since it covers and uncovers the exhaust port in the cylinder, the hottest part of the engine, where piston lubrication is at its most marginal. The front face of the piston is also more vulnerable since the exhaust port, the largest in the engine, is in the front wall of the cylinder. Piston skirts and rings risk being extruded into this port, so it is always better to have them pressing hardest on the opposite wall where there are only the transfer ports in a crossflow engine and there is good support. In some engines, the small end is offset to reduce thrust in the intended rotational direction and the forward face of the piston has been made thinner and lighter to compensate; but when running backwards, this weaker forward face suffers increased mechanical stress it was not designed to resist. Large two-stroke ship diesels are sometimes made to be reversible. Like four-stroke ship engines some of which are also reversible they use mechanically operated valves, so require additional camshaft mechanisms. These engine use crossheads to eliminate sidethrust on the piston and isolate the under-piston space from the crankcase. On top of other considerations, the oil-pump of a modern two-stroke may not work in reverse, in which case the engine will suffer oil starvation within a short time. Running a motorcycle engine backwards is relatively easy to initiate, and in rare cases, can be triggered by a back-fire. Model airplane engines with reed-valves can be mounted in either tractor or pusher configuration without needing to change the propeller. These motors are compression ignition, so there are no ignition timing issues and little difference between running forward and running backward.

Chapter 2 : Four-stroke engine - Wikipedia

A two-stroke (or two-cycle) engine is a type of internal combustion engine which completes a power cycle with two strokes (up and down movements) of the piston during only one crankshaft revolution.

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.

Chapter 3 : Engine 3D Models - 3D CAD Browser

two stroke engine file for the two stroke performance tuning chapter 3 - calendrierdelascience.comanced two-stroke tuned exhaust systemservice and maintenance manual 2 stroke 50cc 1e40qmbtwo-stroke engine - wikipedia.

JPG The two-stroke petrol engine was very popular throughout the 19thth century in motorcycles and small-engined devices, such as chainsaws and outboard motors , and was also used in some cars, a few tractors and many ships. Part of their appeal was their simple design and resulting low cost and often high power-to-weight ratio. The lower cost to rebuild and maintain made the two stroke engine incredibly popular, until for the USA their EPA mandated more stringent emission controls in taking effect in and in taking effect in and The industry largely responded by switching to four-stroke petrol engines, which emit less pollution. This is a major reason why two-stroke engines were replaced by four-stroke engines in many applications. Simple two-stroke petrol gas engines continue to be commonly used in high-power, handheld applications such as string trimmers and chainsaws. The light overall weight, and light-weight spinning parts give important operational and even safety advantages. For example, a four-stroke engine to power a chainsaw operating in any position would be much more expensive and complex than a two-stroke engine that uses a gasoline-oil mixture. These engines are still preferred for small, portable, or specialized machine applications such as outboard motors , high-performance, small-capacity motorcycles , mopeds , underbones , scooters , tuk-tuks , snowmobiles , karts , ultralights , model airplanes and other model vehicles and lawnmowers and dirt bikes. The two-stroke cycle is also used in many diesel engines , most notably large industrial and marine engines, as well as some trucks and heavy machinery. A number of mainstream automobile manufacturers have used two-stroke engines in the past, including the Swedish Saab and German manufacturers DKW and Auto-Union. The Japanese manufacturer Suzuki did the same in the s. Lotus of Norfolk, UK, has a prototype direct-injection two-stroke engine intended for alcohol fuels called the Omnivore [3] [4] which it is demonstrating in a version of the Exige. Different two-stroke design types File: The design types vary according to the method of introducing the charge to the cylinder, the method of scavenging the cylinder exchanging burnt exhaust for fresh mixture and the method of exhausting the cylinder. Piston-controlled inlet port Piston port is the simplest of the designs and the most common in small 2 stroke engines. All functions are controlled solely by the piston covering and uncovering the ports as it moves up and down in the cylinder. In the s, Yamaha worked out some basic principles for this system. They found that, in general, widening an exhaust port increases the power by the same amount as raising the port, but the power band does not narrow as it does when the port is raised. Beyond this, the rings will bulge into the exhaust port and wear quickly. Intake duration is between and degrees. Transfer port time is set at a minimum of 26 degrees. The strong low pressure pulse of a racing 2-stroke expansion chamber can drop the pressure to -7 PSI when the piston is at bottom dead centre, and the transfer ports nearly wide open. An expansion chamber with a strong reverse pulse will stop this out-going flow. Diesel two-strokes often add a Roots blower or piston pump for scavenging. Reed inlet valve File: Old Cox Babe Bee engine dissasembled. JPG The reed valve is a simple but highly effective form of check valve commonly fitted in the intake tract of the piston-controlled port. They allow asymmetric intake of the fuel charge, improving power and economy, while widening the power band. They are widely used in motorcycle, ATV and marine outboard engines. Rotary inlet valve The intake pathway is opened and closed by a rotating member. A familiar type sometimes seen on small motorcycles is a slotted disk attached to the crankshaft which covers and uncovers an opening in the end of the crankcase, allowing charge to enter during one portion of the cycle. Another form of rotary inlet valve used on two-stroke engines employs two cylindrical members with suitable cutouts arranged to rotate one within the other - the inlet pipe having passage to the crankcase only when the two cutouts coincide. The crankshaft itself may form one of the members, as in most glow plug model engines. In another embodiment, the crank disc is arranged to be a close-clearance fit in the crankcase, and is provided with a cutout which lines up with an inlet passage in the crankcase wall at the appropriate time, as in the Vespa motor scooter. Rotary valve engines can be tailored to deliver power over a wider speed range or higher power over a narrower speed range than either piston port

or reed valve engine. Where a portion of the rotary valve is a portion of the crankcase itself, it is particularly important that no wear is allowed to take place. Two-stroke deflector piston Autocar Handbook, 13th ed, This design has been superseded since the s by the loop scavenging method below , especially for motorbikes, although for smaller or slower engines, such as lawn mowers, the cross-flow-scavenged design can be an acceptable approach. Schnuerle porting This method of scavenging uses carefully shaped and positioned transfer ports to direct the flow of fresh mixture toward the combustion chamber as it enters the cylinder. Usually, a piston deflector is not required, so this approach has a distinct advantage over the cross-flow scheme above. Suzuki was one of the first manufacturers outside of Europe to adopt loop-scavenged two-stroke engines. This operational feature was used in conjunction with the expansion chamber exhaust developed by German motorcycle manufacturer, MZ and Walter Kaaden. Loop scavenging, disc valves and expansion chambers worked in a highly coordinated way to significantly increase the power output of two-stroke engines, particularly from the Japanese manufacturers Suzuki, Yamaha and Kawasaki. Suzuki and Yamaha enjoyed success in grand Prix motorcycle racing in the s due in no small way to the increased power afforded by loop scavenging. An additional benefit of loop scavenging was the piston could be made nearly flat or slightly dome shaped, which allowed the piston to be appreciably lighter and stronger, and consequently to tolerate higher engine speeds. The "flat top" piston also has better thermal properties and is less prone to uneven heating, expansion, piston seizures, dimensional changes and compression losses. SAAB built and cc 3-cylinder engines based on a DKW design that proved reasonably successful employing loop charging. The original SAAB 92 had a two-cylinder engine of comparatively low efficiency. At cruising speed, reflected wave exhaust port blocking occurred at too low a frequency. Using the asymmetric three-port exhaust manifold employed in the identical DKW engine improved fuel economy. Base compression comprises a portion of the overall compression ratio of a two-stroke engine. Work published at SAE in points that loop scavenging is under every circumstance more efficient than uniflow scavenging. Ciclo del motore 2T. The scavenging gas-flow is therefore in one direction only, hence the name uniflow. Ported types are represented by the opposed piston design in which there are two pistons in each cylinder, working in opposite directions such as the Junkers Jumo and Napier Deltic. With advanced angle exhaust timing, uniflow engines can be supercharged with a crankshaft-driven piston [9] or Roots blower. The latest invention, called the Reversed Uniflow two-stroke engine, has a large intake valve for compressed intake air without fuel-oil mixture. Direct fuel injection is to be used for gasoline or diesel fuel, pending intake air pressure. This engine will work on the Miller cycle. Stepped piston engine This section does not cite any references or sources. The piston of this engine is "top-hat" shaped; the upper section forms the regular cylinder, and the lower section performs a scavenging function. The units run in pairs, with the lower half of one piston charging an adjacent combustion chamber. This system is still partially dependent on total loss lubrication for the upper part of the piston , the other parts being sump lubricated with cleanliness and reliability benefits. Bernard Hooper Engineering Ltd. BHE is one of the more recent engine developers using this approach. Two-stroke power valve system Many modern two-stroke engines employ a power valve system. The valves are normally in or around the exhaust ports. They work in one of two ways: The result is an engine with better low-speed power without sacrificing high-speed power. However as power valves are in the hot gas flow they need regular maintenance to perform well. Direct injection Main article: Two systems are in use, low-pressure air-assisted injection, and high pressure injection. Since the fuel does not pass through the crankcase, a separate source of lubrication is needed.

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Two-strokes are far simpler machines than four-stroke engines. They're also lighter, easier to work on, and downright angrier, pumping out a lot more power per cubic centimeter of displacement.

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- The 2-stroke engine with direct injection is 30 % lighter, 30 % less expensive, 30 to 40 % less cumbersome and up to 50% more powerful than the 4-stroke engine.

Chapter 7 : calendrierdelascience.com - calendrierdelascience.com - Engine Manuals

It is believed that this design can help to resurrect the besmirched 2-stroke's place among current engine platforms, as 2-strokes are lighter and produce more power per cubic centimeter of displacement.

Chapter 8 : Honda files patents for brand new, fuel injected two-stroke engine

the rickshaws have 2 stroke engines and you can hear the voices of people in the midst of all the traffic. BillRussell UTC #22 Concrete also generated a large amount of CO2 when it is made. Wikipedia: The concrete industry is one of two largest producers of carbon dioxide (CO2.