



- **ATV Performance Tuning and Modifications**

ATV Performance Tuning and Modifications How to install a high flow exhaust on an ATV Steps for re mapping the ECU for improved performance How to choose the right gear ratio for your riding style When to upgrade the clutch springs and weights in an ATV Benefits of a big bore kit for ATV power output How to tune jetting for altitude changes Steps for adding a performance air filter to your ATV How to improve throttle response through tuning Tips for balancing top speed and low end torque in an ATV How to reduce engine lag with proper tuning adjustments When to upgrade the cooling system for performance riding How to test performance gains after modifications

- **Seasonal and Environment Specific ATV Preparation**

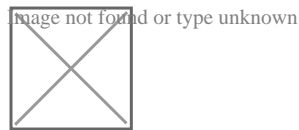
Seasonal and Environment Specific ATV Preparation How to prepare your ATV for winter storage Steps for setting up your ATV for deep snow riding How to waterproof your ATV for water crossings Tips for preventing rust after riding in wet conditions How to adjust jetting for hot summer temperatures Steps for protecting your ATV from saltwater corrosion How to prepare your ATV for muddy trail conditions What to pack for a long distance ATV expedition How to maintain your ATV during hunting season use Techniques for cleaning your ATV after sand dune riding How to set up tire pressure for different terrains When to change coolant for seasonal temperature shifts

- **About Us**



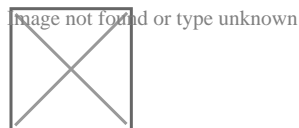
Okay, lets talk about tuning the jetting on your carburetor when youre dealing with altitude changes. Chain and belt maintenance extends drivetrain life [auto](#) [atv](#) Rockingham. Its something every internal combustion engine enthusiast, especially those who love two-strokes and four-strokes on bikes, snowmobiles, or even small planes, eventually has to grapple with. Think of it like this: your engine is a breathing machine, and the air it breathes changes as you climb higher.

At sea level, the air is dense, packed with oxygen molecules. Your carburetor is set up to deliver a specific air-fuel mixture that works well with that dense air. But as you go up in altitude, the air gets thinner. There are fewer oxygen molecules in the same volume of air. If you dont make any adjustments, your engine will be getting too much fuel for the amount of oxygen available. This results in a "rich" condition.

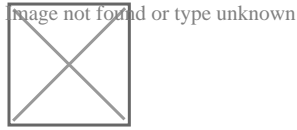


What does a rich condition feel like? Well, it often manifests as sluggish performance. Your engine might feel hesitant, like its struggling to rev up. You might notice excessive smoke coming from the exhaust, and the spark plugs could become fouled (covered in black, oily deposits). Basically, your engine isnt running efficiently, and youre wasting fuel.

So, how do you fix it? The key is to lean out the fuel mixture. This means reducing the amount of fuel being delivered to match the thinner air. The most common way to do this is by changing the jets in your carburetor.



Carburetors have different jets for different fuel circuits. The main jet controls fuel delivery at wide-open throttle, the pilot jet handles idling and low-speed running, and the needle jet/needle combination influences the mid-range. When youre changing altitude, youll typically start by focusing on the main jet, as that has the biggest impact on overall performance.



Generally, as you increase in altitude, you'll need to go to a smaller main jet. How much smaller? That depends on the engine, the carburetor, and the altitude change. A good starting point is to go down one or two jet sizes for every 2,000 to 3,000 feet of elevation gain. But this is just a guideline. You'll need to do some testing to find the optimal jetting for your specific situation.

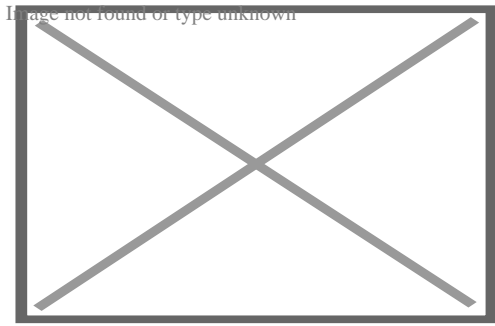
After changing the main jet, you'll want to check the spark plugs. A properly jetted engine will have spark plugs that are a light tan or brown color. Black, sooty plugs indicate a rich condition, while white or very light gray plugs suggest a lean condition (which is dangerous and can lead to engine damage).

Don't forget about the other jets. The pilot jet might also need adjustment, especially if you notice the engine idling poorly at higher altitudes. You can fine-tune the idle mixture screw to dial in the perfect idle. The needle clip position can also be adjusted to influence the mid-range.

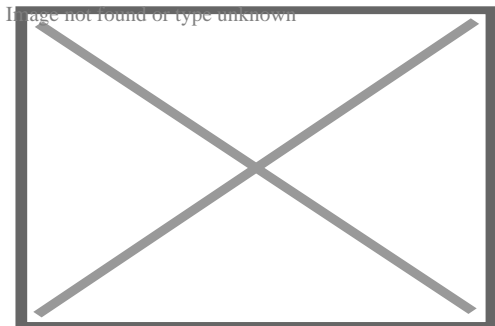
Tuning your jetting for altitude changes is an iterative process. It requires patience, observation, and a good understanding of how your engine is running. It's also crucial to keep safety in mind. A lean condition can be extremely damaging, so it's always better to err on the side of being slightly rich, especially when you're first starting out.

Ultimately, dialing in your jetting for different altitudes will make your engine run smoother, more efficiently, and more reliably. It's a rewarding skill that will enhance your enjoyment of whatever machine you're riding or flying. So, grab your tools, your jets, and your spark plug wrench, and get ready to breathe easy at any altitude.

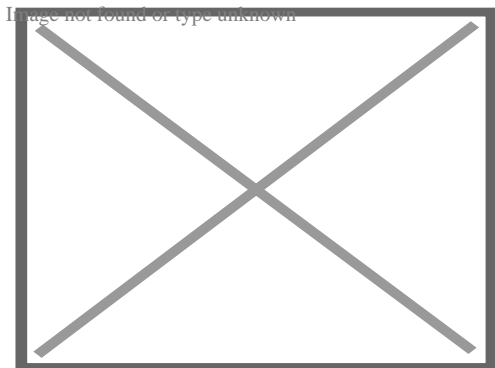
About Car dealership



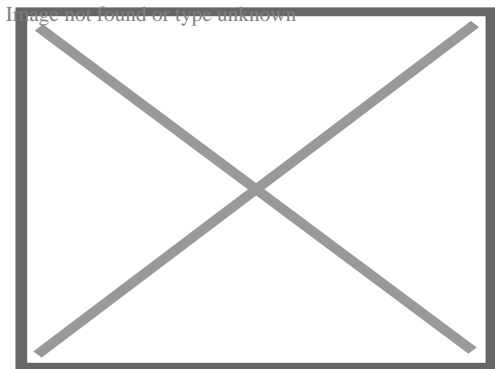
Typical car dealership (in this case a Jeep dealer) in the U.S. selling used cars outside, new cars in the showroom, as well as a vehicle entrance to the parts and service area in the back of the building



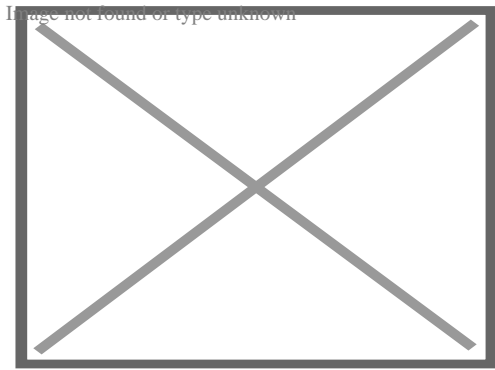
An aerial view of auto dealer's service in Kuopio, Finland



Service and repair entrance



Auto dealer's service and repair facility



Dealer for vintage cars

A **car dealership**, or **car dealer**, is a business that sells new or used cars, at the retail level, based on a dealership contract with an automaker or its sales subsidiary. Car dealerships also often sell spare parts and automotive maintenance services.

In the United States, car dealerships have historically been an important source of state and local sales taxes. They have considerable political influence and have lobbied for regulations that guarantee their survival and profitability. By 2010, all US states had laws that prohibited manufacturers from side-stepping independent car dealerships and selling cars directly to consumers. By 2009, most states imposed restrictions on the creation of new dealerships to compete with incumbent dealerships.

Economists have characterized these regulations as a form of rent-seeking that extracts rents from manufacturers of cars, increases costs for consumers, and limits entry of new car dealerships while raising profits for incumbent car dealers. Research shows that as a result of these laws, retail prices for cars are higher than they otherwise would be.^{[1][2]}

Car dealerships in the United States

[edit]

Main article: Car dealerships in the United States

The early cars were sold by automakers to customers directly or through a variety of channels, including mail order, department stores, and traveling representatives.^[1] For example, Sears made its first attempt at selling a gasoline-engined chain-drive high-wheeler in 1908 through its mail-order catalog and starting in 1951 the Allstate through select its stores and the catalog^{[3][4]}

The first car dealership was opened in 1889 by Fred Koller in Reading, Pennsylvania and sold cars manufactured in Cleveland, Ohio. This would have been the first dealership solely dedicated to automobiles, as opposed to horse-drawn carriages. ^[5]

Today, direct sales by an automaker to consumers are limited by most states in the U.S. through franchise laws that require new cars to be sold only by licensed and bonded, independently owned dealerships.^[6] The first woman car dealer in the United States was Rachel "Mommy" Krouse who in 1903 opened her business, Krouse Motor Car Company, in Philadelphia, Pennsylvania^[7]

The number of car dealerships in the US peaked in 1927 at 53,125 and steadily decreased over the next decades. By 1960, there were 33,658 dealerships; by 1980, 23,379; and by 2001, 22,007.^[1]

Car dealerships are usually franchised to sell and service vehicles by specific companies. They are often located on properties offering enough room to have buildings housing a showroom, mechanical service, and body repair facilities, as well as to provide storage for used and new vehicles. Many dealerships are located out of town or on the edge of town centers. An example of a traditional single proprietorship car dealership was Collier Motors in North Carolina^[8] Many modern dealerships are now part of corporate-owned chains with hundreds of locations.^[9] Dealership profits in the US mainly come from servicing, some from used cars, and little from new cars.^[10]

Most automotive manufacturers have shifted the focus of their franchised retailers to branding and technology. New or refurbished facilities are required to have a standard look for their dealerships and have product experts to liaise with customers.^{[11][12]} Audi has experimented with a hi-tech showroom that allows customers to configure and experience cars on 1:1 scale digital screens^[13] ^[14] In markets where it is permitted, Mercedes-Benz opened city centre brand stores^[15]

Tesla Motors has rejected the dealership sales model based on the idea that dealerships do not properly explain the advantages of their cars, and they could not rely on third-party dealerships to handle their sales.^[16] However, in the United States, direct manufacturer auto sales are prohibited in almost every state by franchise laws requiring that new cars be sold only by dealers.^[17] In response, Tesla has opened city centre galleries where prospective customers can view cars that can only be ordered online.^{[18][19]} These stores were inspired by the Apple Stores.^[20] Tesla's model was the first of its kind, and has given them unique advantages as a new car company.^[21]

Economic theory

[edit]

In economic theory, car dealerships can be characterized as franchisees and automobile manufacturers as franchisors. A franchise relationship can be beneficial to both parties, as the franchisee can sell a well-made and attractive product while the franchisor can rely on the franchisee to incur downstream costs and use its local relationships to sell more products and services.^[1]

The franchisor can act opportunistically by imposing constraints and burden on the franchisee after the latter has incurred sunk costs, such as investing in physical assets and building up a reputation with customers. The franchisor could for example require that cars be sold at low prices, and services be performed for little compensation. The franchisee could on the other hand act opportunistically by using its local monopoly to perform poor customer service, charge customers more, and pass those unnecessarily high costs to the franchisor.^{[1][22]}

Regulations that protect car dealers

[edit]

Car dealerships have lobbied for regulations that increase the survival and profitability of car dealerships:[¹]

- By 2010, all US states had laws that prohibited manufacturers from side-stepping independent car dealers and selling cars to customers directly.
- By 2009, most states imposed restrictions on the creation of new dealerships to compete with incumbent dealerships.
- All states impose severe limits on the ability of a manufacturer to terminate a franchise relationship.
- Most states prevent manufacturers from engaging in "quantity forcing" whereby manufacturers require that dealers purchase vehicles that they had not ordered.
- Most states limit the ability of manufacturers to discriminate between car dealers (for example, by providing better terms to large car dealers with economies of scale or dealers that provide better customer service).
- Many state laws impose upon manufacturers the precise terms under which they must compensate dealers for the costs associated with warranty repairs (these can incentivize dealers to increase the price of repairs to customers).
- Most state laws require upon the termination of a dealership that manufacturers buy back the inventory, and special equipment and in some cases pay the rent of the dealer's facilities.

The issuance of new dealership licenses can be subject to geographical restriction; if there is already a dealership for a company in an area, no one else can open one. This has led to dealerships becoming in essence hereditary, with families running dealerships in an area since the original issuance of their license with no fear of competition or any need to prove qualification or consumer benefit (beyond proving they meet minimum legal standards), as franchises in most jurisdictions can only be withdrawn for illegal activity and no other reason.[²³]

Criticism

[edit]

Economists have characterized these laws as a form of rent-seeking that extracts rents from manufacturers of cars and increases costs for consumers of cars while raising profits for car dealers.[¹][²⁴][²⁵][²⁶] Multiple studies have shown that regulations that protect car dealerships increase car costs for consumers and limit the profitability of manufacturers.[²⁷]

This has led to consumer campaigns for establishment or reform, which have been met by huge lobbying efforts by franchise holders. New companies trying to enter the market, such as Tesla, have been restricted by this model and have either been forced out or been forced to work around the franchise model, facing constant legal pressure.[²⁸]

Electric vehicles

[edit]

According to a 2023 survey by the Sierra Club, two-thirds of US car dealerships did not have electric or hybrid vehicles for sale.^[29] Reasons for this include supply chain difficulties,^[29]^[30] as well as a need for car dealers to make substantial investments in new employee training and infrastructure to be able to sell, service and maintain electric vehicles.^[31]

Car dealerships in the European Union

[edit]

This section needs expansion. You can help by adding to it. *(May 2023)*

In the European Union, car manufacturers were permitted from 1985 to 2006 to enter into contracts with car dealerships that restricted what kinds of cars dealers were permitted to sell.^[32]^[33] Car manufacturers were able "to impose qualitative, quantitative and geographical restrictions on supply by selling their cars only through a limited number of dealers bound by strict franchise agreements."^[32] In 2006, the European Commission determined that it was anti-competitive for car manufacturers to prohibit dealers from carrying multiple car brands.^[33]

Car manufacturers in the European Union are increasingly shifting towards selling cars directly to customers without reliance on independent dealers. Volvo has announced plans to sell all vehicles directly to customers by 2030.^[34]^[35]

Multibrand car dealers

[edit]

Multibrand and multi-maker car dealers sell cars from different and independent carmakers.^[36] Some are specialized in electric vehicles.^[37]

Auto transport

[edit]

Auto transport is used to move vehicles from the factory to the dealerships. This includes international and domestic shipping. It was largely a commercial activity conducted by manufacturers, dealers, and brokers. Internet use has encouraged this niche service to expand and reach the general consumer marketplace.

See also

[edit]

- Auto auction
- Auto row
- Automaker
- Car broker
- Car rental
- List of auto dealership and repair shop buildings
- Showroom
- Used car

Organizations

[edit]

- Carfax
- Kelley Blue Book
- Federation of Automobile Dealers Associations of India (FADA)
- National Automobile Dealers Association
- Presidential Task Force on the Auto Industry

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[edit]

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Further reading

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External links

[edit]

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Wikimedia Commons has media related to ***Automobile dealerships***.

- EU car dealership reforms

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Retail

Key concepts

- Counter display unit
- Display stand
- Endcap
- Facing
- Free standing display unit
- Gondola
- History of retail
- Merchandising
 - Visual merchandising
- Point of sale display
- Retail design
- Retail merchandising unit
- Self-service
- Shelf-ready packaging

- Agricultural supplies
- Alcohol
- Antiques
- Automotive fuel
- Automotive parts
- Beauty products
- Books
- Cannabis
- Catering
 - Mobile
- Chocolate
- Clothes
- Comics
- Confectionery
- Consumer electronics
- Cycles
- *Doujin shop*
- Dry goods
- Equestrian supplies
- Eyewear
- Fish
- Flowers
- Food
- Foodservice
- Fruit stand
- Furniture
- Garden centre
- Gardening supplies
- General merchandise
- Gold
- Greengrocer
- Grocery
 - Public grocery
- Guns
- Hardware
- Health food
- Herbal tea
- Hobby supplies
- Home decor
- Home improvement products
- Ironmongery
- Jewellery
- Lingerie
- Lumber
- Magic supplies
- Meat
- Medications
- Medicinal plants
- Music

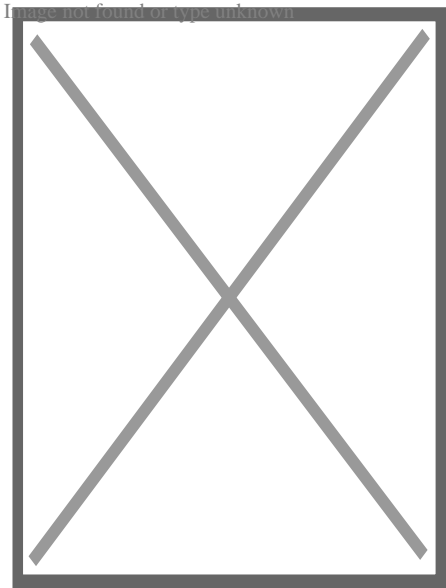
By product

- Anchor tenant
- Automat
- Automated retail
- Big-box store
- Boot fair
- Boutique
- Brick and mortar
- Bring and buy sale
- Butcher shop
- Car boot sale
- Cash and carry
- Cashierless store
- Category killer
- Chain store
- Charity shop
- Closeout store
- Company store
- Consignment shop
- Consignment store (East Asia)
- Convenience store
 - Automated convenience store
 - Corner store
 - Mini-mart
 - Mini market
 - Superette
- Dark store
- Department store
 - Junior department store
 - Public department store
- Discount store
- E-commerce
- Estate sale
- Experiential commerce
- Experiential retail
- Factory outlet
- Factory store
- Flash retailing
- Free box
- Freeshop
- Free store
- Garage sale
- General store
- Give-away shop
- Haberdasher
- Head shop
- High Street
- Honesty box
- Hospice shop
- Hyperstore

By type

- Arabber
- Boutique
- Braderie
- Butcher shop
- Concession stand
- Cooked food centre
- Costermonger
- Direct sellers
- Duty-free shop
- Food booth
- Food cart
- Food court
- Food hall
- Food kiosk
- Food stall
- Food stand
- Food truck
- Gift shop
- Hawker
- Hawker centre
- Ice cream truck
- Ice cream van
- Museum shop
- Pawn shop
- Peddler
- Pharmacies
- Refreshment stand
- Snack bar
- Snack kiosk
- Souvenir shop
- Surplus store
- Tack shop
- Tax-free shopping
- Tuck shop

About Four-stroke engine



Four-stroke cycle used in gasoline/petrol engines: intake (1), compression (2), power (3), and exhaust (4). The right blue side is the intake port and the left brown side is the exhaust port. The cylinder wall is a thin sleeve surrounding the piston head which creates a space for the combustion of fuel and the genesis of mechanical energy.

A **four-stroke** (also **four-cycle**) **engine** is an internal combustion (IC) engine in which the piston completes four separate strokes while turning the crankshaft. A stroke refers to the full travel of the piston along the cylinder, in either direction. The four separate strokes are termed:

1. **Intake:** Also known as induction or suction. This stroke of the piston begins at top dead center (T.D.C.) and ends at bottom dead center (B.D.C.). In this stroke the intake valve must be in the open position while the piston pulls an air-fuel mixture into the cylinder by producing a partial vacuum (negative pressure) in the cylinder through its downward motion.
2. **Compression:** This stroke begins at B.D.C, or just at the end of the suction stroke, and ends at T.D.C. In this stroke the piston compresses the air-fuel mixture in preparation for ignition during the power stroke (below). Both the intake and exhaust valves are closed during this stage.
3. **Combustion:** Also known as power or ignition. This is the start of the second revolution of the four stroke cycle. At this point the crankshaft has completed a full 360 degree revolution. While the piston is at T.D.C. (the end of the compression stroke) the compressed air-fuel mixture is ignited by a spark plug (in a gasoline engine) or by heat generated by high compression (diesel engines), forcefully returning the piston to B.D.C. This stroke produces mechanical work from the engine to turn the crankshaft.
4. **Exhaust:** Also known as outlet. During the *exhaust* stroke, the piston, once again, returns from B.D.C. to T.D.C. while the exhaust valve is open. This action expels the spent air-fuel mixture through the exhaust port.

Four-stroke engines are the most common internal combustion engine design for motorized land transport,^[1] being used in automobiles, trucks, diesel trains, light aircraft and motorcycles. The major alternative design is the two-stroke cycle.^[1]

History

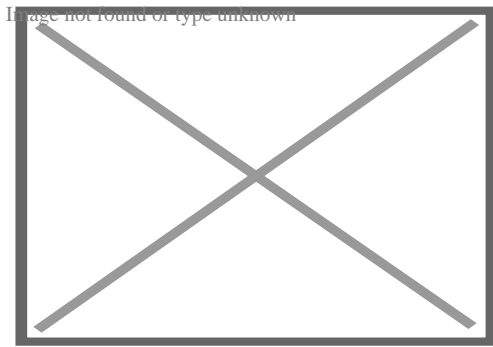
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Otto cycle

[edit]

Main article: Otto cycle

See also: Otto engine



An Otto Engine from 1880s US Manufacture

Nikolaus August Otto was a traveling salesman for a grocery concern. In his travels, he encountered the internal combustion engine built in Paris by Belgian expatriate Jean Joseph Etienne Lenoir. In 1860, Lenoir successfully created a double-acting engine that ran on illuminating gas at 4% efficiency. The 18 litre Lenoir Engine produced only 2 horsepower. The Lenoir engine ran on illuminating gas made from coal, which had been developed in Paris by Philip Lebon.^[2]

In testing a replica of the Lenoir engine in 1861, Otto became aware of the effects of compression on the fuel charge. In 1862, Otto attempted to produce an engine to improve on the poor efficiency and reliability of the Lenoir engine. He tried to create an engine that would compress the fuel mixture prior to ignition, but failed as that engine would run no more than a few minutes prior to its destruction. Many other engineers were trying to solve the problem, with no success.^[2]

In 1864, Otto and Eugen Langen founded the first internal combustion engine production company, NA Otto and Cie (NA Otto and Company). Otto and Cie succeeded in creating a successful atmospheric engine that same year.^[2] The factory ran out of space and was moved to the town of Deutz, Germany in 1869, where the company was renamed to Deutz Gasmotorenfabrik AG (The Deutz Gas Engine Manufacturing Company).^[2] In 1872, Gottlieb Daimler was technical director and Wilhelm Maybach was the head of engine design. Daimler was a gunsmith who had worked on the Lenoir engine. By 1876, Otto and Langen succeeded in creating the first internal combustion engine that compressed the fuel mixture prior to combustion for far higher efficiency than any engine created to this time.

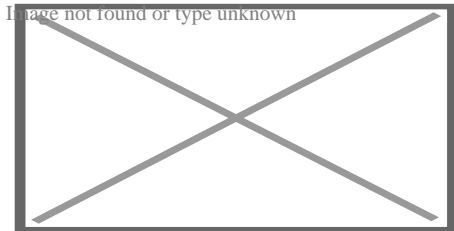
Daimler and Maybach left their employ at Otto and Cie and developed the first high-speed Otto engine in 1883. In 1885, they produced the first automobile to be equipped with an Otto engine. The Daimler *Reitwagen* used a hot-tube ignition system and the fuel known as Ligroin to become the world's first vehicle powered by an internal combustion engine. It used a four-stroke engine

based on Otto's design. The following year, Karl Benz produced a four-stroke engined automobile that is regarded as the first car.^[3]

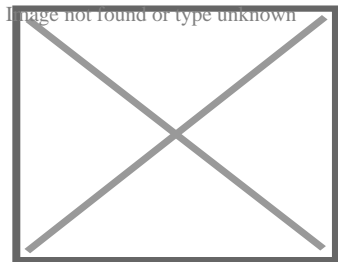
In 1884, Otto's company, then known as Gasmotorenfabrik Deutz (GFD), developed electric ignition and the carburetor. In 1890, Daimler and Maybach formed a company known as Daimler Motoren Gesellschaft. Today, that company is Daimler-Benz.

Atkinson cycle

[edit]



This 2004 Toyota Prius hybrid has an Atkinson-cycle engine as the petrol-electric hybrid engine



The Atkinson Gas Cycle

Main article: Atkinson cycle

The Atkinson-cycle engine is a type of single stroke internal combustion engine invented by James Atkinson in 1882. The Atkinson cycle is designed to provide efficiency at the expense of power density, and is used in some modern hybrid electric applications.

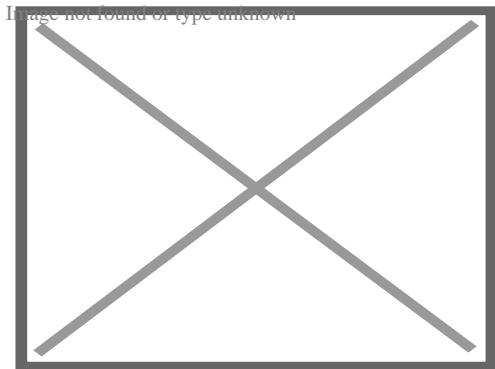
The original Atkinson-cycle piston engine allowed the intake, compression, power, and exhaust strokes of the four-stroke cycle to occur in a single turn of the crankshaft and was designed to avoid infringing certain patents covering Otto-cycle engines.^[4]

Due to the unique crankshaft design of the Atkinson, its expansion ratio can differ from its compression ratio and, with a power stroke longer than its compression stroke, the engine can achieve greater thermal efficiency than a traditional piston engine. While Atkinson's original design is no more than a historical curiosity, many modern engines use unconventional valve timing to produce the effect of a shorter compression stroke/longer power stroke, thus realizing the fuel economy improvements the Atkinson cycle can provide.^[5]

Diesel cycle

[edit]

Main article: Diesel cycle



Audi Diesel R15 at Le Mans

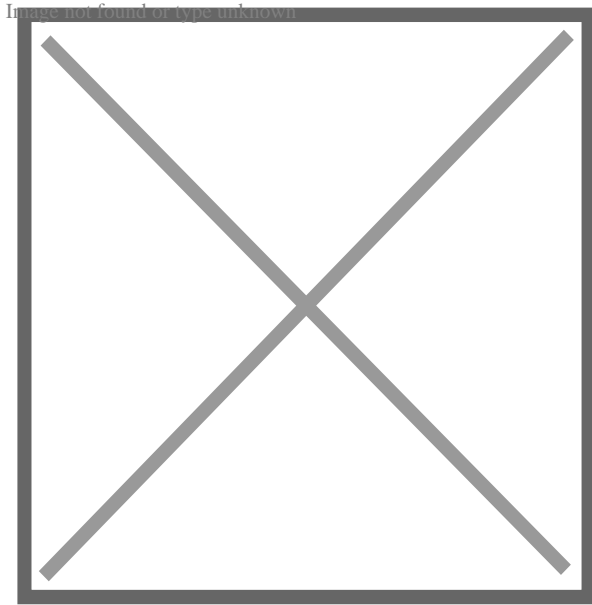
The diesel engine is a technical refinement of the 1876 Otto-cycle engine. Where Otto had realized in 1861 that the efficiency of the engine could be increased by first compressing the fuel mixture prior to its ignition, Rudolf Diesel wanted to develop a more efficient type of engine that could run on much heavier fuel. The Lenoir, Otto Atmospheric, and Otto Compression engines (both 1861 and 1876) were designed to run on Illuminating Gas (coal gas). With the same motivation as Otto, Diesel wanted to create an engine that would give small industrial companies their own power source to enable them to compete against larger companies, and like Otto, to get away from the requirement to be tied to a municipal fuel supply.^[*citation needed*] Like Otto, it took more than a decade to produce the high-compression engine that could self-ignite fuel sprayed into the cylinder. Diesel used an air spray combined with fuel in his first engine.

During initial development, one of the engines burst, nearly killing Diesel. He persisted, and finally created a successful engine in 1893. The high-compression engine, which ignites its fuel by the heat of compression, is now called the diesel engine, whether a four-stroke or two-stroke design.

The four-stroke diesel engine has been used in the majority of heavy-duty applications for many decades. It uses a heavy fuel containing more energy and requiring less refinement to produce. The most efficient Otto-cycle engines run near 30% thermal efficiency.^[*clarification needed*]

Thermodynamic analysis

[edit]



The idealized four-stroke Otto cycle p-V diagram: the **intake (A)** stroke is performed by an isobaric expansion, followed by the **compression (B)** stroke, performed as an adiabatic compression. Through the combustion of fuel an isochoric process is produced, followed by an adiabatic expansion, characterizing the **power (C)** stroke. The cycle is closed by an isochoric process and an isobaric compression, characterizing the **exhaust (D)** stroke.

The thermodynamic analysis of the actual four-stroke and two-stroke cycles is not a simple task. However, the analysis can be simplified significantly if air standard assumptions^[6] are utilized. The resulting cycle, which closely resembles the actual operating conditions, is the Otto cycle.

During normal operation of the engine, as the air/fuel mixture is being compressed, an electric spark is created to ignite the mixture. At low rpm this occurs close to TDC (Top Dead Centre). As engine rpm rises, the speed of the flame front does not change so the spark point is advanced earlier in the cycle to allow a greater proportion of the cycle for the charge to combust before the power stroke commences. This advantage is reflected in the various Otto engine designs; the atmospheric (non-compression) engine operates at 12% efficiency whereas the compressed-charge engine has an operating efficiency around 30%.

Fuel considerations

[edit]

A problem with compressed charge engines is that the temperature rise of the compressed charge can cause pre-ignition. If this occurs at the wrong time and is too energetic, it can damage the engine. Different fractions of petroleum have widely varying flash points (the temperatures at which the fuel may self-ignite). This must be taken into account in engine and fuel design.

The tendency for the compressed fuel mixture to ignite early is limited by the chemical composition of the fuel. There are several grades of fuel to accommodate differing performance levels of engines. The fuel is altered to change its self-ignition temperature. There are several ways to do

this. As engines are designed with higher compression ratios the result is that pre-ignition is much more likely to occur since the fuel mixture is compressed to a higher temperature prior to deliberate ignition. The higher temperature more effectively evaporates fuels such as gasoline, which increases the efficiency of the compression engine. Higher compression ratios also mean that the distance that the piston can push to produce power is greater (which is called the expansion ratio).

The octane rating of a given fuel is a measure of the fuel's resistance to self-ignition. A fuel with a higher numerical octane rating allows for a higher compression ratio, which extracts more energy from the fuel and more effectively converts that energy into useful work while at the same time preventing engine damage from pre-ignition. High octane fuel is also more expensive.

Many modern four-stroke engines employ gasoline direct injection or GDI. In a gasoline direct-injected engine, the injector nozzle protrudes into the combustion chamber. The direct fuel injector injects gasoline under a very high pressure into the cylinder during the compression stroke, when the piston is closer to the top.^[7]

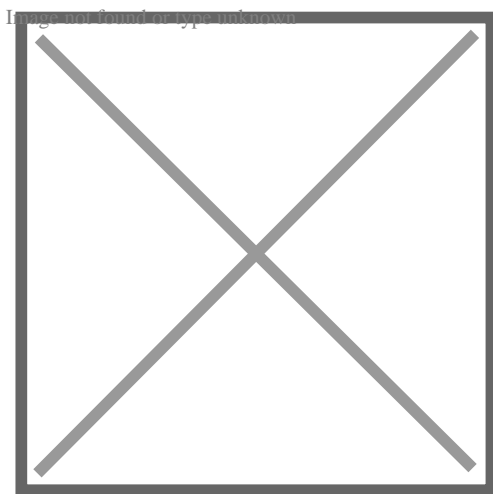
Diesel engines by their nature do not have concerns with pre-ignition. They have a concern with whether or not combustion can be started. The description of how likely diesel fuel is to ignite is called the Cetane rating. Because diesel fuels are of low volatility, they can be very hard to start when cold. Various techniques are used to start a cold diesel engine, the most common being the use of a glow plug.

Design and engineering principles

[edit]

Power output limitations

[edit]



The four-stroke cycle

1=TDC

2=BDC

A: Intake

B: Compression

C: Power

D: 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. This is commonly referred to as 'valve float', and it can result in piston to valve contact, severely damaging the engine. At high speeds the lubrication of piston cylinder wall interface tends to break down. This limits the piston speed for industrial engines to about 10 m/s.

Intake/exhaust port flow

[edit]

The output power of an engine is dependent on the ability of intake (air–fuel mixture) and exhaust matter to move quickly through valve ports, typically located in the cylinder head. To increase an engine's output power, irregularities in the intake and exhaust paths, such as casting flaws, can be removed, and, with the aid of an air flow bench, the radii of valve port turns and valve seat configuration can be modified to reduce resistance. This process is called porting, and it can be done by hand or with a CNC machine.

Waste heat recovery of an internal combustion engine

[edit]

An internal combustion engine is on average capable of converting only 40-45% of supplied energy into mechanical work. A large part of the waste energy is in the form of heat that is released to the environment through coolant, fins etc. If somehow waste heat could be captured and turned to mechanical energy, the engine's performance and/or fuel efficiency could be improved by improving the overall efficiency of the cycle. It has been found that even if 6% of the entirely wasted heat is recovered it can increase the engine efficiency greatly.^[8]

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 the Rankine Cycle, turbocharging and thermoelectric generation can be very useful as a waste heat recovery system.

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.

Turbocharging

[edit]

A turbocharger is a supercharger that is driven by the engine's exhaust gases, by means of a turbine. 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. When much more power output is required, the engine speed and throttle opening are increased until the exhaust gases are sufficient to 'spool up' the turbocharger's turbine to start compressing much more air than normal into the intake manifold. 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. Many engines use one or more camshafts "above" a row (or each row) of cylinders, as in the illustration, in which each cam directly actuates a valve through a flat tappet. 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. Typically, the clearance must be readjusted each 20,000 miles (32,000 km) with a feeler gauge.

Most modern production engines use hydraulic lifters to automatically compensate for valve train component wear. Dirty engine oil may cause lifter failure.

Energy balance

[edit]

Otto engines are about 30% efficient; in other words, 30% of the energy generated by combustion is converted into useful rotational energy at the output shaft of the engine, while the remainder being lost due to waste heat, friction and engine accessories.^[9] There are a number of ways to recover some of the energy lost to waste heat. The use of a turbocharger in diesel engines is very effective by boosting incoming air pressure and in effect, provides the same increase in

Ignition of fuel, power stroke, and exhaust stroke.

See also

[edit]

- Atkinson cycle
- Miller cycle
- Humphrey pump
- Desmodromic valve
- History of the internal combustion engine
- Napier Deltic
- Poppet valve
- Radial engine
- Rotary engine
- Six-stroke engine
- Stirling engine
- Stroke (engine)
 - Two- and four-stroke engines
 - Two-stroke engine
 - Five-stroke engine (uncommon)
 - Six-stroke engine

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External links

[edit]

- U.S. patent 194,047
- Four stroke engine animation
- Detailed Engine Animations^[*usurped*]
- How Car Engines Work
- Animated Engines, four stroke, another explanation of the four-stroke engine.
- CDX eTextbook, some videos of car components in action.
- New 4 stroke

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Engine configurations for piston engines

Type

- Atmospheric
- Axial
- Beam
 - Cornish
 - Rotative
- Bourke
- Cam engine
- Camless
- Compound
- Double-acting cylinder
- Flathead
- Free-piston
 - Stelzer
- Hemi
- Heron head
- Intake over exhaust
- Oscillating cylinder
- Opposed-piston
- Overhead camshaft
- Overhead valve
- Pentroof
- Rotary
- Single-acting cylinder
- Split cycle
- Swing-piston
- Uniflow
- Watt
- Wedge

Stroke cycles

- Two-stroke
- Four-stroke
- Five-stroke
- Six-stroke
- Two-and four-stroke

Inline / straight

- I1
- I2
- I3
- I4
- I5
- I6
- I7
- I8
- I9
- I12
- I14

Flat / boxer

- F2
- F4
- F6
- F8
- F10
- F12
- F16

Cylinder layouts

V / Vee

- V2
- V3
- V4
- V5
 - VR5
- V6
 - VR6
- V8
- V10
- V12
- V14
- V16
- V18
- V20
- V24

W

- W3
- W6
- W8
- W12
- W16
- W18
- W24
- W30

- Delta

- v
- t
- e

Car design

Classification	By size	<ul style="list-style-type: none"> ○ Micro ○ Kei ○ Subcompact ○ Supermini ○ Family ○ Compact ○ Mid-size ○ Full-size
	Custom	<ul style="list-style-type: none"> ○ Baja Bug ○ Hot rod ○ Lead sled ○ Lowrider ○ Sandrail ○ T-bucket
	Luxury	<ul style="list-style-type: none"> ○ Compact executive ○ Executive ○ Personal
	Minivan / MPV	<ul style="list-style-type: none"> ○ Compact ○ Leisure ○ Mini
	SUV	<ul style="list-style-type: none"> ○ Compact ○ Crossover (CUV) ○ Mini ○ Coupe SUV
	Sports	<ul style="list-style-type: none"> ○ Grand tourer ○ Hot hatch ○ Muscle ○ Pony ○ Sport compact ○ Sports sedan ○ Super ○ Go-kart
	Other	<ul style="list-style-type: none"> ○ Antique ○ Classic ○ Economy ○ Ute ○ Van ○ Vintage car

Body styles

- 2+2
- Baquet
- Barchetta
- Berlinetta
- Brougham
- Cabrio coach
- Cab over
- Cabriolet / Convertible / Drophead coupe
- Coupe
- Coupé de Ville / Sedan de Ville
- Coupé utility
- Fastback
- Hardtop
- Hatchback
- Kammback
- Landaulet
- Liftback
- Limousine
- Microvan
- Minibus
- Multi-stop truck
- Notchback
- Panel van
- Phaeton
- Pickup truck
- Quad coupé
- Retractable hardtop
- Roadster / Spider / Spyder
- Runabout
- Saloon / Sedan
- Sedan delivery/Panel van
- Shooting brake
- Station wagon
- Targa top
- Torpedo
- Touring
- Town (Coupé de Ville)
- T-top
- Vis-à-vis

Specialized vehicles

- All-terrain vehicle
- Amphibious
- Connected
- Driverless (autonomous)
- Dune buggy
- Go-kart
- Gyrocar
- Pedal car
- Personal rapid transit
- Police car
- Flying car
- Taxicab
- Tow truck
- Voiturette

Propulsion

- Alternative fuel
- Autogas
- Biodiesel
- Biofuel
- Biogasoline
- Biogas
- Compressed natural gas
- Diesel
- Electric (battery
- NEV)
- Ethanol (E85)
- Fossil fuel
- Fuel cell
- Fuel gas
- Natural gas
- Gasoline / petrol (direct injection)
- Homogeneous charge compression ignition
- Hybrid (plug-in)
- Hydrogen
- Internal combustion
- Liquid nitrogen
- Liquified petroleum gas
- Steam

Drive wheels

- Front-wheel
- Rear-wheel
- Two-wheel
- Four-wheel
- Six-wheel
- Eight-wheel
- Ten-wheel
- Twelve-wheel

Engine position

- Front
- Mid
- Rear

**Layout
(engine / drive)**

- Front-front
- Front mid-front
- Rear-front
- Front-rear
- Rear mid-rear
- Rear-rear
- Front-four-wheel
- Mid-four-wheel
- Rear-four-wheel
- Dual motor-four-wheel
- Individual wheel drive

**Engine configuration
(internal combustion)**

- Boxer
- Flat
- Four-stroke
- H-block
- Reciprocating
- Single-cylinder
- Straight
- Two-stroke
- V (Vee)
- W engine
- Wankel

- **Portal**
- **Category**
- **Template:EC car classification**

- v
- t
- e

Aircraft piston engine components, systems and terminology

Piston engines	Mechanical components	<ul style="list-style-type: none"> ○ Camshaft ○ Connecting rod ○ Crankpin ○ Crankshaft ○ Cylinder ○ Cylinder head ○ Gudgeon pin ○ Hydraulic tappet ○ Main bearing ○ Obturator ring ○ Oil pump ○ Piston ○ Piston ring ○ Poppet valve ○ Pushrod ○ Rocker arm ○ Sleeve valve ○ Tappet
	Electrical components	<ul style="list-style-type: none"> ○ Alternator ○ Capacitor discharge ignition ○ Dual ignition ○ Electronic fuel injection ○ Generator ○ Ignition system ○ Magneto ○ Spark plug ○ Starter
	Terminology	<ul style="list-style-type: none"> ○ Air-cooled ○ Aircraft engine starting ○ Bore ○ Compression ratio ○ Dead centre ○ Engine displacement ○ Four-stroke engine ○ Horsepower ○ Ignition timing ○ Manifold pressure ○ Mean effective pressure ○ Naturally aspirated ○ Monosoupape ○ Overhead camshaft ○ Overhead valve engine ○ Rotary engine ○ Shock cooling ○ Stroke

- Components**
 - Propeller governor
 - Propeller speed reduction unit
 - Spinner

Propellers

- Terminology**
 - Autofeather
 - Blade pitch
 - Constant-speed
 - Contra-rotating
 - Counter-rotating
 - Scimitar
 - Single-blade
 - Variable-pitch

- Engine instruments**
 - Annunciator panel
 - EFIS
 - EICAS
 - Flight data recorder
 - Glass cockpit
 - Hobbs meter
 - Tachometer

- Engine controls**
 - Carburetor heat
 - Throttle

- Fuel and induction system**
 - Avgas
 - Carburetor
 - Fuel injection
 - Gascolator
 - Inlet manifold
 - Intercooler
 - Pressure carburetor
 - Supercharger
 - Turbocharger
 - Updraft carburetor

Other systems

- Auxiliary power unit
- Coffman starter
- Hydraulic system
- Ice protection system
- Recoil start

About Shorewood Home & Auto (Formerly Circle Tractor)

Driving Directions in Will County

auto atv

41.594748226806, -87.999739790257

Starting Point

Shorewood Home & Auto (Formerly Circle Tractor), 13639 W 159th St, Homer Glen, IL 60491, USA

Destination

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ATV Dealer

41.557324506025, -87.928742225499

Starting Point

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Destination

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ATV Dealer

41.558509620271, -87.95950362543

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Destination

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atv stores in illinois

41.631170758126, -87.9510205

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41.57515764718, -88.032512736562

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atv push mower

41.619926653045, -87.892455610928

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atv illinois for sale

41.661417333599, -87.915319377447

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atv push mower

41.576559514074, -88.017102969337

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used atv mowers for sale

41.606342917118, -87.909382977642

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41.58938458501, -87.942080491627

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Google Maps Location

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Google Maps Location

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