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Battery or alternator test

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Explore our latest gallery of Editors’ Picks.Browse Editors' FavoritesExperience AI-Powered Creativity It’s equally important to recognize the signs of a faulty alternator. Symptoms of a bad alternator include: A dead battery after drivingWarning lights on the dashboardElectrical failuresStrange noisesOverheating and burning smellsThe age of the alternator Being aware of these symptoms can help you identify a malfunctioning alternator and address the issue before it escalates. Dead Battery After Driving A dead battery after driving could indicate a bad alternator. The alternator is responsible for keeping your battery charged while the engine is running. If your battery dies after driving, it’s crucial to inspect your alternator and address any issues to ensure your vehicle remains reliable and efficient. Regular maintenance of your alternator is important to keep your vehicle running smoothly. Check the alternator. Warning Lights on Dashboard Warning lights on your dashboard, also known as dashboard lights, can signal an issue with your alternator. If you notice battery, alternator, or check engine lights illuminated, it’s essential to inspect your alternator for any problems. Ignoring these warning signs can lead to further damage and costly repairs. Electrical Failures Various electrical failures can be symptoms of a faulty alternator. Issues such as dimming headlights, flickering dashboard lights, clicking sounds when starting the car, and a swollen battery case can all be attributed to a malfunctioning alternator, which is responsible for regulating electrical components in your vehicle. If you experience any of these electrical failures, it’s crucial to inspect your alternator and address any issues promptly. Strange Noises Unusual noises coming from your engine, such as grinding or squealing, can be a sign of a bad alternator. These noises may be caused by a malfunctioning alternator belt, worn-out bearings, or a failing alternator itself. If you hear strange noises from your engine, it’s essential to inspect your alternator and address any concerns to avoid further damage. Overheating and Burning Smells Overheating and burning smells can indicate a malfunctioning alternator. If you notice a burning rubber smell, it could be a sign that your alternator’s bearings are worn out and overheating. In this case, it’s crucial to inspect your alternator and replace it if necessary to prevent further damage to your vehicle. Replacing the alternator can be a difficult task, so it’s important to consider seeking professional help for an alternator replacement. Age of the Alternator An alternator older than its typical lifespan (7-10 years) is likely to cause issues. To determine the age of your alternator, consult the date of manufacture printed on the alternator. If your alternator is nearing or past its expected lifespan and you’re experiencing symptoms, it’s essential to replace it to maintain your vehicle’s performance and avoid potential problems. Device converting mechanical into electrical energy Alternators made in 1909 by Ganz Works in the power generating hall of a Russian hydroelectric station (photograph by Prokudin-Gorsky, 1911).[1] An alternator (or synchronous generator) is an electrical generator that converts mechanical energy to electrical energy in the form of alternating current.[2] For reasons of cost and simplicity, most alternators use a rotating magnetic field with a stationary armature.[3] Occasionally, a linear alternator or a rotating armature with a stationary magnetic field is used. In principle, any AC electrical generator can be called an alternator, but usually, the term refers to small rotating machines driven by automotive and other internal combustion engines. An alternator that uses a permanent magnet for its magnetic field is called a magneto. Alternators in power stations driven by steam turbines are called turbo-alternators. Large 50 or 60 Hz three-phase alternators in power plants generate most of the world's electric power, which is distributed by electric power grids.[4] In what is considered the first industrial use of alternating current in 1891, workers pose with a Westinghouse alternator at the Ames Hydroelectric Generating Plant. This machine was used as a generator producing 3,000-volt, 133-hertz, single-phase AC, and an identical machine 3 miles (4.8 km) away was used as an AC motor.[5][6][7] Alternating current generating systems were known in simple forms from the discovery of the magnetic induction of electric current in the 1830s. Rotating generators naturally produced alternating current, but since there was little use for it, it was normally converted into direct current via the addition of a commutator in the generator.[8] The early machines were developed by pioneers such as Michael Faraday and Hippolyte Pixii. Faraday developed the "rotating rectangle", whose operation was heteropolar – each active conductor passed successively through regions where the magnetic field was in opposite directions.[9] Lord Kelvin and Sebastian Ferranti also developed early alternators, producing frequencies between 100 and 300 Hz. The late 1870s saw the introduction of the first large-scale electrical systems with central generation stations to power Arc lamps, used to light whole streets, factory yards, or the interior of large warehouses. Some, such as Yablochkov arc lamps introduced in 1878, ran better on alternating current, and the development of these early AC generating systems was accompanied by the first use of the word "alternator".[10][8] Supplying the proper amount of voltage from generating stations in these early systems was left up to the engineer's skill in "riding the load".[11] In 1883 the Ganz Works invented the constant voltage generator[12] that could produce a stated output voltage, regardless of the value of the actual load.[13] The introduction of transformers in the mid-1880s led to the widespread use of alternating current and the use of alternators needed to produce it.[14] After 1891, polyphase alternators were introduced to supply currents of multiple differing phases.[15] Later alternators were designed for various alternating current frequencies between sixteen and about one hundred hertz for use with arc lighting, incandescent lighting, and electric motors.[16] Specialized radio frequency alternators like the Alexanderson alternator were developed as longwave radio transmitters around World War 1 and used in a few high power wireless telegraphy stations before vacuum tube transmitters replaced them.[citation needed] Diagram of a simple alternator with a rotating magnetic core (rotor) and stationary wire (stator) also showing the current induced in the stator by the rotating magnetic field of the rotor. A conductor moving relative to a magnetic field develops an electromotive force (EMF) in it (Faraday's Law). This EMF reverses its polarity when it moves under magnetic poles of opposite polarity. Typically, a rotating magnet, called the rotor, turns within a stationary set of conductors, called the stator, wound in coils on an iron core. The field cuts across the conductors, generating an induced EMF (electromotive force), as the mechanical input causes the rotor to turn.[citation needed] The rotating magnetic field induces an AC voltage in the stator windings. Since the currents in the stator windings vary in step with the position of the rotor, an alternator is a synchronous generator.[3] The rotor's magnetic field may be produced by permanent magnets or by a field coil electromagnet. Automotive alternators use a rotor winding, which allows control of the alternator's generated voltage by varying the current in the rotor field winding. Permanent magnet machines avoid the loss due to magnetizing current in the rotor, but are restricted in size due to the cost of the magnet material. Since the permanent magnet field is constant, the terminal voltage varies directly with the speed of the generator. Brushless AC generators are usually larger than those used in automotive applications.[citation needed] An automatic voltage control device controls the field current to keep the output voltage constant. If the output voltage from the stationary armature coils drops due to an increase in demand, more current is fed into the rotating field coils through the voltage regulator (VR). This increases the magnetic field around the field coils, which induces a greater voltage in the armature coils. Thus, the output voltage is brought back up to its original value.[citation needed] Alternators used in central power stations also control the field current to regulate reactive power and to help stabilize the power system against the effects of momentary faults. Often, there are three sets of stator windings, physically offset so that the rotating magnetic field produces a three phase current, displaced by one-third of a period with respect to each other.[17] One cycle of alternating current is produced each time a pair of field poles passes over a point on the stationary winding. The relation between speed and frequency is N = 120 f / P {\displaystyle N=120f/P} , where f {\displaystyle f} is the frequency in Hz (cycles per second). P {\displaystyle P} is the number of poles (2, 4, 6, …), and N {\displaystyle N} is the rotational speed in revolutions per minute (r/min).[18] Old descriptions of alternating current systems sometimes give the frequency in terms of alternations per minute, counting each half-cycle as one alternation; so 12,000 alternations per minute corresponds to 100 Hz.[citation needed] An alternator's output frequency depends on the number of poles and the rotational speed. The speed corresponding to a particular frequency is called the synchronous speed. This table[19] gives some examples: Poles Rotation speed (r/min), giving... 50 Hz 60 Hz 400 Hz 2 3,000 3,600 24,000 4 1,500 1,800 12,000 6 1,000 1,200 8,000 8 750 900 6,000 10 600 720 4,800 12 500 600 4,000 14 428.6 514.3 3,429 16 375 450 3,000 18 333.3 400 2,667 20 300 360 2,400 40 150 180 1,200 Alternators may be classified by the method of excitation, number of phases, the type of rotation, cooling method, and their application.[20] There are two main ways to produce the magnetic field used in the alternators: by using permanent magnets, which create their persistent magnetic field, or by using field coils. The alternators that use permanent magnets are specifically called magnetos.[citation needed] In other alternators, wound field coils form an electromagnet to produce the rotating magnetic field.[citation needed] A device that uses permanent magnets to produce alternating current is called a permanent magnet alternator (PMA). A permanent magnet generator (PMG) may produce either alternating current or direct current if it has a commutator.[citation needed] This method of excitation consists of a smaller direct-current (DC) generator fixed on the same shaft as the alternator. The DC generator generates a small amount of electricity, just enough to excite the field coils of the connected alternator to generate electricity. A variation of this system is a type of alternator that uses direct current from a battery for initial excitation upon start-up, after which the alternator becomes self-excited.[20] This method of excitation consists of a smaller alternating-current (AC) generator fixed on the same shaft as the alternator. The AC stator generates a small amount of field coil excitation current, which is induced in the rotor and rectified to DC by a bridge rectifier built in to the windings where it excites the field coils of the larger connected alternator to generate electricity. This system has the advantage of not requiring brushes, which increases service life, although with a slightly lower overall efficiency. A variation of this system is a type of alternator that uses direct current from a battery for initial excitation upon start-up, after which the alternator becomes self-excited.[20] This method depends on residual magnetism retained in the iron core to generate a weak magnetic field, which would allow a weak voltage to be generated. This voltage is used to excite the field coils so the alternator can generate stronger voltage as part of its build up process. After the initial AC voltage buildup, the field is supplied with rectified voltage from the alternator.[20] A brushless alternator is composed of two alternators built end-to-end on one shaft. Until 1966, alternators used brushes with rotating field.[21] With the advancement in semiconductor technology, brushless alternators are possible. Smaller brushless alternators may look like one unit, but the two parts are readily identifiable in the large versions. The main alternator is the larger of the two sections, and the smaller one is the exciter. The exciter has stationary field coils and a rotating armature (power coils). The main alternator uses the opposite configuration with a rotating field and stationary armature. A bridge rectifier, called the rotating rectifier assembly, is mounted on the rotor. Neither brushes nor slip rings are used, which reduces the number of wearing parts. The main alternator has a rotating field and a stationary armature (power generation windings). Varying the amount of current through the stationary exciter field coils varies the 3-phase output from the exciter. This output is rectified by a rotating rectifier assembly mounted on the rotor, and the resultant DC supplies the rotating field of the main alternator and hence alternator output. The result is that a small DC exciter current indirectly controls the output of the main alternator.[22] Main articles: Single-phase generator and Polyphase coil Another way to classify alternators is by the number of phases of their output voltage. The output can be single phase or polyphase. Three-phase alternators are the most common, but polyphase alternators can be two-phase, six-phase, or more.[20] The revolving part of alternators can be the armature or the magnetic field. The revolving armature type has the armature wound on the rotor, where the winding moves through a stationary magnetic field. The revolving armature type is not often used.[20] The revolving field type has a magnetic field on the rotor to rotate through a stationary armature winding. The advantage is that then the rotor circuit carries much less power than the armature circuit, making the slip ring connections smaller and less costly; only two contacts are needed for the direct-current rotor, whereas often a rotor winding has three phases, and multiple sections which would each require a slip-ring connection. The stationary armature can be wound for any convenient medium voltage level, up to tens of thousands of volts; manufacture of slip ring connections for more than a few thousand volts is costly and inconvenient.[citation needed] Many alternators are cooled by ambient air, forced through the enclosure by an attached fan on the shaft that drives the alternator. In vehicles such as transit buses, a heavy demand on the electrical system may require a large alternator to be oil-cooled.[23] In marine applications water-cooling is also used. Expensive automobiles may use water-cooled alternators to meet high electrical system demands.[citation needed] Most power generation stations use synchronous machines as their generators. The connection of these generators to the utility grid requires synchronization conditions to be met.[24] Further information: Alternator (automotive) Alternator mounted on an automobile engine with a serpentine belt pulley (belt not present.) Alternators are used in modern internal combustion engine automobiles to charge the battery and to power the electrical system when its engine is running.[25] Until the 1960s, automobiles used DC dynamo generators with commutators. With the availability of affordable silicon-diode rectifiers, alternators were used instead.[26] In later diesel-electric locomotives and diesel electric multiple units, the prime mover turns an alternator which provides electricity for the traction motors (AC or DC).[27][28] The traction alternator usually incorporates integral silicon diode rectifiers to provide the traction motors with up to 1,200 volts DC.[29] The first diesel electric locomotives, and many of those still in service, use DC generators as, before silicon power electronics, it was easier to control the speed of DC traction motors. Most of these had two generators: one to generate the excitation current for a larger main generator.[30] Optionally, the generator also supplies head-end power (HEP) or power for electric train heating. The HEP option requires a constant engine speed, typically 900 r/min for a 480 V 60 Hz HEP application, even when the locomotive is not moving.[citation needed] Marine alternators used in yachts are similar to automotive alternators, with appropriate adaptations to the salt-water environment. Marine alternators are designed to be explosion proof (ignition protected) so that brush sparking will not ignite explosive gas mixtures in an engine room environment. Depending on the type of system installed, they may be 12 or 24 volts. Larger marine diesels may have two or more alternators to cope with the heavy electrical demand of a modern yacht. On single alternator circuits, the power may be split between the engine starting battery and the domestic or house battery (or batteries) by use of a split-charge diode (battery isolator) or a voltage-sensitive relay. Due to the high cost of large house battery banks, Marine alternators generally use external regulators. Multistep regulators control the field current to maximize the charging effectiveness (time to charge) and battery life. Multistep regulators can be programmed for different battery types. Two temperature sensors can be added: one for the battery to adjust the charging voltage and an over-temperature sensor on the actual alternator to protect it from overheating.[citation needed] Further information: APU, RAT, and Hydraulic motor High-frequency alternators of the variable-reluctance type were applied commercially to radio transmission in low-frequency radio bands. These were used for transmitting Morse code and, experimentally, for transmitting voice and music. In the Alexanderson alternator, both the field winding and armature winding are stationary, and current is induced in the armature by the changing magnetic reluctance of the rotor (which has no windings or current-carrying parts). Such machines were made to produce radio frequency current for radio transmissions, although the efficiency was low.[31] Bottle dynamo Dynamo Electric generator Engine-generator Flux switching alternator Folsom Powerhouse State Historic Park Hub dynamo Induction generator Jedlik's dynamo Linear alternator Magneto Polyphase coil Revolving armature alternator Single-phase generator Synchronverter ^ "Abraham Ganz at the Hindukush". Poemas del río Wang. Studiolum. Archived from the original on 11 February 2016. Retrieved 30 September 2015. ^ Aylmer-Small, Sidney (1908). "Lesson 28: Alternators". Electrical railroading; or, Electricity as applied to railroad transportation. Chicago: Frederick J. Drake & Co. pp. 456–463. ^ a b Gordon R. Selmon, Magnetoelectric Devices, John Wiley and Sons, 1966 no ISBN pp. 391-393 ^ "List of Plug/Sockets and Voltage of Different Countries". World Standards. ^ D. M. Mattox, The Foundations of Vacuum Coating Technology, page 39 ^ "Charles C. 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