How to create your own ultra-low EMF car

The lowest radiation vehicles available are modified Mercedes diesel cars from the early 1980s. Here we describe how to do the modifications.

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Who needs an ultra-low EMF car?

People with electrical sensitivities can often get by driving an older car that does not have all the gadgets in modern vehicles. Some may also need to make further modifications.

A few people have such severe electrical sensitivity that they need the lowest radiation possible, well below 1 milligauss (100 nT) and virtually no high-frequency transients (dirty electricity) or radio-frequency radiation from the car. These people, six of whose cars are shown in this article, were unable to drive regular cars. With these modified cars they regained their freedom to drive on their own. Others have as well.

Three people with their modified Mercedes cars.

The unmodified Mercedes 300SD measures about 2 milligauss (200 nanotesla) around the driver. With the modifications, it measures about 0.2 milligauss (20 nanotesla). The 300D models are similar. None of these old diesel cars emit radio-frequency radiation.

A modern car or pickup truck typically exposes the driver to 20 to 80 milligauss (2.000 to 8.000 nanotesla), plus radio-frequency radiation in a wide range of frequencies that often exceeds 1000 uW/m^2.

The Mercedes cars

The following instructions are for Mercedes diesel cars of the models 300D, 300SD and 300CD from the years 1981 through 1985. The modifications may work for the 240D and 300TD, but we are not aware of anyone who has tried. The models 300SE and 300SEL probably cannot be modified this way as they have gasoline engines.

Unlike other car manufacturers, Mercedes sometimes updated their products during a model year. They introduced anti-lock brakes (ABS) on their 300SD model in September 1985, at the very end of the production of those cars. We recommend avoiding these few cars with ABS.

Older Mercedes cars are still available in climates that are dry and see little snow, such as the Southwest USA, where rust is not much of a problem.

What is special about these cars is that they have all of these features:

- diesel engine
- non-electric fuel pump
- non-electric fuel injectors
- non-electric automatic transmission
- no anti-lock braking system (ABS)
- virtually no electronic gadgets
- low electricity need (can run on batteries)
- were built to last

These cars can be further modified if needed. They use so little electricity they can be run using batteries instead of an alternator.

The first person to figure this out is unknown to us, but he lived in Sweden and modified a Mercedes car in the mid-to-late 1990s. An engineer in Snowflake, Arizona, USA, independently came up with the very same idea in the year 2000. Others have made minor contributions, such as the solar system and the degaussing of the tires.

We are not aware of any other car makes or models that work so well. Mercedes did make two diesel cars in the second half of the 1980s that may be worth a look (190D and 300SDL), but we have not inspected any of them. They do appear to have ABS brakes, but not electric fuel pumps. In the early 1990s they had two other diesel models (300SD and 350SDL) which we have not looked at either.

Mercedes was early to introduce new technologies (such as the wireless smart key in 1998), so later models are unlikely to be suitable.

Buying an old Mercedes

These Mercedes cars were built to last. That is why there are still so many of them on the road in dry climates where rust is a minor problem. But old cars still break down, so don't expect to find one in perfect condition. Expect to have to spend some money fixing various problems. After all, there is probably a reason why the car is offered for sale. Check the car well. You can take it to a local mechanic to get it checked by a professional and then make an offer based on the defects you find.

You may have to spend almost as much on repairs as you pay to buy the car. Remember this is not a regular car purchase, the financial criteria are not the same as when buying a regular car. Think of it more in terms of buying a wheelchair or other medical equipment (which are usually overpriced, at least in America).

If you can afford it, consider buying a collector's car. It should be in near-mint condition, but with a much higher price tag.

Warnings and disclaimer

Modifying a vehicle involves risk of damage to the vehicle, injury to persons and breaking laws.

An example could be the mounting of a solar panel on the roof of the car. One or more screws could work themselves loose due to vibration, creating the possibility that the panel could fall off and injure someone.

Another example is a possible short in the electrical system, which could start a fire, or the battery leaking acid, both of which could cause damage and injury.

Some modifications may not be legal to do yourself, or even at all, depending on the local laws. There could be problems if the vehicle has to be inspected (the cars this author knows of are all in areas without vehicle inspections).

We are not aware of any of these problems actually happening, but they could happen, especially if the modifications were done poorly.

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Converting the car

Some people do not need to do any modifications. These Mercedes cars are already less radiant than any other car we are aware of.

If you are comfortable sitting in the car with the engine on, but not driving it, try first to degauss the tires (see the article available on the link at the end of this article).

If you are among the unfortunate few for whom this is not enough, then the rest of this article provides detailed information on how to modify these cars to further lower the radiation levels. You will probably need the help of a mechanic, but you don't need a specialist in Mercedes cars. These old cars are a lot simpler than modern cars. An open-minded backyard mechanic may be quite adequate.

The Alternator

This device sits at the front-right side of the engine on the Mercedes cars, and generates a lot of EMF and "dirty" DC electricity which makes the wiring throughout the car radiate.

There are unoriginal replacement versions available from auto parts stores, such as AutoZone, which are designed differently, and just happen to emit less EMF, but they are not any better on the dirty electricity issue.

The more effective method is to disconnect the alternator, so it no longer charges the battery, or only does so intermittently. The alternator cannot simply be physically removed, as it is needed to tighten the fan belt on the engine.

There are four options for disconnecting the alternator. Which option to choose will depend on the climate, the driver and the use of the car.

- dashboard switch
- engine compartment switch
- permanent disconnect, battery charger
- permanent disconnect, solar charger

A switch could be installed to turn the alternator on from the dash board. This requires modifying the alternator to use an external regulator, rather than the one built into it. If the internal one is used, the alternator will simply start generating power at higher rpm's on its own (it starts "self-exciting" at around 3500 rpm's). We are not aware of anyone who has done this modification.

A simpler method is to install a double-poled switch inside the engine compartment and close to the alternator. This switch must disconnect both wires going to the alternator.

Two switches (right) mounted next to the engine in a 300SD.
The wires were removed from the black plastic distributor box in the upper-left.

It is important not to engage the alternator with such a switch while the engine is running, as the resulting surge will eventually ruin the alternator.

The most common method is to permanently disconnect the alternator wires and never use the alternator. The battery is then charged by a solar panel or a battery charger. The battery charger is plugged in when the car is not in use, as chargers are worse than alternators.

A solar panel can be mounted on the car to charge the battery throughout the day. Solar panels do not radiate or generate dirty electricity and are quite safe to be near if installed according to our instructions.

If disconnecting the alternator completely, it is important to remove both wires going to the alternator. The thin wire provides the current to the regulator, while the thicker wire sends current to the battery. With the thicker wire connected, the self-excitation mentioned above will simply happen at higher engine speeds, and nothing is gained.

It is possible to run off the battery in these cars, as they need very little electricity to run. The driver must be aware of this, and refrain from using power-hungry

features such as headlights, the defroster or the air conditioner, or at least do so very sparingly.

It can also be helpful to turn off unneeded circuits, such as the central locking system, and remove some of the light bulbs, like those under the doors.

The rear brake lights consume a lot of electricity, so it is best to turn the transmission to "neutral" or "park" when sitting for longer periods, or replace the bulbs with LEDs.

Some equipment may be worn out in these older vehicles, and may consume more electricity than intended. Such problems can be located by removing each fuse in the fuse box and letting the power run through an ammeter (use a multimeter on the 10 amp setting). One problem that continuously consumed 8 amps was found that way in the author's car.

The 300SD consumes a little more electricity that the other 300-models, as it has more relays and features.

Solar Charging

Charging with a solar panel mounted on the roof of the car is the easiest method to use, as it is fully automatic. The user of the car does not have to operate anything, the panel charges the battery throughout the day, whether the car is driven or not. The solar system does not emit EMF, if designed correctly.

However, solar charging may not work in all climates. In northern Europe and Canada, the sun may be too weak during the winters to produce enough electricity. Snow on the panel will also block the sunlight. In these climates a battery charger may be needed for part of the year, especially if headlights have to be used.

A solar system is not complicated to install. It consists of a photo-voltaic solar panel, a charge controller, and some wiring and fittings. When the sun hits the solar panel, it generates electricity. The more sun, the more electricity. The power from the panel is sent through the charge controller directly to the battery. The charge controller monitors the battery, and turns off the solar panel when the battery is full, so it does not become overcharged.

The solar panel can be installed on the roof of the car, the lid of the trunk or simply placed in the rear window. All three locations may be needed in less sunny climates.

A 60 watt solar panel mounted on a roof rack.

A 40 watt flexible thin-film panel mounted directly onto the roof.

This car has a 40 watt thin-film panel on the roof and a 20 watt panel that normally sits in the rear window, but can be taken outside and placed so it faces the sun. This is useful for charging early and late in the day on long travel days.

In sunny Arizona, 40 watt solar panels work even in the winter. For climates further from the equator, or with more cloudy weather, higher wattage is needed.

Solar panels that do not use glass fronts are best, as the glass can shatter if a stone lands on it. This is particularly a problem on dirt roads. Thin-film solar panels usually do not use glass; they are also available in flexible versions which can be mounted flush with the roof.

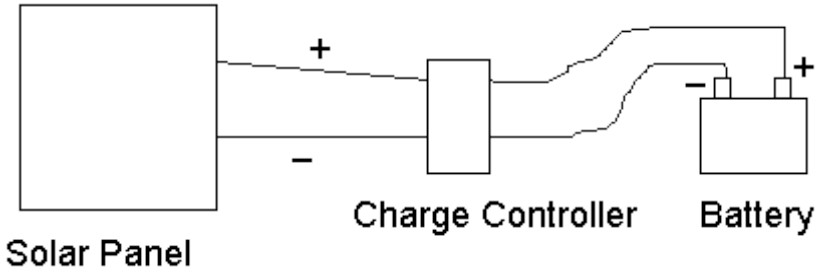
One car had the roof panel mounted on top of a Yakima sports rack. It was put as far back as possible to avoid wind noise. The 48-inch Yakima cross bar fits perfectly on a 300SD.

The electrical cable from the roof rack can be brought down through a roof penetration, which can be done by a body shop. A simpler approach is to bring it through one of the rear doors, and then just not open that door much any more.

The solar panel generates completely clean, smooth DC electricity, which should not be troublesome. However, most charge controllers charge the battery by sending the current in pulses, so-called Pulse-Width-Modulation, PWM, which gives a more efficient charging of the battery, but also produces EMF. One

suitable charge controller is the Specialty Concepts ASC, which does not use PWM.

A basic schematic is shown below:



To gain experience, before installing on the car, try to first set up the components as shown in the diagram. Hook up a 12 volt lamp to consume electricity, and use a voltmeter to monitor the battery. Watch how fast the battery is recharged in direct sunlight, and how slow on a cloudy day, and how slow when the sun does not beat directly down on the panel. Also watch how the battery voltage drops as soon as the light is turned on, and how it recovers when it is turned off, even if the solar panel is not producing any electricity.

Electrical Consumption

Knowing how much electricity a car consumes is very important if trying to run it without the alternator. The following measurements were done on the author's own Mercedes 300SD from 1982. The other diesel Mercedes models from the early 1980's consume a little less, as they have fewer features and do not use as many relays.

A modern car or truck will consume a lot more, just for basic operations, as they have much more electronics onboard. A gasoline powered car will consume much, much more, to fire the spark plugs.

The "basic operation" line is what my car consumes with the engine running and nothing else on. This is the most important number, as that is what it needs whenever it is on. Everything else is of short duration, unless driving at night.

The heating valve is first engaged when the engine is hot. It uses electricity to block the hot water from heating the passenger compartment. It can be disconnected and replaced by a ball valve to save electricity, as mentioned elsewhere.

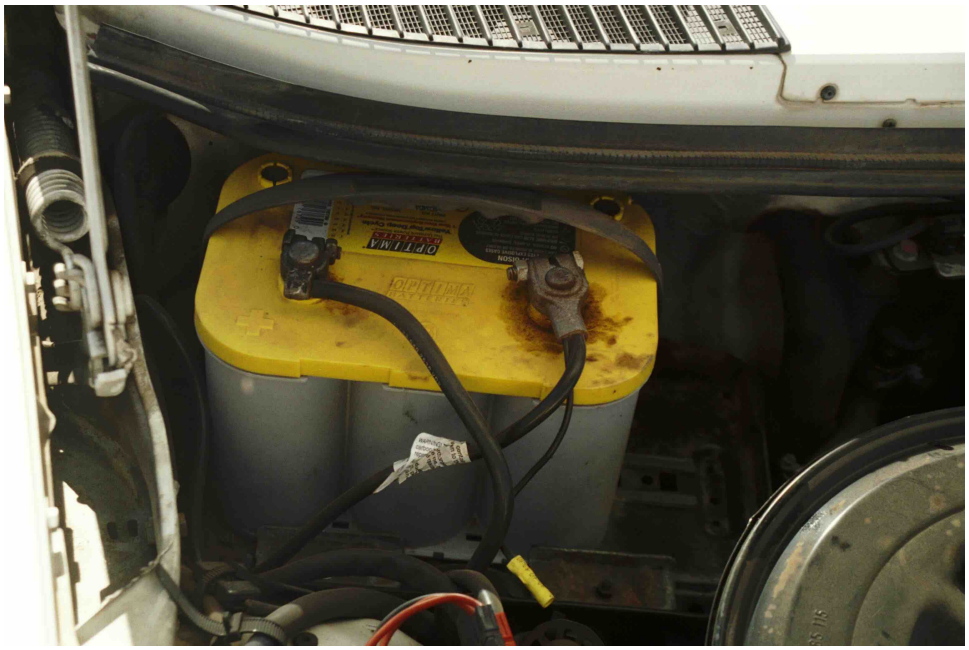
Basic operation	15 W
Heating valve	6 W
Glow plugs	780 W
Starter	1800 W
Brake lights	120 W
Turn signal	36 W
Electric windows	75 W
Head lights	100 W
Tail lights	80 W
Wipers	60 W
Rear window defogger	140 W

Battery Systems

It takes a lot more electricity to start a diesel engine than a gasoline engine, both for the glow plugs and when cranking it, so the batteries in these vehicles tend to be larger. They are designed to be constantly topped off by the alternator while the engine is running, so if the alternator is removed, the battery will have to work harder and may not live as long. This is particularly the case if the battery is only charged at home, the headlights are used or the climate is cloudy. Expect the battery to only live a year under these conditions, possibly much less while the driver gets used to the new setup.

With an adequate solar system, the battery should be fully charged most of the time during the day, and have a life span similar to a regular car.

Where the battery has to work harder, it could be beneficial to upgrade to the newer AGM (Advanced Glass Mat) type batteries, such as the Optima brand.



An Optima "yellow top" AGM battery powering a car without a solar panel. The battery is charged at home with a battery charger.

One alternator-less car uses a split battery system — one battery for starting the car, another for running it. This way, there will always be electricity left to start the car, even if the run-time battery had been depleted. This car has been used for long interstate travel.

Another option is to put a second battery in the trunk and wire it together with the battery in the front. This requires very thick cables to do properly, otherwise the front battery will do all the heavy lifting as the high currents at startup simply cannot make it through a thin cable from the back. Specialty shops that install oversized audio systems in vehicles have the right equipment for doing this correctly.

If you use two batteries that are linked together, they must be of the same model and age. Otherwise they will "fight" each other and both have limited life span.

In northern climes, battery capacity becomes more important, as there is much less sun to charge the battery, and there is more need for operating the headlights and wipers, etc. Deep cycle batteries may be necessary. A good choice is the Advanced Glass Mat, AGM, types. Splitting the battery system in two, one for starting, one for running, can also be considered.

A volt meter is added so the driver can monitor the battery.

This volt meter has a switch to monitor two separate batteries in a split-system car (discussed below).

It is absolutely essential to have a voltmeter installed on the dash board, to monitor the condition of the battery system.

Split Battery System (Mercedes 300SD)

Splitting the electrical system allows the car to have a regular car battery to start the car and a separate battery (or two) to run the car. The batteries to run the car can be deep cycle batteries that can better handle running the headlights or a cloudy climate.

Such a system has been used for long-distance travel.

To split the electrical system is simpler than it seems. The glow plugs are fed from a small, separate relay box on the front left of the engine. Unscrew the cable coming from the fuse box and put in a new cable directly from the battery in the engine compartment. Use AWG 4 cable for the high current. The relay box has its own fuse inside.

On the front right side of the engine is a little black plastic power distribution box (see picture). It is fed from the forward battery and has cables going to the fuse box and the starter. Locate the cable going from there to the fuse box and extend it to the second battery, which can conveniently be placed in the trunk. There is a handy port to bring the cable through the firewall, located right behind the battery. An AWG 6 size cable seems adequate for this long run, which never carries a high current. To bring the cable to the trunk, it can be routed through the speaker in the right rear side of the car, where there is access to the trunk beneath it.

The modified junction box in a 300SD. The red handle is for a ball valve that was installed to replace the electric hot water valve (see later).

The second battery is not used to start the engine and does not need to provide any high current. An "RV/marine" deep cycle battery works better than the typical automotive starter battery, as these are designed to provide a steady lower current.

Make sure to protect the second battery with a fuse; a shorted battery can be very dangerous. Fuse holders are available from auto parts stores.

Also make sure to have good solid connections everywhere. If a connection is not very good, it will not pass through the high current needed to start the engine, even though everything looks fine when checking the voltages with a meter. All cable lugs should be soldered, not crimped.

Cruise Control

The cruise-control emits EMF and should probably be disconnected. On these Mercedes cars, that is easily done by locating the actuator on the front of the engine, and disconnecting the cable to it.

On all models except the 300SD, the cruise control is operated by a moving magnet connected to the speedometer inside the dash board. Consider removing this magnet, though most have not done so.

On the 300SD, the cruise control is operated by an electronic control box, located in the driver-side foot well. Simply unplug the left of the two boxes. The right box is marked "warngerate" (warning device) and generates a warning signal if starting the engine without wearing the seat belt. It does not seem to do anything else and can be disconnected as well.

The Auxiliary Fan

An electric fan is mounted on the front of the radiator, to assist the fan powered directly by the engine. The fan is automatically turned on when the engine temperature goes above 90 degrees centigrade. This may happen if the car is climbing a long hill. On very hot days, it may happen on long inclines or when idling, if the radiator is old. Mercedes offers a kit that upgrades the engine-driven fan for hot climates. Make sure the radiator is the original part from Behr; some brands are not effective enough.

It is important to note that the fan consumes about 4 amps (48 watts), which taxes the battery and generates a lot of EMF and dirty electricity.

It is quite possible to drive with the auxiliary fan disconnected, it just requires monitoring the temperature gauge. With a good radiator, it should not be a problem.

Electronic Speedometer (300SD only)

The 300SD uses an electronic speedometer, while the other models have cable-driven speedometers. The 300SD speedometer works by pulses, that are generated by a magnet located in the very rear of the transmission housing. The pulses are transmitted in a cable that exits the rear of the transmission and (in a left-steered car) it goes into the car on the left side of the center console, right next to the driver's right leg. It continues up into the dash. The EMF from these pulses can be picked up with a gaussmeter and can be bothersome. The solution is to remove the magnet. A skilled mechanic can open the back of the transmission, take out the plastic part with the magnet, cut off the magnet and put the plastic piece back in again. A good mechanic can do that within an hour. To experiment, it is fine to drive around with the plastic plug dangling outside for a while.

The downside of this modification is that both the speedometer and the odometer no longer work. It is quite possible to drive without these, and stay within the speed limit by watching the other cars. This approach may not work for people who insist on driving right at the limit.

Disconnecting the odometer may be illegal, as it can affect the resale value of the car. In some states, older cars are exempt from registering the odometer setting when the car is sold. The odometer in the 300SD was not well designed, many of them break somewhere after 150,000 miles.

Hot Water Valve

On the 300SD there is an electrical valve that controls the flow of hot water coming from the engine into the passenger compartment to warm it up in cold weather. When the engine coolant gets hot, and is not needed to heat up the passenger compartment, the valve closes. It consumes 6 watts continuously while closed, which is a strain on the battery.

On the 300SD, the cord to the valve can be disconnected and a 3/8-inch manual ball valve put in front of it, using an extra hose (see picture on page 14). Of course, then one has to open the hood to control the heating system, but that is fine in my warm climate. The valve is hard to see. It is located right up against the firewall near the battery.

The owners of 300D cars have apparently not needed to make this modification.

One owner of a modified Mercedes put this sign on the back.
It is a spoof on the convoluted California car emission acronyms
and stands for Super Ultra Low EMF.

Check for fluttering relays

Worn relays can start fluttering, which generates high-frequency dirty electricity on the car wiring.

Turn the ignition key so power is on, but the engine doesn't start (or start the engine, then turn one click back on the key). A worn relay can sometimes be heard making a soft, irregular clicking noise. An AM radio is a handy tool to check for flutter. Set the station selector at the low end of the dial where no station can be heard, then move the radio close to the relays and listen for sharp noises in the speaker.

Using an AM radio to check the relays in the fuse box.

A gaussmeter can also be used, but it should be an analog model (such as the TriField meter). A digital gaussmeter may not pick up the brief bursts of radiation. The benefit of the gaussmeter is that it can be used with the engine running, as the noise is not a problem.

Degaussing

When a magnet spins in a circle, it generates EMF (the frequency is the same as the number of revolutions per second). Steel parts in a car often have magnetic spots from when they were manufactured. These spots are removed with a degausser.

As mentioned earlier, the steel belts inside the tires can be a problem. The front wheel can expose the driver to a stronger magnetic field than what comes from the rest of the car, especially once the alternator has been disconnected.

In rare cases it may be necessary to consider degaussing other moving steel parts near the driver, but it is a difficult task. It is difficult to identify the problem and difficult to do the work. We are only aware of two people who have attempted it. It should be attempted only as a last resort, especially since a botched attempt will make the problem worse. Don't try to degauss the torque converter or gear box, they are too complex to do right without complete disassembly.

Aluminum, stainless steel, copper and plastic cannot become magnetized. In practice, it is only regular steel that can. It may make sense to replace a steel part with one of a non-magnetic material, though it can be quite expensive.

Other articles on this website cover degaussing in detail. They are available through the link at the end of this article.

Repairs

Old cars need repairs on a regular basis, unless you have a collector's car. The engine should last at least 300,000 miles (500,000 km), while the transmission should last about 200,000 miles. Rebuilds can extend their lives. If you drive on bad roads, the suspension may need work every five or ten years.

It is not necessary to use a certified Mercedes mechanic. These cars are not complicated. This author has mostly used backyard mechanics, but it is best to use someone familiar with these cars, or someone who'll learn it over time. Repair manuals are available on CDs.

When I bought my car, the radiator was not working well and had to be replaced. The mechanic put in a cheaper brand than the original Behr brand, but the cheaper radiator caused the car to overheat on steep roads since the auxiliary fan was disconnected. The problem was eventually fixed with a genuine Behr radiator.

There have also been problems with a non-original starter and a non-original vacuum pump. Other times, non-originals have worked very well. Refurbished parts can be wonderful, or they may not last.

I've had the transmission repaired by a local transmission shop, and then fail 14 months later because they didn't replace a valve inside. It cost $1400 to get a Mercedes certified shop to replace the valve. If the transmission needs major repair, it may be better to buy a transmission that is completely refurbished by a shop specializing in this work, rather than letting a local shop do it. In this case that would have been cheaper than the two repairs.

Parts are widely available in the United States. Auto parts stores, online sellers and junk yards are much cheaper alternatives than Mercedes. Consider buying a wreck to use as a parts car.

A handy repair tip

These diesel engines have five short hoses mounted on top. They are easy to see, as they arch between the fuel injectors. They return excess diesel fuel to the tank.

These hoses tend to leak around the ends, as the material ages and cracks. The result is that drops of fuel drip on the hot engine. This can be smelled inside the car.

Look closely around each fuel injector. Look for any wetness to identify which hose is cracked.

The hoses can be pulled off easily, but make sure to wear disposable gloves. If the hose is long enough, simply cut off half an inch (1 cm) with a pair of scissors. Then reinsert the hose end. Otherwise, buy a roll of the special "fuel return line." It costs little and is good to have on hand. When installing a new piece, make it extra-long so it can be trimmed when it cracks some years later. This repair can be done in five minutes and saves the wait and cost of a mechanic.

More information

Other articles about low EMF vehicles can be found on www.eiwellspring.org/vehicle.html.

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