



FEATURES OF THE USE AND MAINTENANCE OF ELECTRIC VEHICLES IN EXTREME WEATHER CONDITIONS

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ABSTRACT: - This article covers everything you need for general electric vehicle maintenance. However, there are many electric vehicles in the Uzbekistan market, and each of them requires special maintenance. For maintenance of a specific vehicle, refer to the owner's manual for the electric vehicle.

KEYWORDS: Electric car, vehicle, maintenance, electric motor, battery.

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INTRODUCTION

An electric car is a vehicle with low operating costs compared to a car with an internal combustion engine.

The popularity of electric vehicles, the range of which is constantly increasing in the specialized market, is explained by the optimal combination of car environmental friendliness, comfort, excellent technical and operational characteristics, and low maintenance costs. The maintenance of electric vehicles does require significantly less maintenance than the maintenance of vehicles with gasoline and diesel engines.

A prerequisite for the durability of cars with an electric motor is timely maintenance. Many electric vehicle owners ignore maintenance because there is no need to change the engine oil. The rules for charging the battery are also not observed, as a result of which the loss of battery capacity after two years of operation is about 12%. In order for the electric car to serve for a long time and without accidents, maintenance must be carried out in a timely manner. The maintenance of electric cars is not much different from the maintenance of ordinary cars, with the exception of the power plant, auxiliary systems and transmission systems, and the battery [1].

MATERIALS AND METHODS

Let's consider carrying out maintenance on the units of an electric vehicle.

Engine maintenance:

Nowadays, electric motors are so reliable that other components of an electric vehicle fail before the engine.

The motor and electric drive are lubricated with oil. However, almost all electric vehicles do not require this lubricating oil to be changed for their lifetime. For example, in the motor of any Tesla cars - Model 3, Model S, Model X - replacement of engine lubricating oil is not required.

This is because the electric motor is not subject to high heat, like an internal combustion engine. So, lubricating oil is not destroyed. Therefore, nothing needs to be done to maintain the main engine and electric transmission of an electric vehicle.

Battery Maintenance:

Each electric car comes with 2 batteries. One high voltage main battery. Two, 12V auxiliary battery. This high-voltage main battery powers the electric vehicle. On the other hand, the 12V battery is used for unlocking and opening the door, shifting gears, etc.

High voltage battery maintenance:

Each electric vehicle is equipped with a lithium-ion high-voltage battery.



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Fig.1. Tesla Model S 24V Battery

(photo by https://www.youtube.com/watch?app=desktop&v=MBZ_2_Zgajc)

When driving, this battery performs best at temperatures around 21°C. For this reason, almost every electric vehicle manufacturer has an active battery temperature management system in their car - a battery cooler and heater.

The battery cooling system can be liquid or air. Although most modern electric vehicles do not require this coolant to be replaced, top up this coolant during scheduled maintenance as needed.

Will never charge an electric car to 100% and will not discharge to 0%. To prolong battery life, set the recharge rate to 80%-90%. Discharging the battery to 0% can damage the battery of an electric vehicle and may damage the on-board electronics.

It is recommended that you charge electric vehicle at level 3 charging stations all the time (high voltage battery charging). Because after a large number of battery fast charging sessions, the peak charging rate of the battery will noticeably decrease.

A 12V battery helps turn on the electric lights and radio when the engine is off.

In an electric vehicle, this 12V battery helps with many critical electrical jobs, including locking and unlocking doors. The main high-voltage battery constantly supports this 12 V battery by recharging. The 12V lead-acid battery is designed for a maximum service life of 3 years, depending on the climate temperature. Therefore, it would be better if you change this battery every 2-3 years.

According to research tests, it seemed that at a temperature of -20 ° C, the charge of a

lithium-ion battery drops to 77%. It turns out that 33% is spent only on coping with adverse weather conditions.

Heat generally has a positive effect on the state of charge of lithium-ion batteries, but too high a temperature negatively affects their efficiency. Prolonged exposure to extreme heat can theoretically shorten battery life (albeit slightly).

But weather conditions are not the main factor affecting battery consumption. For the most part, the charge goes to maintaining comfort in the cabin. When tested at -20°C, the battery capacity was reduced to 54% with the heating turned on at full power.

According to an NHTSA (National Highway Traffic Safety Administration) study, an electric car with a heat pump travels 30% more than the same electric car with a resistive heater (of course, at extremely low temperatures). But the main advantage of a resistive heater is its efficiency.

Maintenance of brake pads and rotor:

Every electric vehicle is equipped with regenerative braking. When you leave the accelerator pedal, the electric motor becomes a generator and uses the kinetic energy of your car to move forward to generate electricity, recharge the lithium-ion battery and slow the car down. As a result, an electric car uses a brake rotor and brake pad much less frequently than an ICE car. So, these brake pads and rotors last a long time.

However, these parts must be checked for wear and replaced if necessary. However, according to the owners of electric vehicles,

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their brake pads and rotor last 2 times longer than conventional cars. In addition, clean and lubricate the brake calipers annually.

Tire service:

Electric vehicles are usually heavier than ICE vehicles. Electric vehicles also have high rolling torque. This is why EVs require more thorough tire maintenance than their ICE counterparts.

Maintaining tire pressure at the correct level is very important to ensure a good range in an electric vehicle.

Brake fluid:

Brake fluid absorbs water over time, which reduces the effectiveness of the brake fluid. It is not recommended to open the brake fluid reservoir cap. Only periodically it is necessary to check outside to make sure that the brake fluid level is between the MAX and MIN lines on the reservoir. If necessary, add brake fluid in accordance with the instructions in the owner's manual for the electric vehicle. For example, Tesla suggests every 2 years to check the health of the brake fluid and replace if necessary. Nissan Leaf, however, suggests changing the brake fluid every 5 years.



Fig.1. Testing Brake Fluid

(photo by <https://ru.aliexpress.com>)

Cabin Air Filter:

The cabin air filter reduces road dust, pollen, industrial sludge and other irritants from outside air that is drawn into the vehicle. The instruction manual for Tesla, Chevrolet Bolt suggests replacing this cabin air filter every 2 years.

CONCLUSION

Tips for Saving Charge in Extreme Weather Conditions

1. Air conditioning to a minimum. In hot weather, do not overdo it with the climate

control settings. Firstly, this is the right way to overcool and get sick, and secondly, the battery charge will be significantly spent in this way.

2. Use only what you need. All enabled devices in an electric car consume its charge. Portable batteries, multimedia, even music should be turned off.
3. Preparedness. If the electric car is connected to charging, it is best to turn the heating / cooling on full while the batteries are receiving a charge from the network.
4. Economy mode. Almost every modern electric car is equipped with a magic "Eco" button. This mode was developed by the

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manufacturer in order to reduce consumption due to performance.

5. Use recovery mode.

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