

## Preheating System — Warm up Your EV Effectively in Winter

### 1. What is preheating?

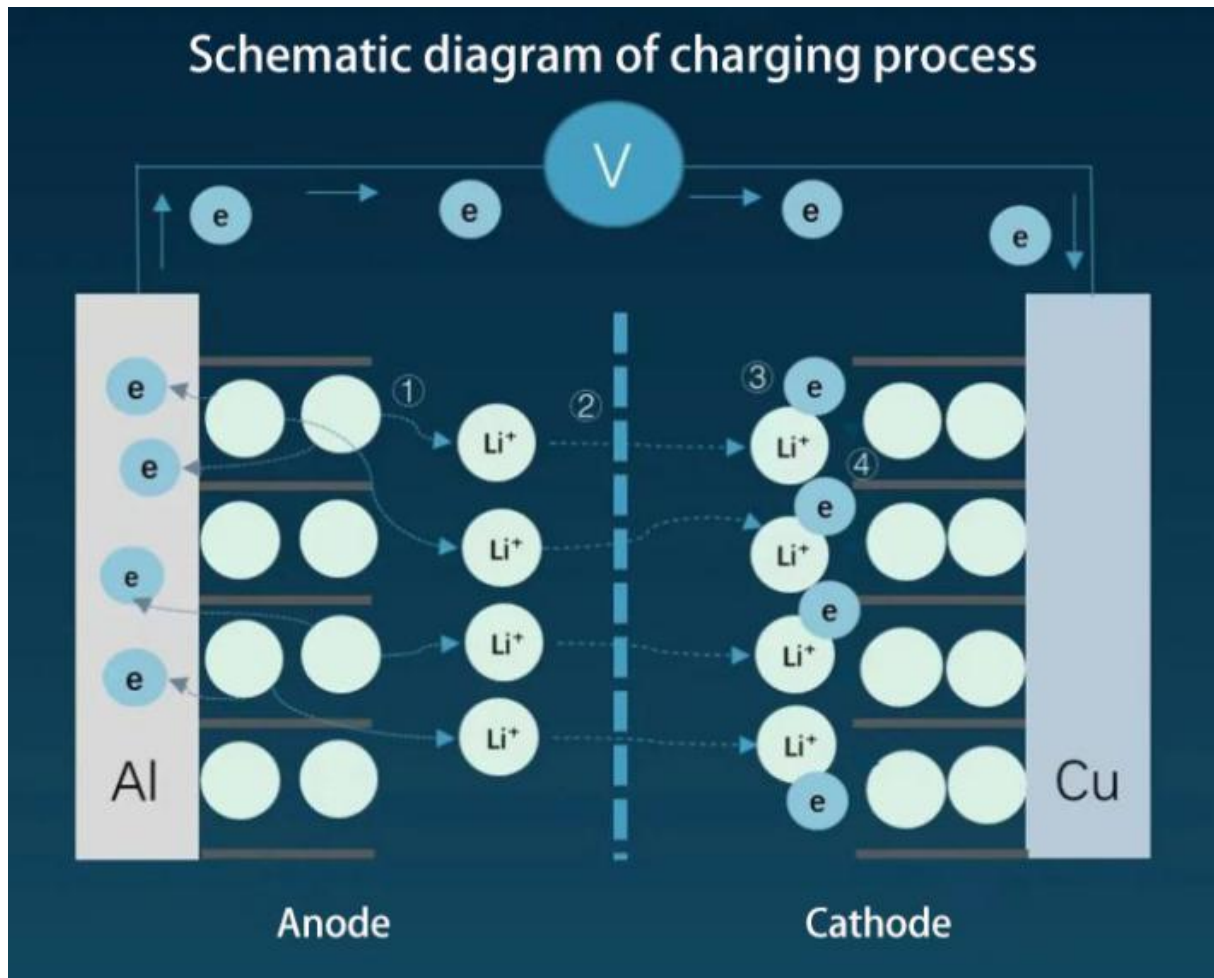
The preheating of the electric vehicle refers to the use of the external power supply provided by the charger or the power supply inside the car battery to heat the power battery with various heating methods before starting the car, so that it reaches the optimal discharge working temperature, and then start the car. It is a warm-up before starting an electric car.



### 2. Why do you need to warm up your car?

The battery life of EVs is shortened in winter, when the temperature is too low, it can't even be started. Therefore, the battery needs to be preheated to power the car

in winter. The heating technology of the battery varies according to the vehicle. Why preheating? It is mainly determined by the structure of the battery. The battery is composed of the positive electrode, the separator, the negative electrode, the organic electrolyte of the battery, and the battery shell. As one of the key elements, the organic electrolyte plays an important role in the battery.



The electrolyte conducts ions between the positive and negative electrodes of the lithium battery, which is the guarantee for the lithium-ion battery to obtain the advantages of high voltage and high energy density, so the low viscosity of the electrolyte makes for the movement of lithium ions. If the viscosity is high, it will form a certain internal resistance, thereby preventing the movement of lithium ions. When the temperature is low, the battery is preheated, so that the viscosity of the electrolyte inside the battery rises with the change of temperature, so that the charging and discharging performance of the battery is improved.

Therefore, in order to meet the power demand of the vehicle, it is necessary to preheat the battery. However, when the temperature is below minus 25 degrees, the lithium electrons will be frozen, resulting in failure to start the car. In this case, the vehicle will charge the battery beforehand, so as to extend the charging time, and also guarantee the cruising range.

### 3. ATESS Solutions

Winter is a serious challenge for EVs- charging anxiety, heating supply, and battery preheating, etc. To deal with these problems, various measures have emerged in the market, and the technologies have become quite mature. The commonly used solutions are mainly the following: PTC preheating system, electrothermal film preheating system, cold preheating system, phase change material preheating system, heat pipe preheating system, thermal system and AC preheating system. No matter what kind of preheating system, it is all about electrothermal conversion. Electricity comes either from the battery or from other sources. If battery power is used all the time, it will reduce battery life.

Though the development of EV charging is rapid, the charging cost of public charging stations is still relatively high. Most users choose to charge their car during the off-peak time at home. That is charging at night, and using the car in the morning. In many cases, when you are in a hurry to use the car in the morning, you have to spend more time warming up the car, and it will also waste the battery power. Of course, many car companies have the pre-heating appointment function, but it is undeniable that the power required for pre-heating still comes from the battery.

If the electricity required for car battery preheating, car heating, etc. comes from the outside, the problem will be solved, it will not affect the battery life, but also meet the starting conditions of the car and improve the interior environment. In response to this problem, ATESS has integrated the following solutions with all of our AC chargers. The user charges at night and uses the car in the morning. After fully charged, the EV charger remains connected to the car to reach the set preheating time, and the electric energy required for preheating comes from the charger. The preheating power for the in-car environment is also provided by the charger, which will greatly improve the user experience.





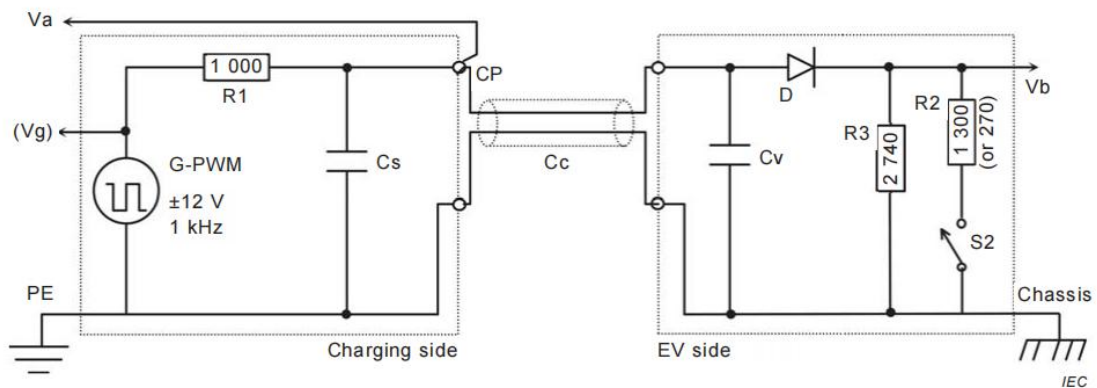
#### 4. Theory

CP is the control connection line between the charger and the onboard charger. When the CP voltage is 12V, it means that the charger is in an idle state; when it is 9V, it means that the charger is in a ready state, and when the CP voltage is 6V, the charger is in the charging state.

After the electric car is fully charged, the S2 on the car end will be disconnected, the charger state will remain in the SenspendEV state, and the PWM state will be sent all the time. At this time, the charger CP voltage is 9V, and the charger will control the relay to disconnect every few minutes, and stop PWM output for a period of time. The whole process simulates plugging and unplugging the charging gun, so that the EV is ready for charging and avoids the car entering sleeping mode. Until the S2 of the car end is closed, the CP voltage is 6V, and the charger enters the charging state.







These are the solution we provide for EV battery preheating. ATESS is committed to providing customers with simple and efficient integrated charging solutions, and we never stop improving customer experience, to create a new lifestyle of green traveling.

