

Air conditioning system



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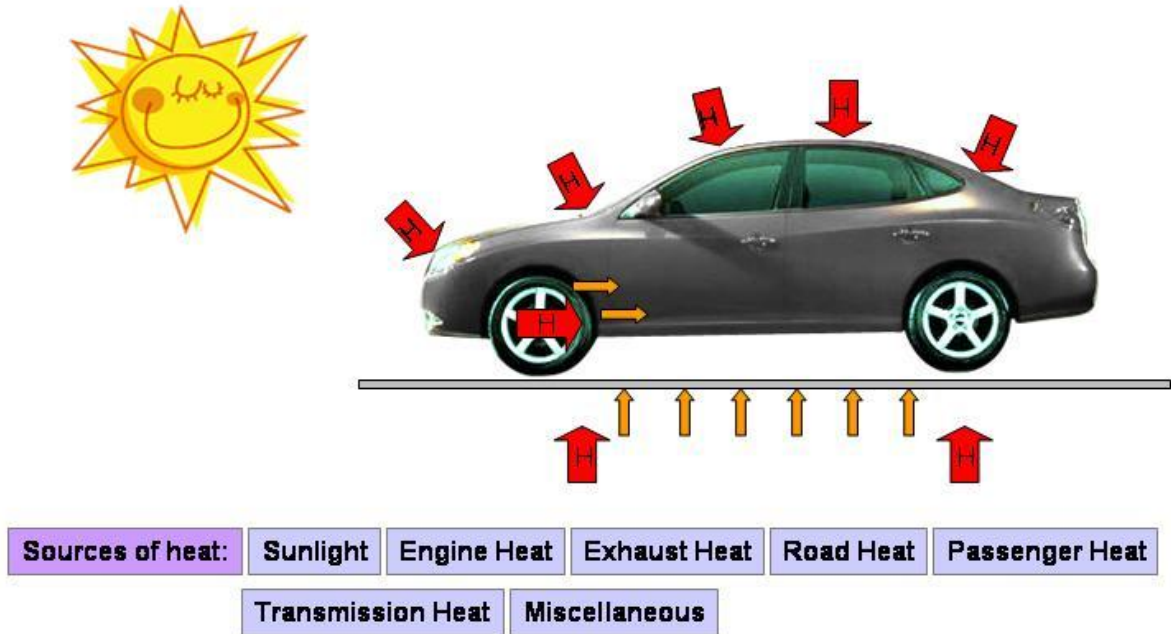
History



Between 1940 and 1942, Packard equipped 1,500 automobiles with air conditioning. By 1954, about 36,000 cars had factory-installed air conditioning systems. In 1966, the Motor Service Manual states that 3,560,000 A/C units had been serviced in the U.S. Sales of A/C equipped cars soon took off. The 1987 figure for A/C units was 19,571,000. It's estimated that now over 80% of the cars and light trucks in operation have air conditioning.

Early automobiles were not exactly comfortable. In winter, passengers huddled under blankets and in the summer, air conditioning was a breeze that resulted from a top speed of 15 mph. In 1908 when car manufacturers began closing up the cabs on cars, heat soon became an issue. Vents were put in the floors of cars, but this brought in more dirt and dust than it did cool. A bucket of water near a floor vent was the first air-conditioning system. The temperature-reducing effect of air passing over water was called an All-Weather Eye. Such systems are actually still available for vans and RVs. This system was invented by Nash in 1938 and provided summer cooling and winter heating with a single knob. The first car with an actual cooling system was the 1940 model year Packard. The "cooling coil", a large evaporator, was located behind the seat, and the only control was a blower switch. This option allowed Packard to advertise, "Forget the heat this summer in the only air conditioned car in the world." The system was advertised as a "Weather Conditioner" and also filtered pollen and dust from the air. The Weather Conditioner could also transform into a heating system by adjusting damper controls located in the trunk. Between 1940 and 1942, Packard equipped 1,500 automobiles with air conditioning. By 1954, about 36,000 cars had factory-installed air conditioning systems. In 1966, the Motor Service Manual states that 3,560,000 A/C units had been serviced in the U.S. Sales of A/C equipped cars soon took off. The 1987 figure for A/C units was 19,571,000. It's estimated that now over 80% of the cars and light trucks in operation have air conditioning. Changes are constantly being made to accommodate new car designs, environmental issues, passenger comfort and safety. Today, few people will consider a new car that does not have air conditioning. Today, heating and air conditioning systems are very efficient. Modern Automatic Temperature Control set-ups are more dependable than the older vacuum and thermostatic creations. Computers also insure that both the passenger and driver stay comfortable.

Heat sources

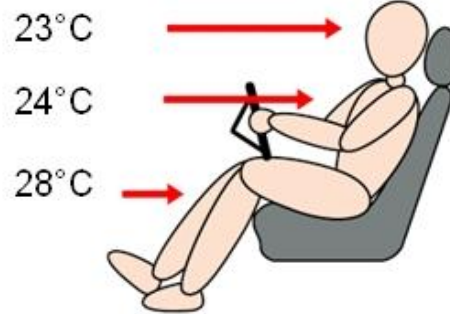


When a car is driven on the highway or even when only parked in the sun, heat enters the car from many sources. Direct sunlight radiates heat on the roof and body panels and through the glass area. Heat is radiated from the hot pavement and from the passengers. Engine heat is conducted from the firewall. Exhaust system heat is generated by the exhaust pipe, tail pipe, muffler and catalytic converter and this heat enters through the floor. All of these and other miscellaneous heat sources increase the air temperature within the car. It has been noted that on a warm day (approximately 30°C), the interior temperature of a car left standing in the sun with windows closed can reach more than 60°C!

Temperatures inside a vehicle



Sweating, overheated head area, burning eyes, high blood pressure



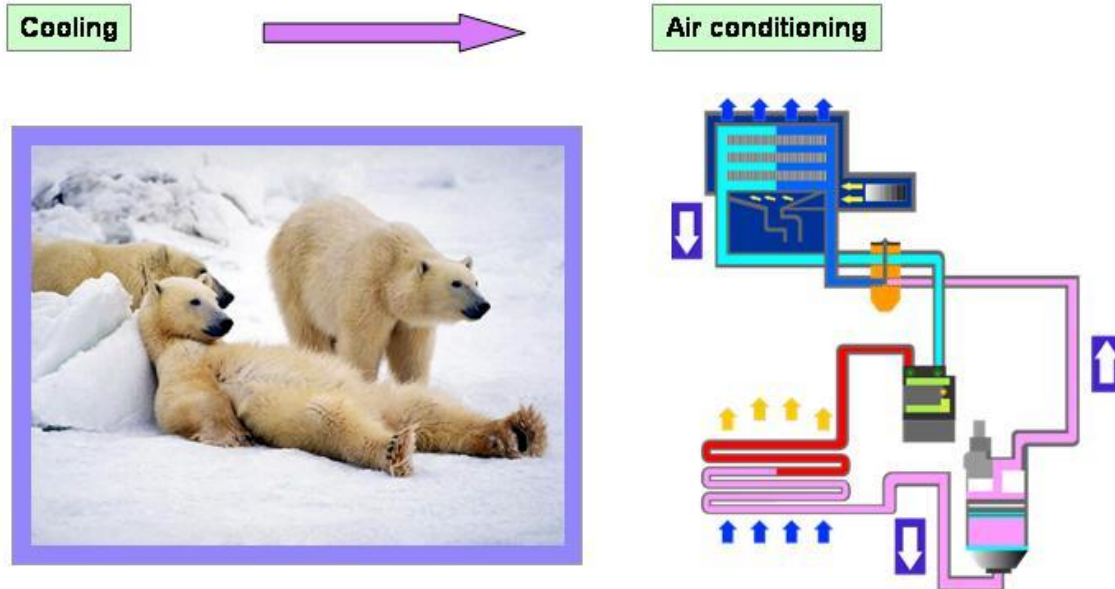
Pleasantly kept at a moderate temperature; blood pressure normally, no problems with the eyes

NOTE:

The heating function, particularly with regard to keeping the windows free of mist and ice, is regulated in many countries (e.g. within the European Community by Guideline EWG 78/317 and in the USA by safety standard MVSS 103)

An cooled down car interior does not only offer appropriate comfort, but is also basis for active driving safety .A super elevated interior temperature (in the summer frequently between 40 °C and up to 60 °C) worsens efficiency and perseverance, attention and response time of the driver. The result of this reaction delay is longer stopping distances and more accidents. Active safety is the most important benefit!

Solution: cooling

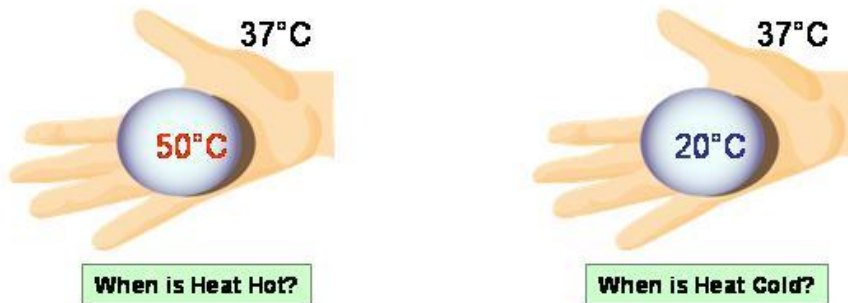


Apart from air-conditioning (cooling) the interior, straight in the summer, an air conditioning system helps to provide clear view in the winter or on wet-cold days as it removes moisture from the air and thereby prevents fogging. Also it cleans interior air of pollutants. The strong pollution of air - in particular in heavy city traffic - arises also, by the usual ventilation system, in the interior of the vehicle. This impairment of the passengers is prevented by an air conditioning system through filters (they are also available w/o air-conditioning) and the cleaning from dust due to moisture removal.

Heat definition



The Dictionary defines heat:
Form of energy arising from random motion of molecules, capable of transmission by conduction convection or radiation.

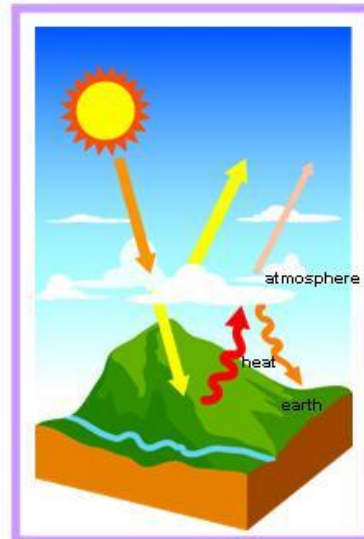


In order to understand the working principle of an air conditioning system it is important to understand the physical principles which make this system work. Heat in the correct amount will provide life and comfort. Heat in either extreme too much or too little, brings about uncomfortable situations. The control of heat means the control of comfort. Air conditioning is a way of controlling heat. To understand how an air conditioning system works; we must first understand the nature of heat. That seems a bit difficult to understand at first, but the principles of rising temperatures, evaporation, expansion and radiation will all become clear as we continue through this chapter. All substances contain heat. Sometimes they feel hot when they are substantially warmer than our own body temperature. Temperature is sensible heat. When something contains much less heat than your body, we say it feels cold. Cold is merely the removal of some heat. Heat will always travel from the warmer side to the colder. This process cannot be stopped. It can only be slowed down by insulation. Therefore: the air con system is not producing cold, but removing heat. In accordance with Natural Law, heat will always move from the hotter object to the colder one. Whenever there is a temperature difference between two objects, the heat energy will be transferred from the warmer object to the cooler one until both objects have stabilized at the same temperature. Examples: when you step outside on a cold day, you feel the cold. Not because the cold enters your body, but because heat is moving away from your body to the cold air, causing you to feel cold. The reverse is true when you are in a place which is warmer than your body temperature- you feel warmer because heat from the warmer air is moving into your body.

Heat transfer



Conduction



Radiation



Convection

Conduction: heat travels through a substance, from a point of heat to a cooler area by conduction. We have all experienced this by lifting a hot pan from the stove. The handle is hot even though it is not in direct contact with the burner. The heat is conducted through the metal of the pan to the cooler handle. (Remember, heat moves from a warmer object to a cooler one). Similarly, a metal bar heated at one end will become hot at the other by conduction.

Radiation: heat is radiated from any hot substance in the form of heat waves. These waves are a form of energy, and they will increase the temperature of any object with which they come in contact. The sun is the major source of heat for the earth. Its heat waves are transmitted through space and they heat up the earth as they come in contact with it. Direct sunlight is a good example of heat by radiation. Color has an important part to play in heat radiation. A dark colored vehicle will get hotter than a light colored vehicle. This is because lighter colors reflect more heat (light) waves, while darker colors absorb more heat (light) waves. To put radiation heat in the perspective of an air conditioning system, note that the condenser, which bears the high temperature refrigerant, will conduct and radiate heat to the cooler outside air.

Convection: heat is also conveyed (carried) from one point to another by the movement of a heated substance. This heat movement is called convection. When we turn on a hot water faucet, we get hot water, although the water heater is some distance away. This is because the moving water carries the heat from the water heater to the faucet.