

3 Dedicated to Producing Energy-Efficient and CFC-Free Products

Toyota Industries Proactively Takes the Initiative in Striving to Overcome Contemporary Challenges as the World's Leading Manufacturer of Car Air-Conditioning Compressors.

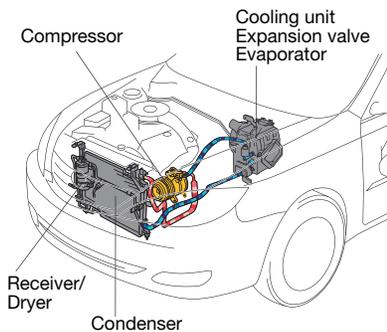
Making Compressors not only Compact, Lightweight and Power Efficient, but also Quiet, Durable and Safe

When refrigerant gas is compressed, liquefied, and vaporized again, it absorbs the heat from its surroundings, cooling the surrounding area – this is the principle of how air is cooled using air conditioners.

As car air-conditioning compressors we develop and produce are mounted in the engine compartment, they need to fit in limited spaces as well as be resistant to extreme heat, extreme cold and vibrations.

Accordingly, compressors are required to be compact, lightweight and power efficient in addition to being quiet and durable.

It is important to be small in size to secure the safety of the passengers in the vehicle. In case of a collision, the impact is absorbed by “denting” at the front end of the vehicle, making it important to increase denting space – even by a single centimeter – by minimizing the size of compressors that are installed in the front part of the vehicle.



Toyota Industries Develop “Power Efficient” Compressors that Contribute to Vehicle Fuel Efficiency

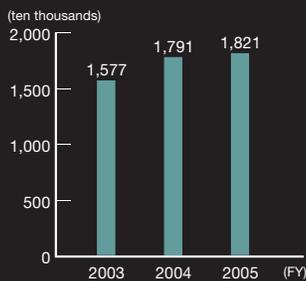
The environmental function of vehicles is now emphasized more than ever, placing even greater importance on the need to develop “power efficient” (lower fuel consumption and energy

Swash-Plate Type Compressor

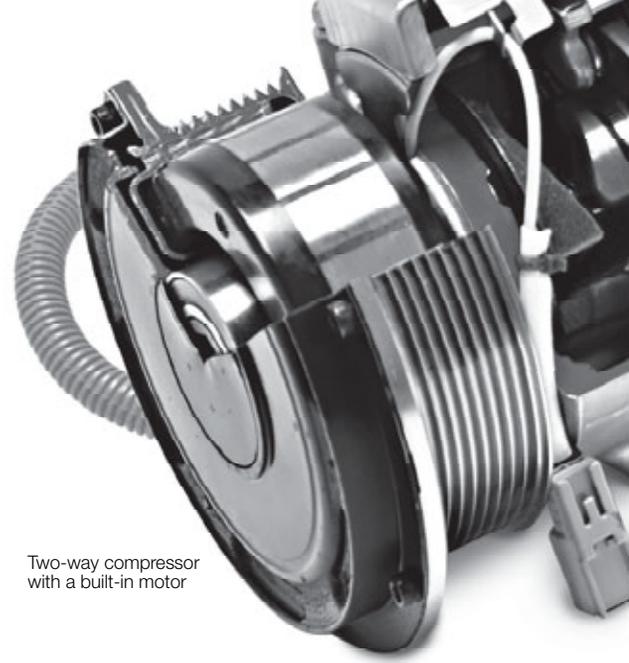


This is our newest swash-plate type model. In 1964, we commercialized our first car air-conditioning compressor. We adopted the swash-plate system where the power of the engine is transmitted to a spinning disc (swash-plate) and moves the piston to compress refrigerant.

Production Units of Compressors



Display of compressors at a trade show



Two-way compressor with a built-in motor

saving) and “CFC-free” technologies.

Toyota Industries is the world’s leading car air-conditioning compressor manufacturer with the highest market share.

This places a significant responsibility on Toyota Industries, as it means that the development of new technologies that we employ in our products will have a significant impact on vehicles throughout the world, placing us in the unique position of being able to make a significant contribution to the environment.

Given this situation, the company has developed an externally controlled, variable displacement compressor that was launched in May 1997. This is a compressor whereby an electrical signal is sent to the control valve to control the discharge volume of refrigerant, thereby achieving significant power savings.

In March 2004 Toyota Industries also developed and sold the world’s first compressor using a rotary valve, which raises the suction efficiency of fixed-displacement type compressors, enabling them to be made more



compact and lightweight.

Furthermore, Toyota Industries also succeeded in achieving the world's first mass production of "an electrically driven compressor" powered by battery for hybrid and electric vehicles – demand for which are expected to increase in the future. This compressor was used on the Prius (released in 2003) and realized significant reductions in size and weight, as well as in noise and vibration, improving comfort and energy efficiency. At the same time, Toyota Industries developed the world's first two-way compressor with a built-in motor. This is an epoch-making compressor, which is driven alternately by the engine during driving and by a built-in motor during engine stop. The market for this product is expected to expand in the future.

CFC-Free Technology Development, Advancement from Development of Non-Leaking Technologies

Regulated Freons, such as chlorofluorocarbon (CFC), which were used as refrigerant for air conditioners and refrigerators until the late 1980s, and controlled Freons, such as hydro chlorofluorocarbon (HCFC), which had been used up until the late 1990s are substances that deplete the ozone layer.

Toyota Industries is therefore promoting a shift to CFC substitutes, such as hydro fluorocarbon (HFC). HFC is the most commonly used refrigerant in air conditioners today. However, HFC is also a greenhouse gas that causes global warming.

Toyota Industries developed the world's first measuring equipment in May 2004 to detect leakage of HFC while the compressor is operating. Using this equipment, we are effectively developing technologies that prevent leakage of even an extremely small amount (a couple of grams per year) of HFC. We are also researching natural refrigerants with low environmental impact.

ES18 Electric Compressor for the Prius

Air conditioners can also be used during engine stop. Fuel efficiency is improved, as the air conditioner does not consume petrol.

Obu Plant, Compressor Business

The EU, which is considering banning the use of CFC substitutes in car air conditioners to be sold after 2011, has a policy of using CO₂ as a new refrigerant alternative. However, cost and safety issues still remain, as compressing CO₂ requires 7-10 times more pressure than that used for compressing fluorocarbons. In the meantime, the U.S. has declared that it would not use CO₂ refrigerant and Japan has not yet reached a conclusion on this matter.

Amidst this uncertain environment, Toyota Industries is taking the initiative for developing technologies that alleviate the environmental impact of vehicles used throughout the world while monitoring movements in terms of natural refrigerant alternatives, including the use of CO₂.



Demonstration at a trade show



Prius

Enhancing Driver Safety

Comfortable driving assists drivers to concentrate on driving. Car air-conditioning compressors are, therefore, required to reduce noise and vibration to enhance comfort levels. Reducing shocks when the car air-conditioner is turned on or off and improving drive feeling by increasing engine power efficiency are examples of some of our efforts in this area.

The reliability of our products is also enhanced by efforts to avoid locking of compressors as a result of burn out.

Toyota Industries continues to work hard to develop and manufacture reliable compressors that overcome these challenges.