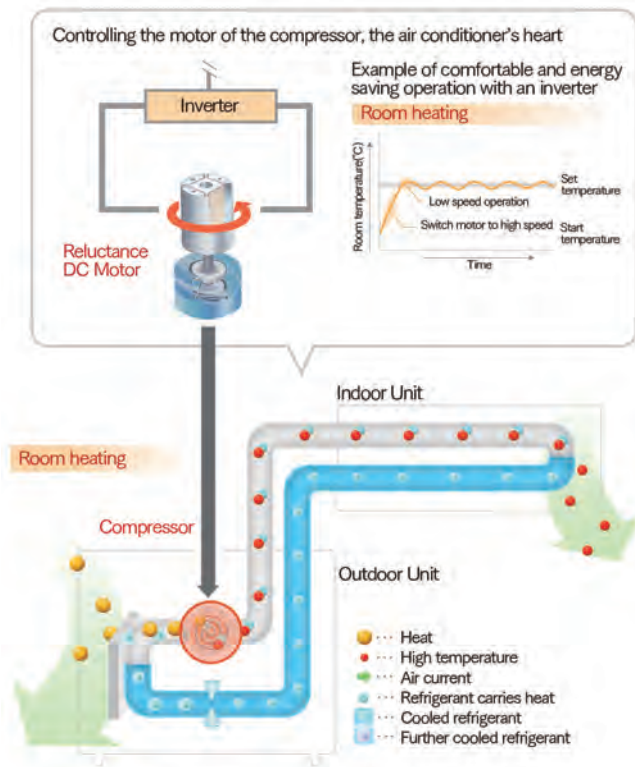


Overview of Air Conditioner Inverter



When operating the air conditioner as a heater, ① The outdoor unit draws in air and the refrigerant absorbs heat from the air ② The compressor motor begins rotating at a high speed to further heat the refrigerant and blow the heated air into a room ③ When the room temperature reaches a set temperature, the motor speed is reduced and the room temperature is maintained at a constant temperature. This system ensures energy saving operation. When cooling rooms, the refrigerant is heated to a temperature higher than that of the outdoor unit and the heat released from the room.

The inverter development also proved tricky. An inverter controls the motor at a rate of about 10,000 operations at second. A high degree of precision is required, as the inverter itself can break down if a pulse errs just once every one-millionth of a second. The adoption of microcontrollers meant even higher cost. While relying heavily on the cooperation of the microcontroller manufacturer, the development team conducted repeated tests over an 18-month period to ensure it met Ohyama's strict requirements. The result was the successful development of an inverter capable of controlling turning force of both the magnetic torque and the reluctance torque with a high degree of efficiency.

As development of prototypes for the mass production started, Daikin was able to unleash its monozukuri (manufacturing) might. The motor contained layers of electromagnetic steel plate with a width of only several tenths of a millimeter, in which the magnets were embedded. The margin of error was less than 10 microns. The team accumulated know-how by repeating such accurate manufacturing processes, and eventually whittled

down a three-month manufacturing process to one week.

The development team itself also had a unique structure. While normally a motor expert would have been put in charge, Daikin's team was geared towards commercialization by having the compressor division general manager as team leader, and Ohyama and the room air conditioner product manager as sub-leaders. The motor engineer and inverter engineer filled out the team. With this organizational structure, the team succeeded in completing the compressor with an inverter delivering optimal efficiency. At Daikin, people use the term machine electric fusion to describe the company's work. "Daikin's real strength is its ability to develop products through this collaboration between the electrical shop and the machine shop," says Ohyama.

Developing lower cost, energy saving air conditioners for the Chinese market

Room air conditioners with reluctance DC technology hit the market in 1996 and caused a sensation in the industry, which began to view inverter technology as Daikin's strength. That

History of Daikin Air Conditioners

1984 ● First inverter type room air conditioner is launched



2nd generation inverter air conditioner 1985 (30HZ-120HZ)



3rd generation inverter air conditioner 1987 (30HZ-180HZ)

1990 ● Joint research with Osaka Prefecture University begins for development of new DC; new inverter development also begins

1991 ● First prototype of new motor is completed

1992 ● Inverter technology is unveiled at scientific conference, marking turning point for company and technology

1994 ● First Air Conditioning Business Reform Plan is announced with three-pronged strategy to revitalize the air conditioning business

1995 ● Reluctance DC technology is announced, combining new DC motor with DC inverter and other technologies

1996 ● Mass production of air conditioners with new technology is launched

1998 ● Second Air Conditioning Business Reform Plan implemented in response to downturn in domestic air conditioning business

1998 ● New technologies are expanded to commercial products; Super Inverter 60, commercial air conditioner that uses 60% less electricity, is launched (Awarded the Grand Prize for Excellence, Energy Conservation Center, Japan; Director General Prize by the Agency of Natural Resources and Energy in Japan)



Super Inverter 60 commercial air conditioner delivers huge electric power savings

1999 ● E Series, compact, split inverter air conditioner and Ururu Sarara, world's first air conditioner with built-in humidification, is launched (Awarded the Grand Prize for Excellence, Energy Conservation Center, Japan; Director General Prize by the Agency of Natural Resources and Energy in Japan)

2000 ● Super Inverter 70 and Super ZEAS commercial air conditioners are launched