In Pursuit of the Ultimate Lightweight Compressor—
for Comfort and the Environment

Environmental Responsibilities

• To help curb global warming by reducing the amount of fuel consumed during operation (low power consumption)
• To help curb global warming by preventing leaking of CFC substitutes
• To help curb global warming by conducting research into natural and next generation refrigerants that will replace CFC substitutes and by complying with refrigerant regulations in each country or region

Social Responsibilities

• To maintain and improve the reliability and durability of our products
• To improve driver comfort and fuel efficiency by making compressors more compact and lightweight and reducing noise and vibration

In fiscal year 2007, we developed the ES34 inverter-integrated electric compressor for large hybrid vehicles. This model is used for the Lexus LS Hybrid in 2007.

The ES34 meets the high levels of quietness required for the Lexus flagship series and also ensures the same installation capability as belt driven compressors. The weight to cooling capacity has been reduced by 14% compared to the previous model (ES27), thanks to a uniquely designed motor and a compact inverter.

Drivers assume that their car air-conditioning system will not break down, and if the air-conditioning system is not working well, it can reflect badly on the reputation of the car itself. As a specialist in compressors for car air-conditioning systems, it has been Toyota Industries’ unswerving goal to ensure that its compressors continue to perform at a high level for as long as possible. Towards this end, we have pursued more power efficient, smaller, and lighter compressors with reduced noise and vibration. The compressor is an indispensable component for maintaining cabin comfort. However, because it uses the engine’s power and is located in the front of the vehicle, the more power-efficient, compact, and lightweight it is, and the less noise and vibration it produces, the better.

In terms of environmental impact, the vast majority of CO₂ emissions caused by car air-conditioning compressors over their life cycles are due to fuel consumption while the air-conditioning is operating. Compressors therefore need to be made more power-efficient in order to reduce their fuel consumption.

Although CO₂ emissions during the manufacture of compressors are lower than during their use, the majority of emissions that occur during the manufacturing stage are due to the manufacture of materials, especially aluminum die casts. Consequently, by making the compressors smaller and lighter, we can help to reduce CO₂ emissions from the manufacturing process. Looked at in these terms, making our products more compact and lightweight is our greatest responsibility as a compressor manufacturer both in social and environmental terms.

To achieve this, we use computer-aided engineering (CAE) to optimize basic specifications and the dimensions of each part. Specifically, we have reduced excess thickness by optimizing die cast shapes using flow analysis and shape optimization software. Other efforts to reduce the size and weight of our compressors include the development of die casting methods to cut oversize for machining and increasing the number of “process-less” parts.

Another important challenge is to prevent the leakage of CFC substitutes (greenhouse substances), which are currently used as refrigerants. We are also pursuing a range of research and development activities, including research into natural and next generation refrigerants to replace CFC substitutes.