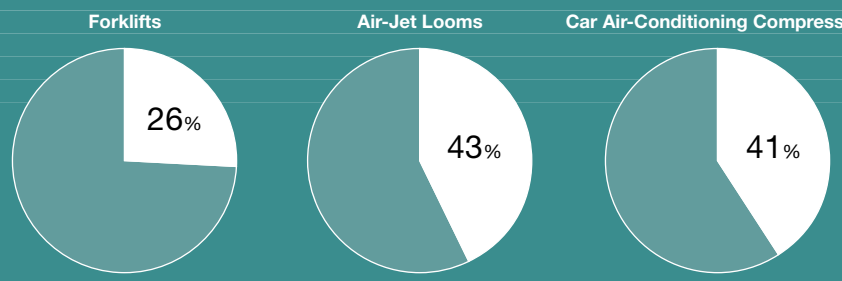
# Products and Responsibilities of the Toyota Industries Group

## Fulfilling Responsibilities with High Quality Products

The Toyota Industries Group is characterized by the variety of business operations it carries out in diverse markets and the large number of products that hold high shares in their respective markets.

This chapter introduces the group's eight major business divisions and presents the "high quality products" that these divisions offer, as well as explaining what types of responsibilities each division is striving to fulfill.

**Top-Selling Products throughout the World (Share of Global Market)**



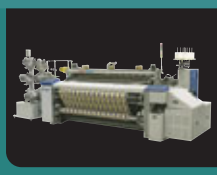

(internal estimate)

Toyota Industries' materials handling equipment business provides materials handling solutions optimally designed for each customer. We develop, manufacture, and sell industrial vehicles such as forklifts, tow tractors, and shovel loaders. We are also dedicated to providing customers with optimal materials handling systems for conveying, storing, sorting utilizing automated storage and retrieval systems and automatic guided vehicle system. We provide a broad range of forklifts, ranging in capacity from 0.5-ton to over 40-ton heavy-duty models. Toyota Industries maintains the top share of the forklift market throughout the world, including both internal combustion trucks (gasoline, diesel, LPG, and CNG) and electric trucks, estimated to be approximately 26% (internal estimate) and 42.6% in Japan in 2004.
In 2000, we acquired BT Industries AB of Sweden, the world's leading supplier of warehouse trucks. In 2001, we established TOYOTA Material Handling Company, an internal company that ensures consistent operations—from manufacturing to marketing—since taking over the industrial equipment sales and marketing operation of Toyota Motor Corporation. In order to maximize our group strengths, we established the Toyota Material Handling Group, which combines the operations of BT Industries and TOYOTA Material Handling Company.

1956: Forklift production starts.
1988: Toyota Industrial Equipment Mfg., Inc. (TIEM) established to produce industrial vehicles in the United States.
1995: Toyota Industrial Equipment, S.A. (TIESA) established to produce industrial vehicles in France.
2000: BT Industries AB of Sweden, a world-leading manufacturer of warehouse trucks becomes a Toyota Industries subsidiary.
2001: Toyota Industries takes over the Industrial Equipment Sales Division of Toyota Motor Corporation.
2003: Aichi Corporation, a manufacturer of aerial work platforms becomes a Toyota Industries subsidiary.

Since the founding of the Toyota Group, the textile machinery business has been engaged in a continuous unbroken line of operations, offering spinning machinery, which spins bundles of fibers into yarn, and weaving machinery, which weaves yarns into fabric, to customers throughout the world. Textile machinery has evolved as time advances, into the fruit of advanced technologies such as control, communications and mechatronics technology. Our mainstay air-jet loom boasts the number one share in the world and we regularly receive high praise as a world leading company in the spinning machinery industry.

1885: Sakichi Toyoda pursues inventions of weaving machinery.
1924: Toyoda Automatic Loom Type G, with Non-Stop Shuttle-change motion invented by Sakichi Toyoda.
1929: Spinning frame production starts.
1980: JA air-jet loom production starts.
1995: Kirloskar Toyoda Textile Machinery Pvt. Ltd. (KTTM) established in India as a joint venture with the Kirloskar Group.
2003: JAT710 air-jet loom production starts.



Toyota Industries has always offered world-leading products as a car air-conditioning compressor manufacturer. Variable-displacement type compressors that automatically control cooling capabilities and fixed-displacement type compressors that realize excellent reliability in harsh environments, are lightweight and feature upgraded functions, are giving us a dominant share in the global market.
Recently, Toyota Industries developed an electrically driven compressor and a two-way compressor with a built-in motor for hybrid vehicles. Toyota Industries is also currently working to develop a future-oriented compressor such as a CFC-free $CO_2$ refrigerant compressor.

1960: Car air-conditioning compressor production starts.
1989: Michigan Automotive Compressor, Inc. (MACI) established in the U.S. as a joint venture with DENSO Corporation to produce car air-conditioning compressors.
1998: TD Deutsche Klimakompressor GmbH (TDDK) established in Germany as a joint venture with DENSO Corporation to produce car air-conditioning compressors.
2002: Higashiura Plant starts operations, producing parts for car air-conditioning compressors.
2004: TD Automotive Compressor Georgia, LLC (TACG) established in the U.S. as a joint venture with DENSO Corporation to produce car air-conditioning compressors.

Toyota Industries' vehicle business manufactures automobiles under consignment from Toyota Motor Corporation. With built upon and proven experience in manufacturing mainly compact automobiles, Toyota Industries' vehicle business is currently manufacturing two models: the Vitz (Yaris in Europe), which was re-launched in Japan in February 2005 after undergoing a full-model change, and the RAV4 for Europe and the United States.
Toyota Industries' vehicle business is renowned throughout the Toyota Group for its top-class quality and short production preparation lead-time. The Toyota Production System (TPS) ensures that waste is thoroughly removed from operations on the production site and that plant space is efficiently and optimally utilized.

1967: Nagakusa Plant starts operations.
1978: Starlet (automobile) production starts.
1999: Vitz (Yaris in Europe) production starts.
2001: RAV4 production starts.

Toyota Industries' engine business manufactures diesel and gasoline engines ranging in capacity from 1,500 cc to 5,200 cc.
Our automobile engines are manufactured under consignment from Toyota Motor Corporation (TMC) and installed on designated Toyota vehicles. Our diesel engines developed in collaboration with TMC in particular are light weight and offer high power in addition to lower noise and vibration.
Moreover, Toyota Industries leads the world in market share of high-output, environmentally friendly industrial engines for lift trucks and other materials handling equipment in addition to engines like gas engine-driven heat pumps. We proactively promote technological development to reduce environmental impact, such as through cleaner exhaust emissions.

1953: Kyowa Plant starts operations producing engines for automobiles.
1982: Hekinan Plant starts operations producing automobile diesel engines.
2000: Higashichita Plant starts operations producing foundry parts.
2002: Toyota Motor Industries Poland Sp.zo.o. (TMIP) established as a joint venture with Toyota Motor Corporation to produce diesel engines.
2005: AD diesel engine and KD diesel engine production starts.

Toyota Industries' electronics business produces power electronics components for automobiles, liquid crystal displays and semiconductor package substrates.
For components for automobiles, we strengthen development and production of electronics components and equipment such as compact, highly efficient and lower cost converters, and DC-AC inverters for vehicles with which home appliance products can be used.

1997: ST Liquid Crystal Display Corp. (STLDC) established as a joint venture with Sony Corporation to manufacture liquid crystal display panels.
1998: TIBC Corporation (TIBC) established as a joint venture with Ibiden Co., Ltd. to produce semiconductor package substrates.
2005: Electronics Division and New Electronics Sub-Division set up.

In 2002, Toyota Industries launched its 3PL* (logistics solutions) business, which includes the establishment of logistics systems, and the provision of our customers' logistics center management and operation services. We are currently working on rationalization of logistics for various industries by making use of the experiences that we have acquired in our development, manufacturing and sales of materials handling equipment. We are also drawing upon the continuous improvement (kaizen) know-how acquired from our experience at production sites as a member of the Toyota Group.
We aim to reform logistics operations in Japan by proposing a comprehensive solution for planning, building and operating logistic centers, and optimizing processes throughout the supply chain.

2002: Advanced Logistics Solutions Co., Ltd. (ALSO) established as a wholly owned subsidiary to plan logistics and operate distribution centers.
2005: Advanced Logistics Division set up (formerly Advanced Logistics Project).

* Third party logistics is a new logistics business which provides completely new services, such as comprehensive solutions for the establishment, operation and management of distribution systems. These services have been drawing attention in the U.S. since the 1990s.

Materials Handling Equipment Business

# 1 Putting the Customer First with High Quality Products and Enhanced Sales and Service

*Fulfilling Our Responsibilities as a Leading Manufacturer of Forklift Trucks*

## Toyota Industries Is Proactively Creating Optimized Material Handling Solutions through Actual Observation and Analysis of Customer Operations.

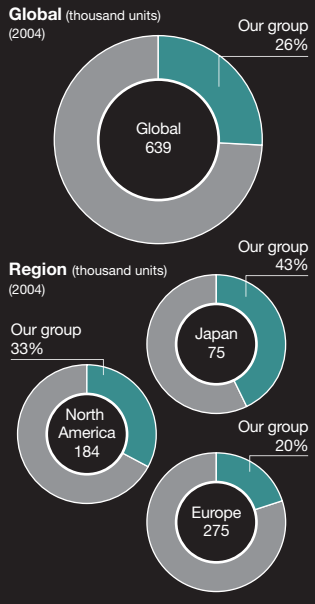
A forklift is an essential tool in a business's materials handling operations, which typically comprise loading/unloading and transportation of materials. Approximately 640 thousand new forklifts are sold around the world and 80 thousand units are delivered in Japan annually. They play an important role in the manufacturing and logistics operations of a variety of industries. Toyota Industries Group maintains the top share for forklift sales in the world. Toyota Industries' materials handling equipment business supplies optimized materials handling solutions to each customer through the provision of industrial vehicles, including forklifts, and materials handling equipment and systems, such as automated storage and retrieval systems.

We recognize our responsibility as a global leader in forklift development and manufacture. In order to fulfill this responsibility, we continually enhance our activities in the area of research and development of new products that anticipate customer needs, and ensure the continuous improvement of quality, sales and service to achieve customer satisfaction. We shall continue to take the initiative and contribute to society by ensuring we meet this responsibility. In research and development, we are developing new technologies and functions that put more emphasis on safety, environmental performance and ergonomics, as well as improving basic performance.

As forklifts play an important role in customers' manufacturing or distributing processes, our customers expect constant forklift operation, making reliability and durability two key factors. We are now developing our new product series, which ensures reliability and durability with considerations for safety, environment and ergonomics.

To meet our customers' demands for improved efficiency and quality of materials handling service, we have also developed various logistic management systems.

### Forklift Market Share




### Safety Features

**1) The world's first SAS (System of Active Safety)**
Even after 7 years since it was first released, we are still the only company providing such technology. This system reduces the risk of tipovers by bracing the four wheels. It optimally controls the movement of the mast to prevent forward rolling when tilting the mast forward, and spilling of loads when tilting the mast backward.

Rear stablization with Swing Lock Cylinder

**2) OPS (Operator Presence Sensing) System**
This is a safety feature that prevents accidents caused when the operator is not in the forklift. This function has been developed in accordance with upcoming ISO regulations reform to be implemented from January 2007. It will be installed on all major models from August 2005, with installation on other models to commence shortly thereafter.

In terms of sales and after service, we have built a global network to serve our customers in their respective countries and areas. As part of the forklift sales side of our business, which is different from the auto industry where retailers invite customers to come their outlets, our sales staff and service mechanics visit our customers' factories, warehouses and other premises where our products are used to observe and analyze our customers' needs, propose optimized solutions that consider efficiency, safety and environmental performance, and carry out the appropriate maintenance and repairs accurately and carefully, thereby establishing a trusting relationship with our customers.

We propose products, specifications and support frameworks that best match our customers' operations by proposing improvements based on TPS (the Toyota Production System), implementing instruction and training for operators, recommending periodical maintenance and inspection and maintenance depending on work situations, safety training seminars and 24 hour support exclusive for material handling equipment and systems.

Our proposals aim to ensure a safe, efficient and well-organized work place that leads to benefits for our customers, such as cost reductions, preventing potential loss through down-time or low efficiency and securing a safe working environment.

We will make continued efforts to strengthen our sales and service organization throughout the globe. In China in particular we are preparing for rapid market expansion by building service facilities at all our sales outlets.

Our materials handling equipment business has been working together with group companies such as BT Industries on reliable business activities based on the principle of "the customer comes first".

## Supporting Distributors throughout the World to Improve Overall Sales and Service Quality

Toyota Industries is committed to improving the quality of our distributors' sales and service activities. We provide materials for sales promotions and


solutions proposals to support our sales staff in preparing even better proposals for our customers. We have also introduced certification programs to facilitate accurate recognition and motivation of sales staff and service mechanics and provide well-organized training to improve their skills.

Our service activities include the introduction of the "Toyota Industrial Equipment Service Skill Qualification System" to Japan, which has been approved by Japan's Minister of Health, Labour and Welfare and sets a target level for each service mechanic to increase the level of their skills. One of our aims is to ensure mechanics that have achieved Level 1 (the top level of our qualification) are placed at every service point for Toyota forklifts.

The ASEC (After Sales Service Evaluation & Certification) program was introduced to classify the service quality level of Toyota forklift's overseas distributors with our service guidelines. The ability of service mechanics is classified according to the "Step Program", and all mechanics are encouraged to pass from Step 1 to Step 2. These programs will enable us to provide even better service to our customers throughout the world.

## Development of Environmentally Friendly Products to Reduce the Burden on the Work and Global Environments

Forklifts are closely linked to customers' cost and working environment, highlighting the need for environmental consciousness.

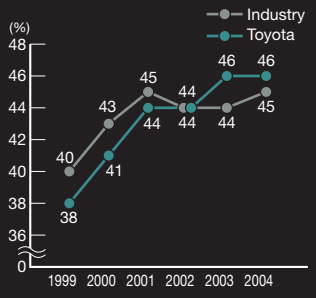
In internal combustion forklift development, we have made efforts to improve fuel efficiency, decrease the amount of toxic matter in emissions, such as NOx, developed DPFs (diesel particulate filters) and low-emission trucks (LPG and CNG trucks) and reduced overall noise levels. Electric forklifts have also become quite popular as we have achieved the same level of performance by utilizing an AC motor system that extends running time and improves energy efficiency.

As customers become more and more aware of their working environments, more electric trucks are being introduced for indoor use. Today, electric forklifts account for 45% of the market and 46% of our sales in Japan. However, certain issues remain for electric forklifts, including initial cost and the down time required to recharge batteries. Currently, we are also promoting the sale of low-emission trucks (LPG and CNG) and the development of environmentally conscious products. R&D activities to ensure cost reductions, better performance and shorter charging time of electric trucks are examples of our activities in this area.

We are also promoting recycling and disposal activities together with dealerships. The recycling rate for forklifts is high, as they are made mainly of steel and iron. However, proper treatment by professional companies is necessary when disposing of oil used in hydraulic systems for loading/unloading, and the lead batteries used in battery trucks.

We ensure that dealerships carry out the necessary disposals properly when performing maintenance, parts replacement and trade-ins. As the number of electric forklifts in operation continues to increase, our industry must deal with the issue of proper disposal of used batteries.

**Ratio of Electric Forklift in Japan**




**Battery Compartment, 7FB**

**Second Toyota Industries World Convention Held under the Slogan, "United We Grow"**

The Convention

The second Toyota Industries World Convention was held in April 2005 at the Kyoto International Conference Hall and other venues. Over 1,200 Toyota/BT-related people including distributors and dealers from over 60 countries gathered to pledge their support for future growth and a shared vision and goals under the slogan, "United We Grow".

## Aim to Maximize Group Strengths through a Shared Vision and Targets

The second Toyota Industries World Convention was held in April 2005 with the aim of sharing our common vision and targets with our dealers, distributors and group companies. Our materials handling equipment business has been operated by TOYOTA Material Handling Company and BT Industries Group. The convention gave us the opportunity to announce the establishment of the Toyota Material Handling Group to facilitate the further integration of operations and maximize our groups' strengths.

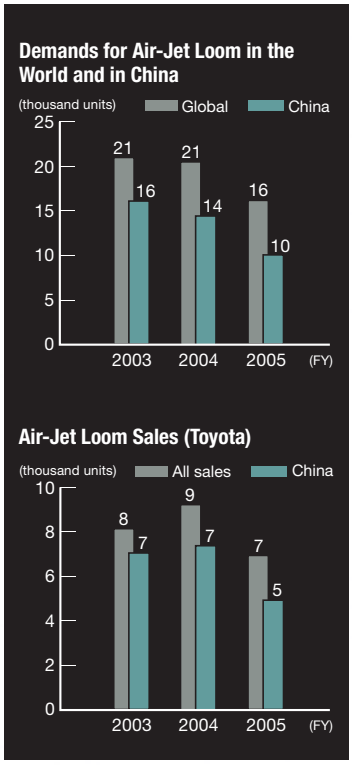
# 2 Thoroughly Predicting the Call of the Market and Customer Needs

*Realizing All of What Is Required, from Product Development to After-Sales Services.*

## Air-Jet Loom with the Largest Share in the World Supports Global Textile Production

The major textile production countries of recent years are China, India, Pakistan and Turkey. China, in particular, is the world's largest textile producer in terms of production volume of synthetics, cotton yarn and silk thread, and export volume of clothing materials. The Chinese government has launched a policy of expanding total textile exports from $50 billion in 2000 to $65 billion in 2005, in its "New Industry Plan" for 13 major industries, and promotes policies to switch itself from a textile producing country that is large in terms of production volume, to a country that is excellent in terms of quality, and which will be highly evaluated by the markets of advanced countries. China is aiming to become the top textile producing country in the world, both in name and reality.

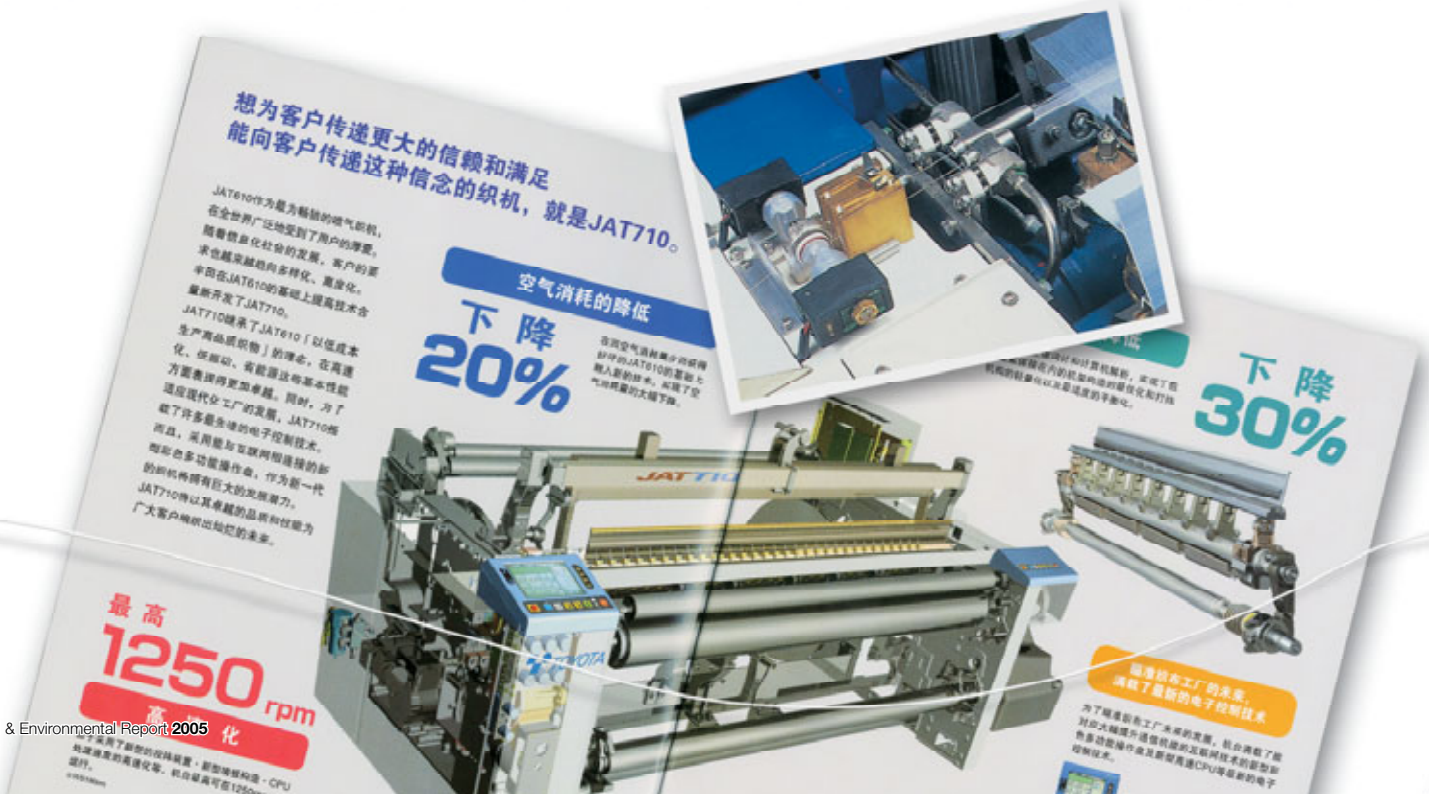
What supports the textile industry in China is Toyota Industries' air-jet loom, which accounts for the largest global share of loom sales. The air-jet loom inserts weft yarn by air jet, significantly improving the productivity of the weaving process compared to the time required when weft-inserting process relied on manual labor. In addition, with air-jet looms, premium textiles such as corduroy and cloth for down blankets can be weaved. The air-jet loom, however, is machinery that is difficult to manufacture, even in China, where remarkable developments in technology have been made.




## Improving Energy Efficiency and Usability while Facilitating Easier Production Process Control for Premium Textiles

At present, Toyota Industries' air-jet loom, the JAT710 launched in February 2003, enjoys an extraordinary reputation in China because it considers market needs and customers demands thoroughly in advance.

Function panels have an upgraded CPU and web browser installed as standard. By connecting the JAT710 to a network with a standard LAN cable and installing Toyota's proprietary



software, the operator is able to monitor total production, working efficiency and warp finish timing. In addition, it has a world first function with which production status can be managed from anywhere in the world, and the ability to communicate with Toyota Industries to exchange technical information via the Internet.

In addition, while the machinery attains a high speed operation of a maximum 1,250 rpm, consumption of air is cut by around 20% compared to conventional equipment, thereby achieving energy savings. It also realizes an improvement in work environment as vibration of the machinery is reduced by around 30% compared to conventional equipment.

While the JAT710's basic function is enhanced by including these functions (which used to be added according to customer needs) as standard specifications, we have managed to control sales price increases through our efforts to reduce development and manufacturing costs.

In the future, Toyota Industries will further enhance operability by installing our database of manufacturing know-how as an expert system so that even less experienced operators can handle the equipment safely.

## Local Staff Supporting Local Customers

Toyota Industries is also responsible for creating an environment that supports users so that the product gives the best performance.

In China, there are more companies entering the textile industry from different industries, as the textile business is booming. Consequently, the textile industry is short of experts. This means that both company management and workers at the plant need professional support, even though they are in need to produce high quality products in order to expand the market overseas. Toyota Industries has established five after service areas throughout the whole of China to facilitate effective customer support in order to make finely-tuned proposals and provide after-sales service.

In addition, based on the premise that "it is more effective if local Chinese staff take care of Chinese customers," we proactively employ, educate and train local employees to develop them as sales and service staff. As a part of those efforts, we have prepared a training facility at the Shanghai Service Center in April 2004, and started technical training for Chinese staff. We use this facility for customer training as well.

### JAT710 Air-Jet Loom

Boasting improved features such as higher speed, lower vibration and lower energy consumption, the JAT710 is equipped with the latest electronics technology, taking today's weaving mill into a new dimension.

### JAT710 Network System


Monitoring information displayed on function panels

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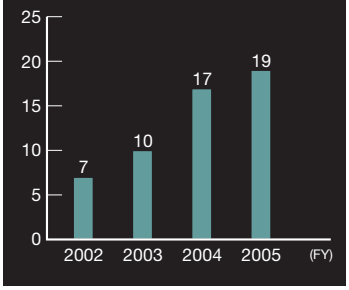
| Monitoring | Manuals | Technical News |
| TTCS | Parts Catalogs | Camera |

### Number of Local Staff in China



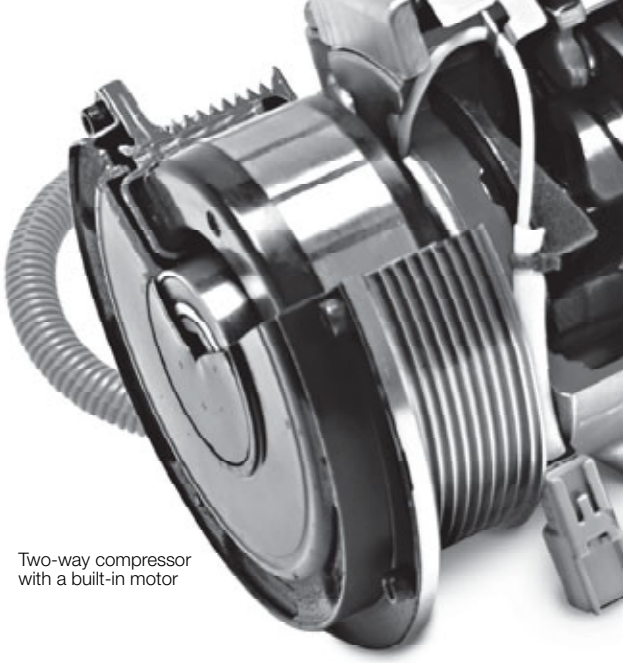

## Consolidated Sales and Service Operations that Contribute to Enhancing Our Customers' Business throughout the World

Toyota Industries' stance of contributing to customers by improving not only products but also sales and service, and hence to the whole of society, remains the same in any country throughout the world. Toyota Industries continuously adheres to the policy of "Quality First", and sales and service staff continuously fulfill their responsibilities in unison for our customers and other stakeholders.

Car Air-Conditioning Compressors Business

# 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.***



Two-way compressor with a built-in motor

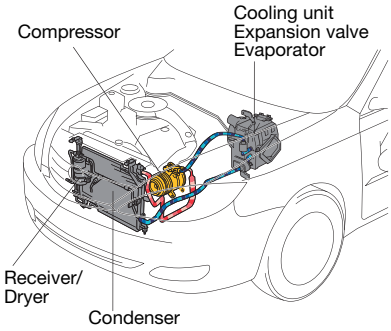
## Making Compressors not only Compact, Lightweight and Power Efficient, but also Quiet, Durable and Safe

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 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.

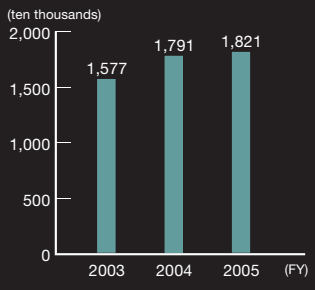
Given this situation, the company has developed an externally controlled, variable displacement compressor that was launched in May 1997. This is a compressor whereby an electrical signal is sent to the control valve to control the discharge volume of refrigerant, thereby achieving significant power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

### 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

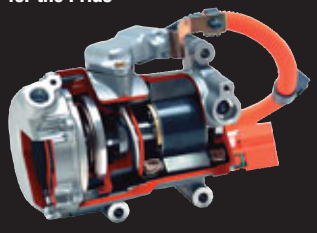



Display of compressors at a trade show

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.

**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**

## 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.

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 $CO_2$ as a new refrigerant alternative. However, cost and safety issues still remain, as compressing $CO_2$ 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 $CO_2$ 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 $CO_2$.

Prius

Demonstration at a trade show

### 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.

Vehicle Business

# 4 Pursuing a Higher Level of Manufacturing with Skill and Spirit

*Working Together to Achieve Continuous Improvement and Innovation*

## Aiming to Be the Top Automobile Manufacturer in the Industry and amongst the Global Toyota Group

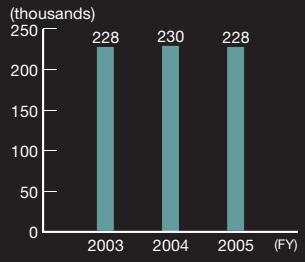
As an automobile manufacturer, our vehicle business is responsible for realizing quality, low costs and delivery that satisfies customers. The entire division comes together to strive for continuous improvement and innovation in unison and always strives to realize the most advanced manufacturing.

Our vehicle business has been manufacturing the popular Vitz (Yaris in Europe) since 1999 and the RAV4 since 2001 under consignment from Toyota Motor Corporation and is continuously producing them at a high level. There has been no single case of a serious quality problem in the manufacturing process. Our vehicle business competes in quality terms with the other automobile manufacturers of the Toyota Group throughout the world and received the Toyota Quality Management Outstanding Performance Award for two consecutive years in 2003 and 2004.

Our efficiency in carrying out production preparations that enable us to begin production in a shorter period is also highly renowned. An example of this ability is the fundamental reformation we implemented throughout the production preparation process for the Vitz, which achieved an extremely short lead-time by implementing measures that were groundbreaking and a first within the Toyota Group.

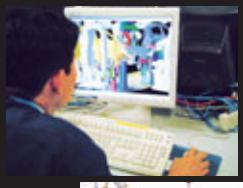
In addition, we give top priority to the safety of our employees during the production process.

**Production Units of Vehicles**

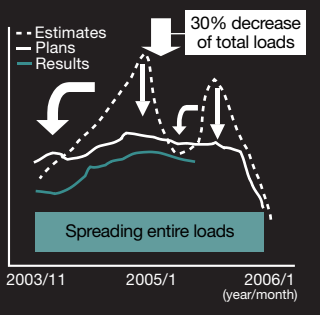



**Nagakusa Plant, Vehicle Business**

**Simulation with Three Dimensional Image**



**Production Preparation Loads**




We constantly strive to enact even better safety management to ensure the safety of all production line members, including temporary workers that regularly join Toyota Industries to handle increases in production loads.

## Think Out of the Box to Reform Production Preparation

In preparation for production of the Vitz, which was re-launched in February 2005, we carried out reform of production preparation processes that went beyond conventional ideas, and attained excellent results. In the past, during the planning for operation processes and specifications of facilities, we used to confirm our plans by making an actual production line after discussing various issues on drawings. Then, we would begin to solve problems that occurred.

This time, we implemented a production line simulation at the planning and conceptual stages using three-dimensional data (three dimensional images), thereby front-loading discussions for specifications and increasing efficiency. Furthermore, using virtual training and virtual manuals (moving manuals) that employ three-dimensional data, we shortened the work training period and enhanced production accuracy.

In addition, through project activities that removed every conceivable barrier among departments, such as production engineering, quality assurance and manufacturing, we created a system where decisions could be made more quickly and promptly. These improvements reduced the total production preparation load by 30% and spread that load more evenly across the entire production preparation process. Furthermore, at the request of TMC, members of our manufacturing department are participating in production preparations for the Yaris in France, utilizing their experiences in Japan.

Engine Business

# 5 Creating Engines that Boost Confidence and Ensure Environmental Conservation

*Offering Diesel Engines with Lower Environmental Impact and of Higher Quality in Response to Increased Demand in Europe and Other Regions*

## Boosting Customer Confidence in Toyota's Engines

Toyota Industries, in manufacturing automotive engines under consignment from Toyota Motor Corporation (TMC), bears an enormous responsibility. That is, to boost customer confidence in the excellence of Toyota's engines. Our engine business, needless to say, carries out thorough quality control, as well as using FMEA (Failure Mode and Effect Analysis) at the product and process designing stage to forecast failure mode (trouble), such as potential defects or malfunctions, and rates the level of importance according to frequency of occurrence, the degree of impact and difficulty of detection. In addition, we input data relating to past failures and problems into a database.

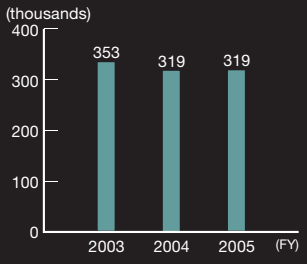
In order to prevent defect occurrence, we undertake steady and continuous efforts when preparing new production lines, such as checking whether each item of equipment, jig and standardized worksheet perfectly incorporates countermeasures against problems that are anticipated by utilizing the information contained within the database.

## Improving Fuel Efficiency for More Environmental-Friendly Diesel Vehicles

While diesel engines are more fuel-efficient and discharge less $CO_2$ than gasoline engines, they emit more NOx and particulate matter. In an effort to enhance the environmental performance of diesel engine vehicles, we have implemented post-treatment measures for NOx and particulate matter, however our biggest challenge for engines themselves is to improve fuel efficiency and to reduce $CO_2$ emissions. Our mission is to work to improve fuel efficiency and produce the world's most environmentally friendly engines.

In Europe, where highway networks are well developed, there is a growing awareness that diesel engines are more environmentally friendly.

**Production Units of Diesel Engines**




**New Model Diesel Engine**

AD diesel engine
(displacement: 2.2ℓ, used in the Avensis )

**Toyota Motor Industries Poland (TMIP)**

Line-off ceremony

**Hekinan Plant**

**Higashichita Plant**

Based on this awareness, TMC is striving to expand sales of diesel vehicles in the European market. In collaboration with TMC, Toyota Industries has realized significant reductions in environmental impact by introducing a number of new technologies that raise fuel efficiency in diesel engines.

European emission regulations, EURO 4, which came into force throughout the EU in 2005, requires new automobiles to reduce emissions of particulate matter to one tenth of that of current automobiles. Our AD diesel engines, which we began producing in March 2005, satisfy the requirements of EURO 4 regulations.

## Establishing Production Lines that Assure Quality, Even with Less Experienced Staff

Our three plants in Japan that produce engines (Hekinan, Higashichita and Kyowa) are charged with the task of using newly developed manufacturing technologies ahead of overseas counterparts. These technologies are then transferred to our overseas production bases after being implemented in Japanese production processes and carrying out any necessary improvements.

AD diesel engines are produced not only at Toyota Industries, but also at Toyota Motor Industries Poland Sp.zo.o (TMIP), which was established in 2002 as a joint venture in Europe with TMC. Naturally, less-experienced workers joined the manufacturing lines of the new company. Toyota Industries took steps to develop a production line in which even less-experienced workers can assure quality. For example, after carefully considering safety issues, we devised ways that allow workers to see inside the processing equipment, enabling them to detect and improve the cause of a malfunction by themselves. These steps enhance our employees' consciousness of quality and bring about significant benefits.

We will continue to utilize these experiences and respond to the growth of production throughout the world.

# 6 Reducing Environmental Impact by Contributing to the Performance and Adoption of Hybrid Vehicles

*Aiming to Become the Top Supplier of Power Electronics Devices and Systems for Motor Vehicles*

## Promoting Improvements to DC-DC Converters and Contributing to Improvements in Fuel Efficiency and Cost Reduction for Hybrid Vehicles

Toyota Motor Corporation's hybrid vehicles draw significant attention from around the world with their superior environmental friendliness. In the future, the hybrid vehicle market is expected to expand even further, with other automobile makers entering into the market. Toyota Industries' electronics business produces DC-DC converters, which are an extremely important component for hybrid vehicles. These converters convert the high voltage of the main battery to a lower voltage to recharge the auxiliary battery and to supply power to the lights, wipers, horns and other in-vehicle devices, or to operate the electric power steering. By proceeding with improvements to make products smaller and lighter, with higher efficiency and lower costs, and attaining higher fuel efficiency and cost reductions, we are contributing to the performance and adoption of hybrid vehicles, and hence contributing to a reduction in their environmental impact.

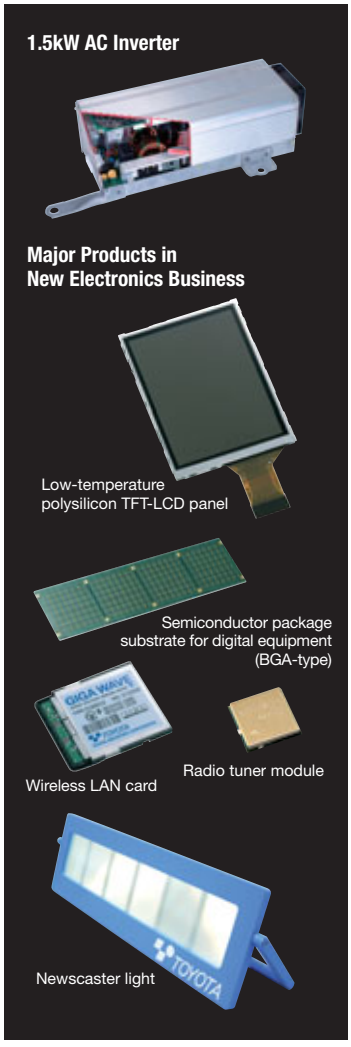
We must not produce defective components in any case, as the performance and function of our products is directly related to a vehicle's fuel consumption, costs and safety. Toyota Industries has, therefore, been working on "activities to improve market quality" since 2004. In 2005, we set even higher standards and started production of converters for the power steering used on Lexus (hybrid vehicle models), the top-of-the-line luxury Toyota vehicle.

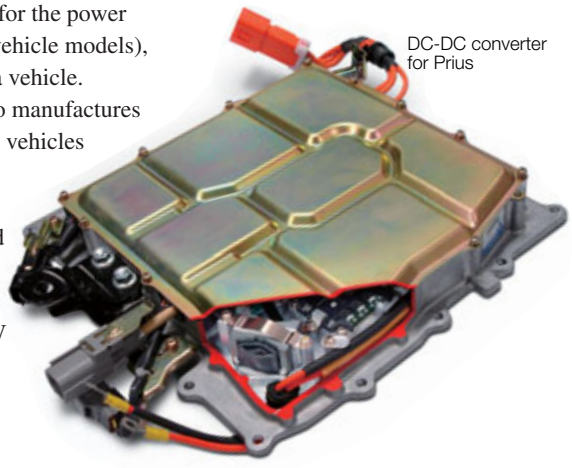
The electronics business also manufactures 1.5kW DC-AC inverters fitted to vehicles that convert direct current to alternating current.

The DC-AC inverter installed on popular hybrid vehicles such as the Alphard and Estima, is capable of delivering up to 1.5kW of electricity, and enables the use of household electrical appliances with high electric consumption, such as microwave ovens and hair driers outdoors. It is expected that the product not only makes owners' car lives more enjoyable, comfortable and convenient, but it can also be used as an emergency power source during blackouts or in the event of a disaster.

We aim to become the top supplier of power electronics devices, such as converters and inverters, and electric power systems for motor vehicles.

We will continue to work on enhancing design, production preparation and initial management; to ensure high quality products are constantly provided; as well as improving production efficiency in order to meet the anticipated increase in demand.




## Launch of New Electronics Business

We have also engaged in a new electronics business not only for automobile manufacturers but also for manufacturers of mobile phones, and electric products.

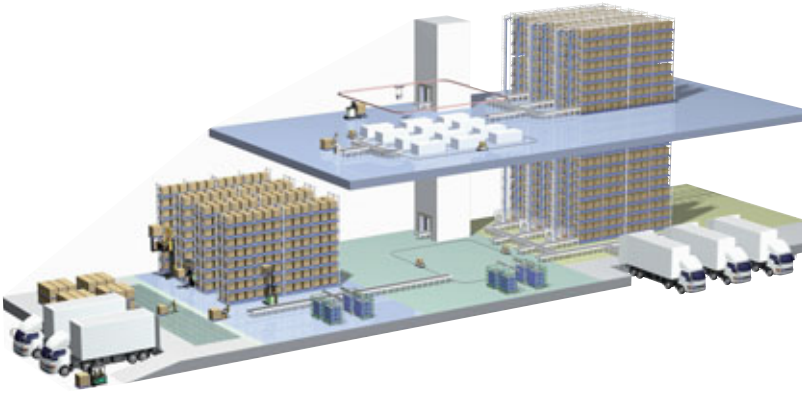
ST Liquid Crystal Display Corp (STLCD), a joint venture with Sony Corporation, manufactures low-temperature polysilicon TFT-LCD panels, the next generation in liquid crystal displays, for use in digital still cameras, video cameras, PDAs and mobile phones used across the globe. TIBC Corporation (a joint venture with Ibiden Co., Ltd.) manufactures the latest semiconductor package substrates for use in PCs, mobile phones, IC cards, etc.

Toyota Industries is also actively involved in the development, manufacture, and sale of radio tuner modules for use in mobile phones, wireless LAN cards optimized for use in small information terminals, and our newscaster light (which is used to light up the face of newscasters on TV programs) with triple wavelength luminescent white organic EL light source.

3PL Business (AL Business)

# 7 Improve Logistics in Japan

***We Aim to Optimize Logistics Using Continuous Improvement (kaizen) Know-How from the Toyota Production System***



## Responding to Expectations of Customers that Are Striving to Reduce Their Logistics Costs and Commercializing Improvement of Logistics Operations

The common demand from many companies in the food distribution industry when we visited them in order to expand our forklift sales in 2001 was "What we need is not just forklifts but Toyota's continuous improvement (kaizen) know-how fostered through experiences at production sites". These customers' needs resulted in Toyota Industries launching its 3PL business the following year.

Toyota Industries' 3PL business, which aims to reduce total logistics costs, does not merely engage in establishing and operating logistics centers for customers. Our 3PL business assists customers, particularly retailers with in-store distribution issues, such as at shelves or backyard centers, by introducing TPS to promote reform in a comprehensive way that is not limited to a logistics center.

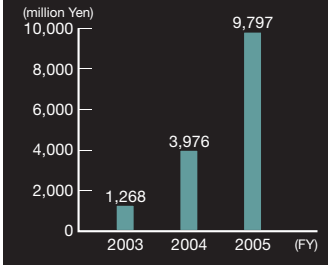
What our 3PL business aims for is "optimization of the whole logistics process from the stand point of shoppers." That is, the logistics of "market-in" where "we provide the products that are needed in the amount needed, when they are needed" in accordance with the needs of the market. In the future, we will proactively provide solutions including co-sharing logistics operations with other industries and improving the production sites of manufacturers. We will carry out these activities in order to pursue an "optimum logistics solution", or, provide an entire solution for processes, from production sites to the checkout counter of retail stores.

In the two years since launching this business, our customer base has expanded to include many industries, such as the food, daily goods, pharmaceutical products and the home improvement industries.

**In-Store Logistics Consulting**

- Food manufacturers: Production consulting
- ▼
- Logistics centers: Total logistics management and operation
  - •Planning and design
  - •Operation
- ▼
- Retail stores: In-store logistics consulting
  - •Delivery and storage consulting
  - •Food preparation system consulting
  - •Product display and arrangement consulting
  - Financial services
  - •Sales revenue management
  - •Cash collection
  - •ATM (cash replenishment and maintenance)

**Sales of AL Business**




## Provide thorough Instruction in Compliance that Is the Premise for the Creation of Added Value

In the past, logistics and logistics departments used to be regarded as "cost centers that just cost money". In order to change these industry views on logistics, improvements to change logistics to profit centers with high value and thorough implementation of compliance that is the premise for improvements are necessary. In the future, Toyota Industries will continue to promote optimal logistics solutions that contribute to promoting an even greater awareness of compliance in the industry.

Based on such ideas, we established the Compliance Group within the Advanced Logistics Division in March 2005. We organize regulations according to the industry and operational theme, and prepare and use these lists of regulations for self-checking of compliance status. We take the initiative in compliance efforts and require other logistics companies with which we cooperate to do the same. The social responsibility of the 3PL business of Toyota Industries is to transform logistics into a high value-added business and improve its social status.

Line markings to easily indicate dolly locations

Work management board