





SHAPING AIR TO YOUR NEED 19821983198419851986 19871988198919901991 19921993199419951996

19971998199920002001 20022003200420052006 2007 2008

Message

My sincerest thanks to all of you for your continued patronage. By merging with O.Y.L. industries last year, we were able to become the number 2 player in the air conditioning industry. This has made our goal of becoming number 1 in the air conditioning industry an even closer reality. Also, by increasing the capacities of our outdoor units and extending the piping lengths, we were able to place VRV[®]IIIs on the market with specifications applicable to even larger-scale buildings than ever before.

As the VRV[®] was released in 1982, 2007 marks its 25th anniversary. For this as well, we have only to thank our customers who could appreciate the VRV[®] air conditioning system and procured a great number of them. To all of you who nurtured this product - one of our most successful - I offer my utmost gratitude.

In commemoration of these successes, we have published this VRV[®] 25years History. It describes the product's journey from the first generation VRV[®] to the latest model VRV[®]III, along with its evolution in technology. And if you notice the information included in the history regarding the units of the VRV[®] that have been sold during each age, you will see that the VRV[®] has come to support larger-scale buildings over time. We also highlight our R&D, sales, service systems that have supported the VRV[®] for these 25 years.

This anniversary history reveals the 25 years underlying the VRV[®]'s reliability and technology which have made it a cuttingedge product across the ages. It would be my great pleasure to have you as a loyal user of the VRV[®], now and into the future.



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M. MINAKA President Daikin Europe NV

SHAPING AIR TO YOUR NEED

RV 25 years

25 years since the birth of the VRV[®]. Realizing Future Dreams by Maximizing Corporate Value, Daikin fulfills the dreams of the ages by sending out a multitude of products into the world. Going through this retrospective record, we look back on the footsteps of the VRV[®]'s 25 years - and aiming to realize even more dreams, we take our first step into the next 25 years.



As the world's leading air conditioner manufacturer, we have constantly built up our base of technological development to offer air conditioners that meet the needs of the future.

In 1982, Daikin developed the world's first multi-air-conditioners for buildings. In the blink of an eye, breakthrough products using individual air conditioning systems have spread throughout the world. Since its initial release, the VRV® has met the needs of the ages through successive technological improvements right up to the present. Here we look back on the changing numbers that represent the 25-year history of the VRV®.

Transitions in Product Specifications

Outdoor unit maximum capacity (HP) Maximum no. of connectable indoor units

[Maximum capacity of outdoor units / maximum number of connectable indoor units / actual refrigerant piping length]

The performance of the VRV[®] has greatly improved since the release of the first unit in 1982, as shown by the transitional specifications in the figure below. With the G series released in 1992, we introduced the energy saving effects of the inverter compressor. The K plus series saw the expansion of outdoor unit maximum capacity to 30 HP through the development of a function unit that enabled multiple outdoor

units to be linked. Thereafter, successive technological improvements resulted in the 2004 release of the VRV®IIM series in which the new R-407C refrigerant was replaced by the even further improved R-410A refrigerant. Next, specifications of the latest models of the VRV®III series released in 2006 allowed them to fully support large scale buildings.







Control systems

At first, even initially centralized control systems –which consisted only of start/stop control for 16 indoor units– took a great step forward with the development of DIII-NET, a proprietary control communication method employing digital technology. This allowed up to 1024 indoor units to be centrally controlled with the simplicity of a common remote control, simply by wiring a single system. Now, they continue to evolve through support for open networks and robust Web access functions.



'82 - **'**89

Daikin introduced the world's first multi-air-conditioner for buildings in 1982.



During the 1970s, awareness increased about resource and energy saving against the backdrop of the energy crisis caused by the two oil shocks. In 1982, the world's first multi-air-conditioner for buildings was born. Multiple indoor units were connected to a single outdoor unit, and the cooling/heating capacity required to handle the thermal load was judged by controlling each one individually. As this new system always supplied and circulated just the needed quantity of refrigerant, it was named the "VRV[®]" [variable refrigerant volume system] in contrast to the VAV [variable air volume system]. Overseas products were developed in 1987, and Daikin released its first overseas VRV[®]. This is where the history of the VRV[®]'s global expansion begins.

The first generation model RSC-C was introduced in 1982. The birth of a breakthrough product that would change the history of air conditioning technology

Development began based on the fundamental concept of linking both room air conditioners and multi types with central air conditioning style cassette-type ceiling-mounted units. After a long development period of two and a half years, a solid technological foundation was formed through the development of capacity control type compressors that facilitated energy savings plus long refrigerant piping systems that supported 8-story buildings. In the year after the introduction [1983], Daikin was awarded the Technology Award by the Japan Society of Refrigerating and Air Conditioning Engineers.





The model RSC-F released in 1988



Enabled connections of up to 6 indoor units





The D series, the first generation of VRV[®] released in 1987 for overseas markets

Indoor unit maximum capacity of 15 HP Enabled connections of up to 6 indoor units

Technology Award by the Japan Society of Refrigerating and Air Conditioning Engineers

The Japan Society of Refrigerating and Air Conditioning Engineers bestows the Technology Award in recognition of superior technology in instruments and equipment in the freezing and air conditioning fields, and for products, manufacturing equipment and production technology in the low temperature foods and biological fields. Daikin was awarded for its proprietary individual system technology in 1983.



World's First Installation in a Skyscraper

The VRV[®] for buildings was adopted by the 32-story Umeda Center Building completed in 1987. This demonstrated the VRV[®] for buildings' ability to also support high-rises.



Sketch of the Umeda Center Building installation.

'82 - '89 Trading case

Released domestically in 1982, the VRV[®] began making inroads in overseas countries that had many small and medium sized buildings coupled with high demand for air conditioning.

The VRV[®] was introduced in high-rises, and gained the attention of the domestic construction and design industries in Japan. The development and know-how gained during this period formed the backbone of our overseas expansion.

Completed in 1987, the 32-story Umeda Center Building in Osaka, was the city's first "intelligent building" skyscraper. Daikin Industries' head office took up office in the building, and the air conditioning system we introduced was the world's first multi-air-conditioning system for buildings used in a high-rise. In addition to the VRV® being installed in floors 3 through 32, a modular design was adopted inside the rooms which represented innovative technology for that time. With such successes domestically in Japan, VRV®s were developed for overseas markets in 1987. Major sales efforts were launched in many different countries around the world.

Umeda Center Building Umeda, Osaka, Japan March, 1987 | Office



Wakabane cooking school Nara, Japan

1982 | School



Kao Hong Department Store Taipei, Taiwan

September, 1989 | Supermarket



Three Star Twin Tower Building Taipei, Taiwan

1989 | Office



Keio Shinjuku Sanchome Building Shinjuku-ku, Tokyo, Japan August, 1989 | Office



Anabuki Komuten head office Building Takamatsu, Kagawa, Japan October, 1989 | Office



Palais Renaissance Orchard Road, Singapore

1989 | Office

09

'90 - '99

Clearing technical hurdles one after the other, Daikin moved ahead with the development of VRV®s using new refrigerants.



Being pushed by a wave of strengthening regulations all over the world, it became an urgent matter for air conditioning manufacturers to develop alternatives. Even in such conditions, Daikin was able to utilize its combined competitive strengths in its Chemicals and Air Conditioning Divisions to develop successive new technologies, and to quickly release the VRV[®] in Japan using a new refrigerant. By shifting to larger capacities and longer piping, we were able to support large to medium scale buildings overseas. And also, by placing products on the market that provide simultaneous cooling and heating on a single system, Daikin demonstrated its technological strength to the world.



'92

I The G series released in 1992

- > Refrigerant piping could be extended to 100 m max
- > Achieved external static pressure 49.0Pa
- (5mmH₂0) to support installations on each floor

Simultaneous Cooling and Heating Operation from One System

Daikin developed the VRV[®] HEAT RECOVERY SERIES for the G series. This system is highly energy efficient and enjoys complete flexibility to meet both the cooling and heating requirements of buildings with a wide variety of applications.



The H series released in 1995

'95

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- Full range of controllers also available such as central remote control and schedule remote control
- > Made possible to connect to BMS using the DIII-NET





I The K series released in 1996

Indoor unit maximum capacity greatly increased (to 10 HP)

> Expanded number of indoor unit models to 10

'99

'96

The K plus series released in 1999 completed a large scale air conditioning system by developing the world's first function unit

In response to the global popularity of the VRV[®], and while also leveraging technological improvements and developments to differentiate Daikin from other companies, we announced the VRV[®] K plus, a new series of 30 HP maximum capacity outdoor units for large scale buildings. Using Daikin's newly developed function unit with industry-first technology, one system could be used to connect up to 30 indoor units.



The individually controllable VRV[®] became highly regarded for its installation aspects and efficiency, and thus expanded and developed throughout the world.

Easy to install in completed structures, VRV^{*}s were also popular in hotels, hospitals, and other facilities.

The primary reason that the VRV[®] was adopted in this property was that it can be installed quicly and easily. With simplified refrigerant piping, small and lightweight outdoor units, and other features, VRV[®]s are structured for easy design and installation, making it possible to complete installation almost entirely without disrupting city administration operations. Such ease of installation and other characteristics have received high praise; the VRV[®] has proliferated to a variety of facilities in many different countries around the world.



> Moscow, Russia Office | Historical

8688.5



Lismore Base hospital Redevelopment Lismore, New south Wales, Australia

November 1993 | Hospital



Nanjing Xingye Building ^{China}

1998 | Office



Hotel Do Guincho Portugal

1999 | Hotel



FTZ PLAZA Ankara, Republic of Turkey 1998 | Office



Key Point Tower Singapore 1999 | Office



Eurimpro offices Mechelen, Belgium

1999 | Office

'00 - '07

To meet the rising demand for updated air conditioning systems in buildings, we are making new proposals with systems offering value in terms of both functionality and energy efficient characteristics.



Since 2000, the VRV[®] market has expanded from medium and small buildings to large scale buildings. Through technological improvements in compressors, heat exchangers, fans, and other devices, the VRV[®] series has been released to support large scale properties. At the same time, specialized products for small scale buildings have also been developed and released. While air conditioning needs have diversified in terms of application, ease of use, and other factors, the VRV[®] is able to support all sizes of buildings and therefore has expanded widely into these markets. Also, in recent years there has been significant deterioration of building facilities in the various metropolitan areas of the world, and the demand for replacement equipment such as air conditioning is increasing. Replacement VRV[®] products have also been developed, with sales already underway domestically. In this manner, development of products with new value-adding functions beyond air conditioning is progressing steadily.



I The KA series released in 2000

- The function unit was omitted, realizing combined connection of the refrigerant piping
- > Achieved a maximum space savings of approximately 14%

The L series released in 2002

- Adopted the new R-407C refrigerant
- COP improved by a maximum of 17%, external static pressure expanded to 58.8Pa [6mm H₂0] and installation on each floor made easier



The VRV®II-M series released in 2004

- Adopted the new R-410A refrigerant
- Including maximum capacity of 48 HP and improvements in COP of up to 13%



The VRV®II-S released in 2004

- > Lineup of 4,5, and 6 HP outdoor units for small properties
- Realized approximately 50% space savings compared with same-capacity VRV®s with trunkshaped outdoor units
- > Up to 9 indoor units also able to be connected



The VRV®II-MA series released in 2005

 Improved installation by omitting the oil equalizing pipe



The VRV[®]-WII series released in 2005

VRV® 25 years 📰 📰 📰 📰 📰 📰 📰 📰 SHAPING AIR TO YOUR NEED

- Can easily support high-rises and updated properties
- Indoor units in the same lineup with air-cooled VRV[®]

'05

The VRV[®]III series released in 2006 as a breakout for expanding into the large-scale building market. An evolutionary VRV[®] system that integrates Daikin's technological strengths.

In addition to making installation easier, energy saving technology is incorporated into the heat exchanger, outdoor unit fan, refrigerant circuit, and compressor; individual air conditioning systems that further raise the value of buildings were completed. Outdoor unit capacity was expanded to a maximum of 54 HP. The maximum actual piping lengths were changed from 150 m to 165 m, total piping lengths were greatly extended from 510 m to 1000 m, and other measures were taken to attain the industry's top level of freedom in design and installation, thereby strengthening our ability to support largescale buildings. Thus the scale of the VRV® market was expanded even further.

Latest VRV[®] System in the Japanese Market



The VRV[®] for replacements series

 Enables smooth replacement of air conditioning systems using existent refrigerant piping
 Replacement process simplified by performing the test run simultaneously with automatic refrigerant filling and contaminant dirt inside the piping processing



The ice storage VRV[®] series

- Uses nighttime power, thereby greatly decreasing daytime power consumption and contributing to power smoothing
 Bunning costs are reduced by reducing
- Running costs are reduced by reducing money for basic power



The highly efficient in cold areas VRV[®] series

 Greatly improved COP in low outside temperatures with a newly developed
 2- stage compressor system

01

The VRV®III-S released in 2006

 Compared to the VRV[®]II-S, COP improved from 2.92 to 3.36 HP [6 HP]

Operating sound also reduced, comfort also increased

'00 - '07 Trading case A wide variety of VRV[®] series models to support individual user needs have been widely adopted in various buildings regardless of scale or application.

VRV[®]II Saves Time and Money

Significant savings in plant and electrical costs, increased cooling and reduced plant space have resulted from installing VRV II in a new Stuttgart office complex.

The 19 storey 'Colorado' building provides 17 floors of office accommodation, planned originally with 16 offices per floor, all with VRV[®] air conditioning using R-407C refrigerant.

During construction however, the specification changed to 20 offices per floor, requiring 20 outdoor units or a switch to VRV*II, using R-410A refrigerant. The latter option was adopted, providing 17% more cooling, 7% lower air conditioning costs, 20% savings in electrical supply costs and 48% less plant footprint area.

Colorado building Stuttgart, Germany 2003 | Office



Ministry of Agriculture & Fisheries Laboratory Muscat, Oman

2002 | Office



Independence Bank Owensboro, Kentucky, North America

2004 | Office



Hilton Hotel Manchester Manchester, the United Kingdom



Nippon Express Paris, France September, 2006 | Office

Municipal Library Torrepacheco, Spain

August 2006 | Library/Conference Room



Reh-a Pola Factory Trzebnica, Poland

2004 | Special Application



Creating value through innovative technologies and carrying out research and development on the world's most advanced air conditioning technology.

R&D is indispensable for the creation of excellent products that enrich people's lives. As symbolized by the VRV[®], Daikin has put forth a multitude of technology and products that have always been, and continue to be, at the forefront of the age. To be able to offer such products and services that delight and astound our customers, we have constructed an advanced R&D system.



Formation of a three division system of research, IT, and development to support development of Daikin's superior products

To create more advanced functions and new value, Daikin has instituted specialized R&D divisions: the "Environmental Technology Research Laboratory" and the "Solution Product Development Center." In combination with Product Development Group, each of the three divisions works in close cooperation to precisely ascertain the customers' needs and to enable commercialization of products incorporating advanced technology that take the lead over our competitors.



Environmental Technology Research Laboratory : Intensive research on Energy Saving Air Conditioning Technology

Amidst accelerating globalization of our air conditioning business, diversifying needs in the countries of the world are increasing our research challenges. We have furthermore established a research laboratory devoted to the two fields of "air conditioning" and "the environment." With our mission to promote energy efficiency in air conditioners, we are engaged in R&D on technologies that can give birth to superior products from fundamental research on motor inverters, and other areas on up to support of individual product development. Going forward, we will advance our technological development toward even further global business expansion.



Simulation for predicting the magnetic flux distribution of motors to increase energy savings

The Solution Product Development Center: Integrating Air Conditioners with IT

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Keeping in mind the changes in business brought by the computerization and networking of society, we have integrated IT into our air conditioners including communication technology, software technology, and digital control We are initiating R&D that will offer new system services, such as realizing comfortable environments with superior energy efficiency by networking air conditioners to enable them to exchange information with service centers.





With our global customer support system, we are offering services that satisfy our customers allover the world.

Along with the activation of our global air conditioning business, Daikin has established service centers in various countries around the world, and is strengthening its support system. Aiming to further equip our service systems in other regions overseas to match the levels of service in Japan, we are moving ahead to build systems most suited to the unique conditions of each country, and to expand our service capabilities.

Remote monitoring of customer installations at the ACC center. The Air Conditioning Network Service System offers more efficient management and faster service.



Founding of the Global Operations Division for building and expanding our overseas sales networks

The founding of Daikin Europe, N.V. in Belgium in 1973 marked the beginning of our global expansion in earnest. As the major issues raised for managing our air conditioning global strategy, we then proceeded with building and expanding overseas bases in various countries of the world, and constructed an overseas sales network. In the process, and with the further globalization of the economy, we implemented organizational reforms to strengthen Daikin's aggressive global expansion. In 1996, we merged the "International Sales Headquarters" with the "Air Conditioning Production Strategy Labs" to create a "Global Operations Division." With demand for air conditioners gradually expanding overseas, the organization plays a major role in examining holistic global strategies in synch with the trends of a changing world.





20 Daikin Europe, Belgium

Daikin Industries, Thailand

Presenting of air conditioner showrooms in various countries around the world

As another element that supports our global air conditioning business, we have opened air conditioner showrooms in various countries around the world. These facilities exhibit Daikin's latest air conditioning products and provide information on our state-of-the-art technologies.



Shanghai



Building a global service network

We are building sales and production bases in Europe, Africa, Asia, Oceana, China, America, and various other countries to support our customers around the world. To also expand our global development from now on we are taking advantage of the network gained in our acquisition of OYL. Industries in 2006 to strengthen our system of service contact networks. We at Daikin will strive to build the ultimate service system by combining a variety of technology and experience, under the key words "Fast Reliable and Friendly"



providing the same level of sevice we offer in Japan

Implementing training and programs for overseas sales bases, production bases, licensing of technology, and other assets. We are aiming to offer Japanese levels of service in all aspects, starting with ordering, estimating, and other sales technologies, planning & design, quality control, and other manufacturing technologies and repair & maintenance services.

Air Conditioning and the Environment

Air conditioning systems provide a significant level of indoor comfort, making optimum working and living conditions possible in the most extreme climates. In recent years, motivated by a global awareness of the need to reduce the burdens on the environment, Daikin has invested enormous efforts in limiting the possible negative effects associated with the production and the operation of air conditioners. Hence, models with energy saving features and improved eco-production techniques have seen the light of day, making a significant contribution to limiting the impact on the environment.

Product manufacturing emphasizing 3R & Repair for effective resource utilization

In product development and design, we combined the three "R's" of reducing, reusing, and recycling with "repairing" as a guideline for our initiatives on effective resource utilization.

3R & Repair Initiatives

Reduce	Compact and light-Weight product design Use of recycled materials	
Reuse	Reuse the components of used products	
Recycle	Development	 Design products that are easy to take apart and recycle > Use easy-to-recycle resin > Label materials > Use a construction that is easy to disassemble
	After use	Recycle used products
Repair	Development	Design products that are easy to maintain and repair
	After disposition	Offer a maintenance and repair system to extend product life cycle



Activities taken on by the entire company to reduce emissions in production and transport

We are carrying out various initiatives to reduce emissions of the greenhouse gasses that cause global warming in our production process and transport activities. At Daikin, we have focused on reducing emissions of HFCs, and are striving to reduce energy use in our production process. On top of that, Daikin invests in CO, neutral energy for the entire Ostend plant. In the same manner we are also working to cut back on CO, emissions and reduce energy use during transport. Switch our long-distance shipping modes (from trucks to trains and ferries), improving load efficiencies by shrinking packaging volumes, and putting other measures during transport into practice.





on information from the intergovernmental Panel on Climate Change and the Belgian Government.

VRV[®] an energy efficient approach

Widely acknowledged as the most advanced system of its type on the market, VRV[®]III represents a powerful combination of advanced inverter and heat pump technologies. As a reverse cycle heat pump it can provide a complete indoor environment obviating the need for a separate heating system and offering output efficiency gains of up to 4:1 compared to fossil fuel based heating systems.

VRV[®]III can switch from cooling to heating or supply both at the same time to different parts of a building. In its heat recovery format, heat exhausted from indoor units in the cooling cycle is merely transferred to units in areas requiring heat, maximising energy efficiency, reducing electricity costs and leading to COPs and EERs up to 9*.

Cutting edge performance figures such as these are achieved primarily as a result of the system's inverter controlled compressor, which modulates refrigerant flow to match required cooling and heating loads at any one time. This enables system start up time to set point temperature to be reduced by about 33% and evens out room temperature fluctuations. It also reduces stop/ start cycles and regulates power input and operating capacity to suit outdoor temperature variations. In short, it enhances energy efficiency and user comfort, cuts CO₂ emissions and returns energy savings some 30% greater than can be achieved with fixed speed control systems**.

With the environment in mind

Daikin's well known environmentally aware credentials and strict adherence to 'F' Gas regulations are also reflected in the unique VRV®III capacity for refrigerant containment during both charging and system operation. This important facility enables the amount of additional refrigerant charging during commissioning to be controlled automatically. Charging, initiated via a button on the outdoor unit printed circuit, ceases as soon as the correct amount of refrigerant is transferred. An electronic containment check can also be activated manually by an HVAC technician in less than 30 minutes to ascertain whether any refrigerant has escaped since the previous maintenance check. This ensures against losses in efficiency and resultant increases in consumption and CO₂ emissions.

Leakage prevention is supported by the use of brazed joints in place of flanged and flared connections before the shut off valves as well as by brazed pressure sensors and electronic gauges instead of sensors and gauge ports. There is also on average, 10% less refrigerant content in VRV[®]III compared to similar sized VRV[®]II systems.

Finally, considerable attention has been afforded to RoHS regulations concerning phasing out the use of lead, cadmium, hexavalent chromium, mercury, PBBs and PBDEs, including their use in components sourced from outside suppliers.

^{*} REYQ8P8 50% cooling – 50% heating load. Conditions: outdoor

temperature 11°CDB, indoor temperature: 18°CWB, 22°CDB. ** Case study Daikin on Sky-air inverter – non-inverter.

In all of us, a green hear



environmental issues. For several years Daikin has had the intentio to become a leader in the provision of product that have limited impact on the

environment. This challenge demands the eco design and development of a wide range of product and an energy management system resulting in energy conservation and a conduction of monthe



Daikin Europe N.V. is approved by LRQA for its Quality Management System in accordance with the ISO9001 standard. ISO9001 pertains to quality assurance regarding design, development, manufacturing as well as to services related to the

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nagement system in order to help protect nan health and the environment from the ential impact of our activities, products and rices and to assist in maintaining and improving

Daikin units comply with the European regul that guarantee the safety of the product.

VRV[®] products are not within the scope of the Eurovent certification programme.

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