DAIKIN

your comfort. **our world.**

VRV IV Heat Recovery

Efficiency redefined

VRV IV Heat Recovery: from Daikin UK

Heat recovery technology completely redesigned

Designed-in flexibility

New efficiency benchmarks for design, installation and operation

Unrivalled versatility

Perfect system balance

Three-pipe system to recover more free heat

A revolution in climate control for buildings

Complete comfort and efficiency without compromise

Redefining efficiency

About Daikin

World leader in innovative technology

Daikin has a worldwide reputation for innovation in HVACR technology. We made many of the pioneering technological advances in this field that have since become the norms for modern systems. Today, we are one of only two suppliers of building services equipment to be included in the Forbes 100 list of The World's Most Innovative Companies.

The UK launch of VRV IV systems is the result of Daikin's continuing focus on innovative thinking in technology.

Contents

For commercial buildings

For climate control in all types of commercial buildings, the mission to achieve ever greater efficiency is relentless. That quest is being driven constantly by new legislation and ever tougher regulations, by increasing pressure on costs and by greater environmental awareness.

Over time, progress is typically made in small steps, with marginal refinements of technological design or operational control. Major advances – such as the inverter compressor in the late 1990s – are extremely rare.

But now, Daikin is introducing the next generation.

Our new and unique VRV IV Heat Recovery technology completely redefines efficiency – of design, installation, operation and comfort.

It brings significant benefits for everyone concerned: specifying consultants, installation contractors, building owners and tenants.

This brochure introduces you to the very latest major advance in VRV technology, which is part of our constant drive towards even better efficiency in design, installation and operation.

360° efficiency

VRV IV + **HEAT** recovery

FAST design + **QUICK** installation + **MORE** free heat + **MAX** comfort

Redefining efficiency

Everyone involved in designing, installing, providing and using Heating, Ventilation, Air Conditioning and Refrigeration [HVACR] systems for commercial buildings has their own perspective on efficiency.

Consultants look mainly at how much energy will be used to deliver the building services required. Contractors focus on how much resource, time and cost is needed to complete and commission the installation to specification.

These criteria also matter to the owners and managers of buildings. But they also need to consider how efficiently the system can be adapted over time to the constantly changing needs of building occupants to provide high quality, comfortable working environments – and all with minimal disruption to day-to-day operations.

Daikin can now offer a new perspective for all concerned with equipping and using the building: a 360° redefinition of efficiency that will help you meet the specific challenges you each face today.

Capturing wasted energy, harvesting more free heat

Until now, most commercial buildings have relied entirely on primary energy resources for all functions: business equipment, lighting, heating, cooling, air conditioning and, where required, refrigeration. Power for HVACR systems usually accounts for around half of this energy usage.

Typically, all of these functions are powered and operated separately from each other. Much of this primary energy is wasted. So is the energy created inside the building daily: surplus heat from equipment and lighting, from refrigeration units, from solar gain and from the people who work there.

New technology delivers total solutions

By understanding these diverse needs and energy sources, it is now possible to reduce dependency on primary energy, harness the available surplus energy and re-use it.

Through Daikin technology, a proportion of everyday energy requirements can effectively be cost-free.

MORE free heat

Designing for the long-term

System selection and specification is no longer confined to current needs.

This new model of efficiency builds in flexibility to allow for future changes in building use and configuration.

FAST design

Enabling faster and easier installation

For installers, extra efficiency means initial Cat A fit-outs can be completed in less time and with greater certainty of meeting deadlines.

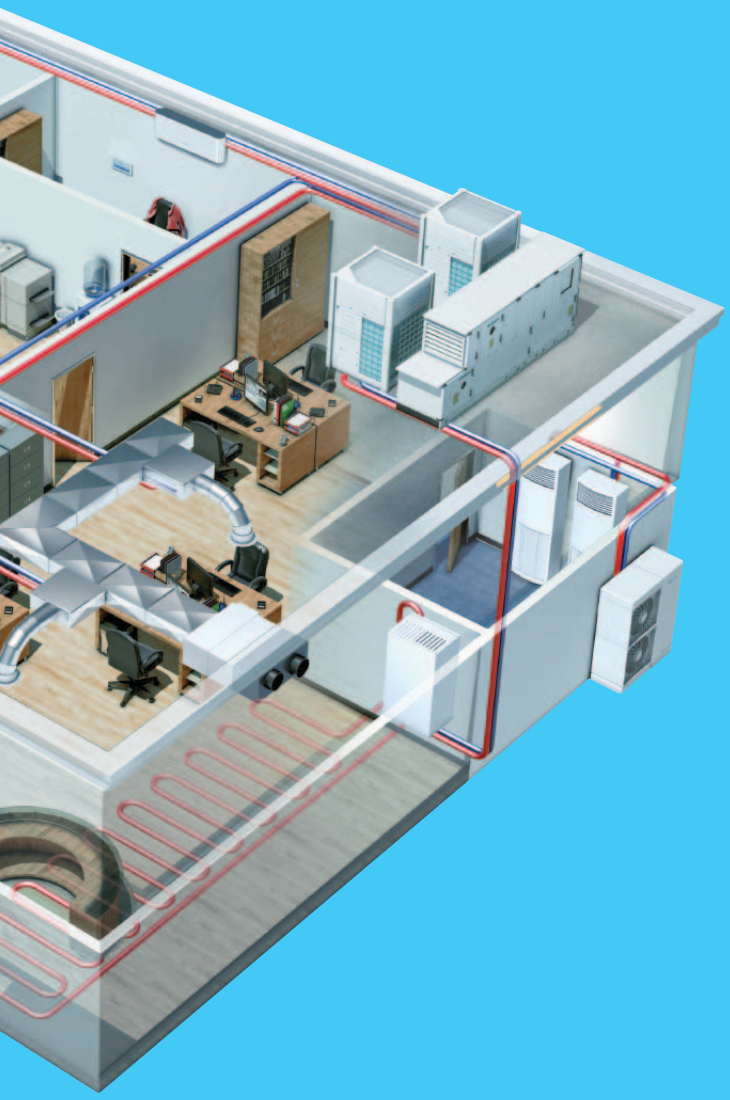
Any future Cat B reconfigurations for changes to interior layout or building use are easier to implement too.

QUICK installation

Achieving smarter control for more consistent comfort

Free energy and eliminated waste aren't the only enhanced efficiency benefits for building owners and occupants. Intelligent controls can also ensure the optimum balance of temperature, humidity and air freshness to suit more precisely the time of day and changing requirements of the building's diverse functions and zones – all with user-friendly controls.

MAX comfort



Delivering total solutions

Daikin UK now offers total solutions, individually designed and created for commercial buildings, to incorporate all these aspects of redefined efficiency. They ensure an optimum interior climate for all who visit or work in each building, whatever its size, type or function.

With enduring, future-proofed benefits

The benefits for building owners of this higher efficiency are substantial and enduring. Energy waste is minimised. Carbon impact is reduced and the cost of energy is lowered for the long-term. Future reconfiguration or upgrade of the system – to take account of changes to tenant, internal layout or building use – is much simpler.

Managing the load without extra plant

Our latest high-efficiency technology also has physical advantages. In comparison, a typical high sensible system would need almost double the plant size to be sure of coping with the same peaks in demand.

Principles of VRV technology

Variable Refrigerant Volume [VRV] was first developed by Daikin over 30 years ago. This game-changing innovation revolutionised heating and cooling so that various areas of a building could operate different climate control settings simultaneously.

By circulating only the volume of refrigerant required at any given time, VRV offered two principal benefits: reduced energy consumption and greater control for building occupants.

Since its introduction, Daikin has led the way in taking this technology to new levels of energy efficiency, climate comfort and versatile control. Its modular principles mean that a system can be tailored precisely to any individual building in its entirety.

Aiming for ultimate efficiency

In summary, VRV opened up the potential to achieve the highest energy efficiency levels, moving closer to zero wastage of heat.

However, this ultimate objective requires peak performance efficiency to be sustained hour-by-hour and day-by-day, whatever the multiple changing needs within each building.

With our VRV IV Heat Recovery system, incorporating Variable Refrigerant Temperature [VRT], Daikin has now taken a giant leap towards that goal.

Versatility applied to whole buildings

VRV technology works best when it is designed as a solution for entire buildings. This achieves much more than simply offering simultaneous heating and cooling of different zones in a building.

Rather, when it cools an area where the highest heat gains are made, it reclaims the surplus heat and transfers it to other areas of the building that need heating or hot water.

This balancing of requirements within a building is the key to achieving the highest efficiency scores and can actually deliver a performance efficiency of more than 10.

MORE
free heat

Totally redesigned

with Variable Refrigerant Temperature (VRT)

Daikin has now completely re-designed this technology to create our market-leading climate control solution: VRV IV Heat Recovery.

We have taken the principles of VRV and found a completely new way of controlling it.

At the core of this technological breakthrough is Variable Refrigerant Temperature [VRT], the most significant development since the arrival of the inverter compressor.

Our VRV systems no longer just control the amount of refrigerant in all the parts of the system; they also control the temperature.

The system can manipulate evaporating and condensing temperatures to suit each individual building or tenant, so the system always meets the load.

Customised seasonal efficiency

With VRT, which is already incorporated in our VRV IV Heat Pump, individual HVAC installations can be tailored to achieve the optimum balance between comfort and efficiency.

Now, with our new generation Heat Recovery, we can apply it even more precisely to the varying real life needs of commercial buildings.

In any building, the system load requirement fluctuates across each day, according to the differing requirements of individual zones or rooms within each building, and the influence of daily weather variations.

Applied to real-life needs

VRV IV Heat Recovery with VRT adjusts intelligently to real-time working situations. It manages all these variations while keeping energy efficiency and comfort consistently balanced *(see* typical example *on pages 10-11)*. So the required interior climate is delivered year-round, harvesting and re-using available energy, without wastage.

VRT: multi-stage heat recovery unit

- Indoor heat recovery coil on four sides: 50% more surface area for heat exchange
- Heating and cooling portions variable according to demand rather than fixed sections
- Continuous heating: warm air still being delivered even during outdoor unit defrost
- No cold draughts: no dip in comfort levels
- Immediate return to full capacity after defrost

Anticipating the revised basis for rating efficiency

The enhanced capabilities of our new systems mean that we are already well-placed for imminent changes in how efficiency will be rated in future.

From 2016, VRV systems will no longer be rated on the basis of a single measure, but on their performance over a typical year.

Over 30% more efficient than previous systems

Measured data from an actual installation shows how significantly energy consumption can be reduced with the addition of VRT.

In this retail outlet example, a VRV III condenser was replaced by our new VRV IV condenser. Average daily consumption of energy was measured against the daily difference between average shop temperature and ambient temperature.

Measured comparison of energy consumption: VRV III outdoor unit versus VRV IV (with VRT)

This shows that, compared with our VRV III system, the addition of VRT achieves 31.75% greater efficiency over a year. Currently no other heat recovery system comes close to matching this level of efficiency.

When other improvements now incorporated within our total solutions are taken into account, the Daikin VRV IV system now offers the best performance available by a clear margin.

Major savings across each year

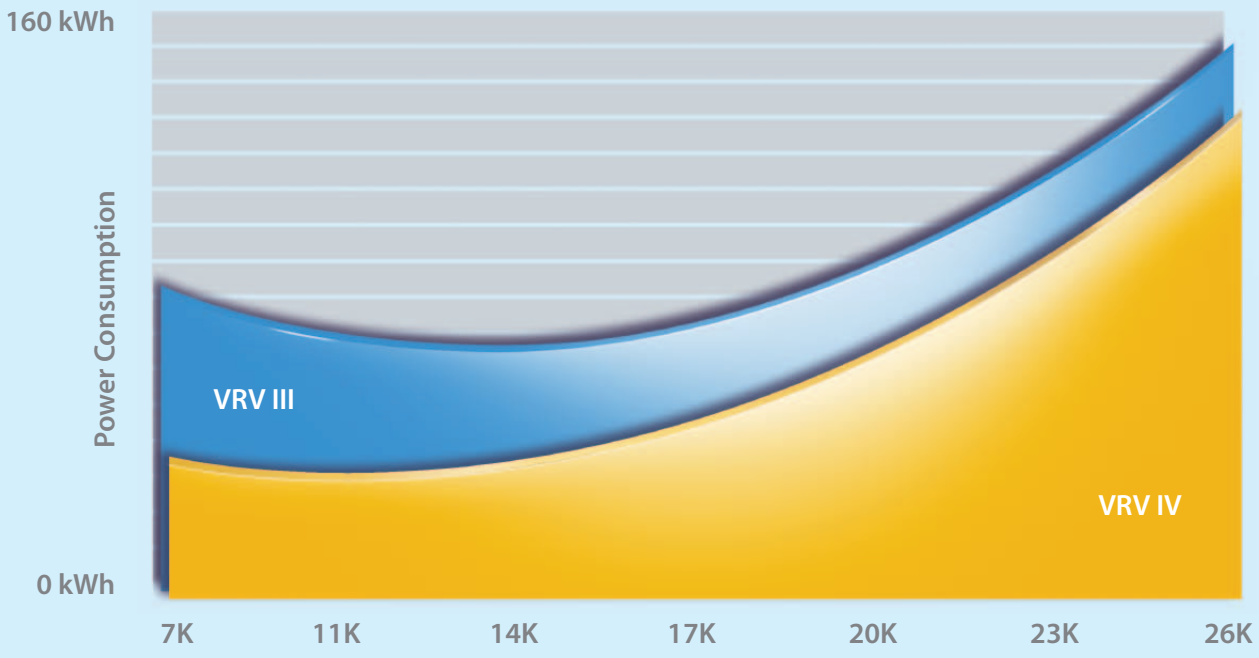
VRT offers the potential for major savings in both energy costs and carbon emissions for every business where it is incorporated in their installed system.

Assuming that there are 250,000 VRV installations in the UK, and all are VRT-enabled, it has been calculated that this would save business a total of £750,000 per day and £187m per year. Over the lifetime of the systems, the savings could be £2.8bn plus 10m tonnes of CO_2 emissions.

MORE free heat

+

MAX comfort



Difference between average shop temperature and ambient temperature during opening hours

Other key differences

Other elements of the latest Daikin VRV system solution have distinct advantages over those of other manufacturers.

These contribute further to the superior efficiency that we can now offer.

Advantage of three-pipe heat recovery system

In our three-pipe system, heat can be recovered at high temperatures because it has dedicated gas, liquid and discharge piping.

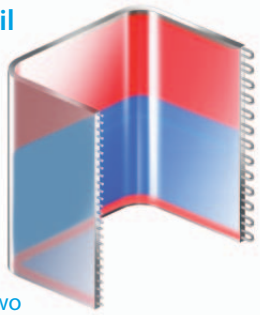
By comparison, in a two-pipe system, gas and liquid travel through the system components as a mixture – and so heat cannot be recovered at the same high temperatures.

The three-pipe system captures more free heat.

3-pipe: Separate gas and liquid discharge pipes

2-pipe: Gas and liquid is mixed

Multi-stage heat recovery coil



The heat recovery coil in our VRV IV Heat Recovery solution has several physical differences compared with competitors' systems:

– It wraps around all four sides of the compressor, rather than just three sides.

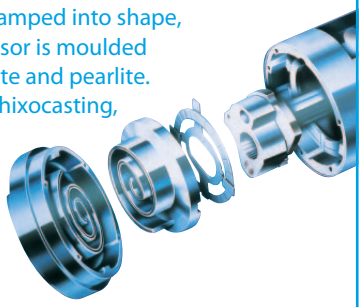
– It is three rows thick rather than two

This provides 50% more surface area across which heat can be exchanged, so the compressor needs less power.

In operation, rather than having fixed sections for different roles, it incorporates a multi-stage function, moving the heating and cooling portions of the coil. It can operate in all heating, or all cooling, or a variable proportional split between heating and cooling, as required. This further increases heat recovery efficiency, typically by around 15%.

MAX comfort

Stronger VRV scroll compressor

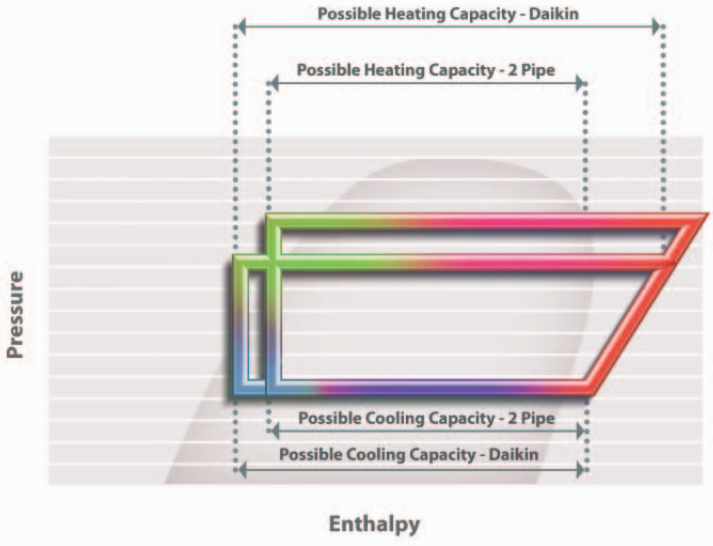


Rather than metal being stamped into shape, Daikin's VRV scroll compressor is moulded from liquid granular graphite and pearlite. This advanced technique, thixocasting, is more usually associated with engineering for Formula One motor racing. It creates a material that is 240% stronger than any other VRV compressor.

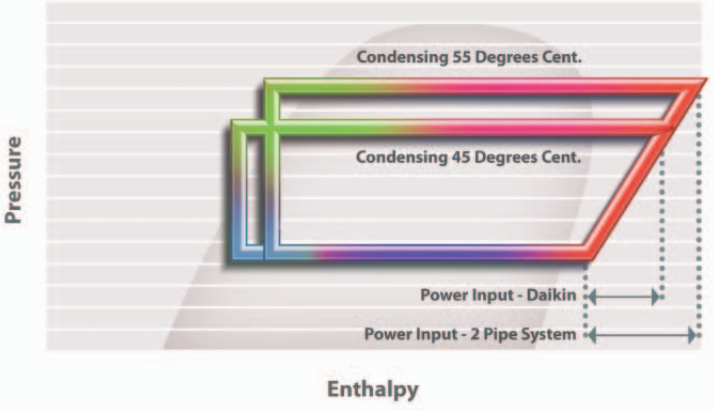
The final product is also smoother than products created by any other manufacturing process. Moving parts glide together without any unnecessary metal-on-metal contact.

That's why the compressors in Daikin systems can withstand more wear and tear, last longer and are more reliable than any alternative currently on the market.

MORE free heat



These charts describe the difference between two systems. One shows a system with significantly more heating capacity available when in heat recovery mode. The other shows the extra power needed to reach the required system condensing temperature. Charts represent theoretical operation in cooling dominant heat recovery mode.



Redefining efficiency in DESIGN

Today, maximum efficiency in design should cover the lifetime of the system, not just today's immediate requirements. Design needs to anticipate and understand the long-term needs of a building. The owners or tenants may change, and so may the internal layout. There could also be change of use in some areas of the building. So the HVACR system that is selected and installed now may have a significantly altered job to do in the future.

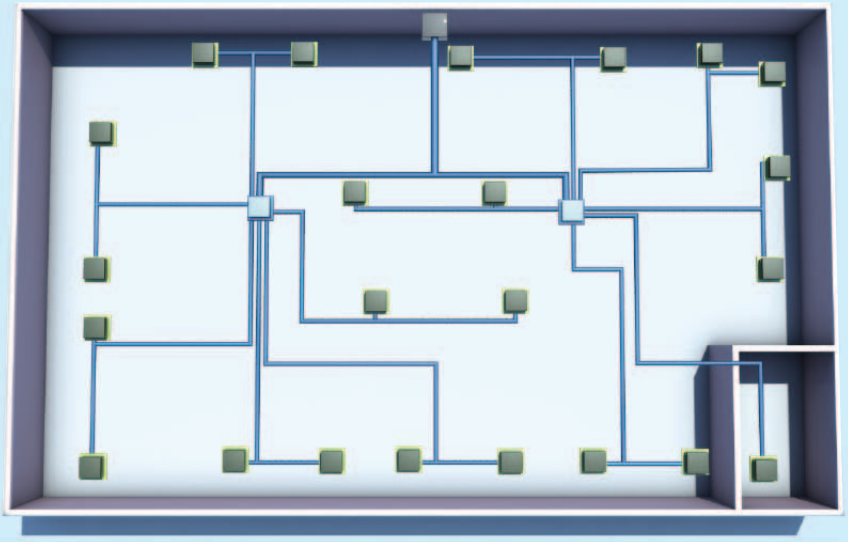
How Cat B fit outs are made simple

EXAMPLE:
Whole floor in multi-storey office block

Original open plan layout

CAT A fit out: Open plan. 100kW cooling load. 24 fan coils. One separated zone (access area – stairwell)

Two multi-boxes, each with 6 connections plus unused ports

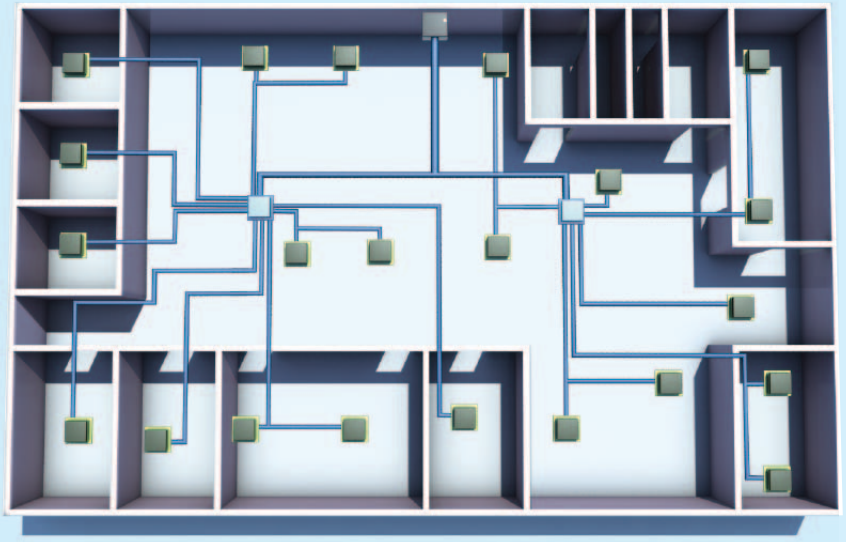


KEY: BS boxes Fan coils

Reconfigured layout with partitioned offices

CAT B fit out: Reconfigured layout with multiple cellular offices, meeting room and comms room. 100kW cooling load. 22 fan coils

Two multi-boxes: one now with 9 connections (other still with 6 connections)



KEY: BS boxes Fan coils

Daikin technology now enables system specifiers to build-in flexibility without compromising future operating cost, energy efficiency or environmental impact. Several tools are available to aid design *(see panel)*.

Planning to include future flexibility

With future-proofed design, it will be quicker and easier to adapt the system for revisions to building layout, with newly-defined areas such as cellular offices being added or changing shape.

There should be no need to fit different or additional BS boxes. Only the pipe work needs to be changed in order to reposition fan coils for the new configuration.

FAST design

A change of tenant or building usage typically requires substantial changes to BS boxes as well as to pipework. Until now, BS boxes have had limitations on the number of unused fan coil connections.

With Daikin's new BS boxes *(see pages 12-13)*, that restriction no longer applies. In theory, a single fan coil could be attached to a 10-way box and leave 9 ports unused for future needs. A 14kW fan coil can be added to each of these vacant ports later – and any one of these can serve the high demand of a communications room.

Daikin continues to offer single BS boxes, so a dedicated box can easily be added to the main pipework, if required.

Daikin tools to aid design

Including:

Advanced IES Modelling

To size and select the correct VRV system for a building's heating and cooling loads. Alternative configurations are simulated to find the option that maximises energy efficiency and will minimise annual energy usage.

**Provided by Daikin UK in partnership with Integrated Environmental Solutions [IES]*

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Seasonal Solutions Simulator

A tool that can be fully customised to simulate a full year's energy usage, running costs and CO_2 emissions for different Daikin commercial heating and cooling system configurations. Each simulation takes into account the specific building's location and use, the system's anticipated operating hours – and the detailed heating and cooling loads. Other Daikin systems or other technologies can then be simulated for comparison.

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Daikin City

An online interactive tool that uses a virtual environment to demonstrate different climate management scenarios for specific types of building. While not intended as a definitive design tool, it does indicate the energy savings potential of a number of selectable options that could form part of a total solution.

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VRV Xpress

For simple, accurate selection and professional quoting of VRV systems. This tool prevents over- and under-sizing of systems, so that unnecessary installation costs can be avoided and system efficiency increased. The software is upgraded automatically to ensure the latest information is always included.

Redefining efficiency in INSTALLATION

For installers, efficiency is all about time and profitability: the time taken to fit and commission systems, meet project deadlines and avoid delays due to unexpected complexity or changing conditions.

Efficiency in installation is pivotal to competitiveness in project tenders. Ultimately, it can also be the difference between profit and loss on the job.

The new Daikin three-pipe VRV IV Heat Recovery system takes no longer to install than a two-pipe system. In fact, our latest technology is designed to make installation faster, easier and more flexible than ever before.

Smaller Multi-Branch Selector Boxes [BS]

To make system fitting easier for installers, our range now includes 4, 6, 8, 10, 12 and 16-way BS boxes. Unlike other manufacturers' multi-boxes, these do not require complex separators inside. Accordingly, all Daikin multi-boxes are at least 30% smaller – and our 4-way and 8-way boxes are actually half the size of other manufacturers' equivalents.

A single BS box is also available if required for a remote area requiring independent control of heating and cooling [EXAMPLES: comms room, or a newly-added enclosed office].

All Daikin multi-boxes will fit comfortably into a 300mm ceiling. They are also quieter and up to 32% lighter than those of other manufacturers. Unlike other manufacturers' multi-boxes, each port can be connected to a 14kW fan without any loss of cooling capacity. Those other multi-boxes are also subject to a maximum 8kW fan coil on each port. So each Daikin BS multi-box can handle 75% extra capacity.

Easier commissioning and servicing

Daikin VRV IV technology includes advanced software to simplify system commissioning and servicing as well as multi-site commissioning and control of installed systems.

The VRV configurator incorporates a graphical interface so that settings can be pre-prepared off-site for high-speed uploading on site. Among other benefits, this reduces the time required on a roof to configure outdoor units, as well as reducing set-up errors that would otherwise require repeat visits to site.

In addition, the software allows engineers to check systems, evaluate operational data and identify any errors.

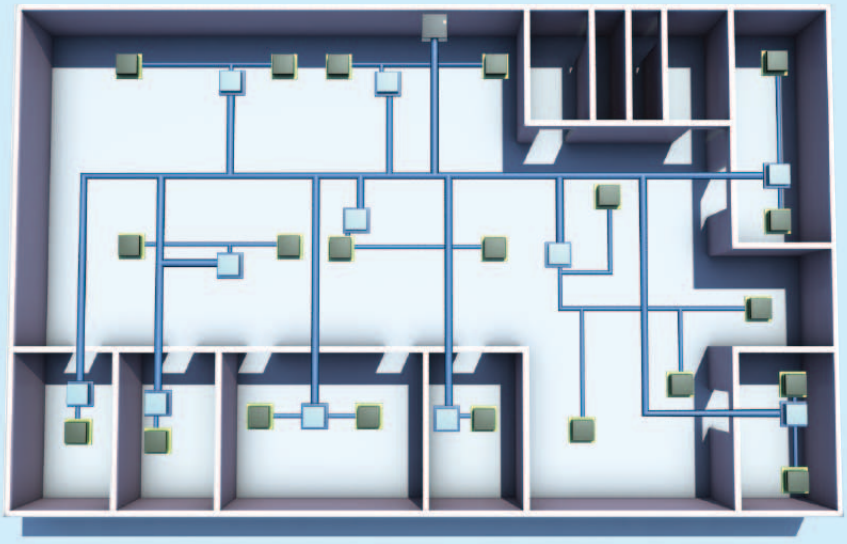
No. of Connections	Physical Size (m^3)		Daikin Box Reduction
	Daikin	Other	
1	0.262	N/A	N/A
4	0.474	0.957	50%
5	0.743	0.957	22%
6	0.743	0.957	22%
8	0.743	1.422	48%
10	1.051	1.422	26%
12	1.051	1.422	26%
16	1.358	1.422	5%

VRV III compared to VRV IV

The examples shown compare VRV III and VRV IV installations in an identical building layout. They demonstrate how using multi-boxes instead of single boxes dramatically reduces installation time and complexity. The VRV IV configuration reduces hot works by well over 40% – equivalent to two days' work.

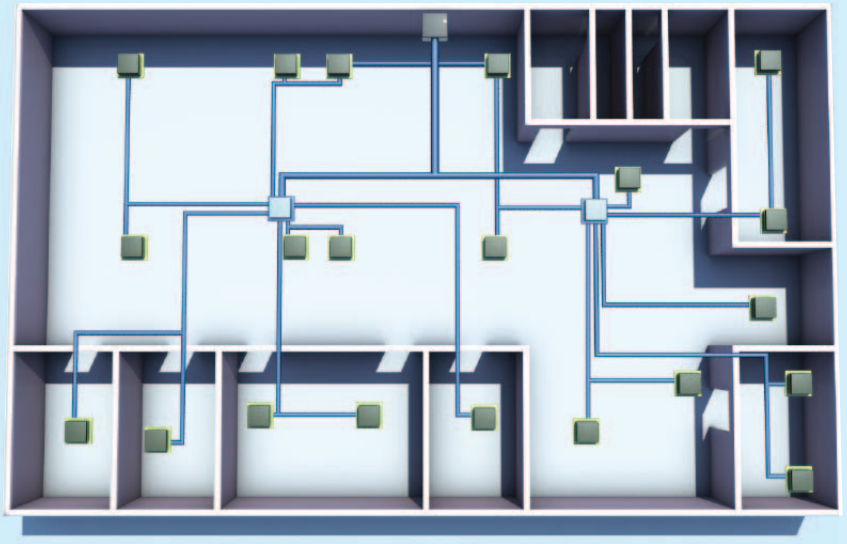
Without taking into account insulation, fixtures or labour, the notional reduction in copper piping costs would be over 32% – or around £1,100 for this floor plan.

VRV III installation – using single BS boxes



KEY: BS boxes Fan coils

New technology VRV IV installation – using multi-branch BS boxes



KEY: BS boxes Fan coils

Saving time on site

Running three pipes to BS boxes gives us better heat recovery and the best operational performance *(see page 9)*. Then from the BS boxes to the fan coils, our system uses a two-pipe configuration so that each zone has independent control of heating or cooling.

Daikin systems are the only ones that can switch from heating to cooling without needing to equalise pressure over the entire system. This was already an advantage of the VRV III system, as illustrated.

QUICK installation

Redefining efficiency in OPERATION

Operational efficiency is much more than a nominal measure of energy consumption. It is now measured in real-life application of technology through changing seasons and the varying demands of building usage across each year. Progress is less about creating entirely new components, and more about finding better ways to exploit the principles – and control the functions – of the latest technology.

Tailored to building types, sizes and usage

Every commercial building has its own individual mix of variables that influence its heating or cooling requirements. Some buildings are routinely unoccupied for part of each 24 hours, while others function around the clock. Individual areas of a building may only be in use intermittently, such as office meeting rooms, with no fixed schedule.

Across the year, seasonal weather is also a factor, but is irrelevant to certain interior zones or facilities. For example, refrigeration or chiller units in food stores, or communications rooms in offices require temperature control non-stop, all year round, regardless of external conditions.

If the installed system can fully and accurately recognise these variations, energy consumption can be maximised.

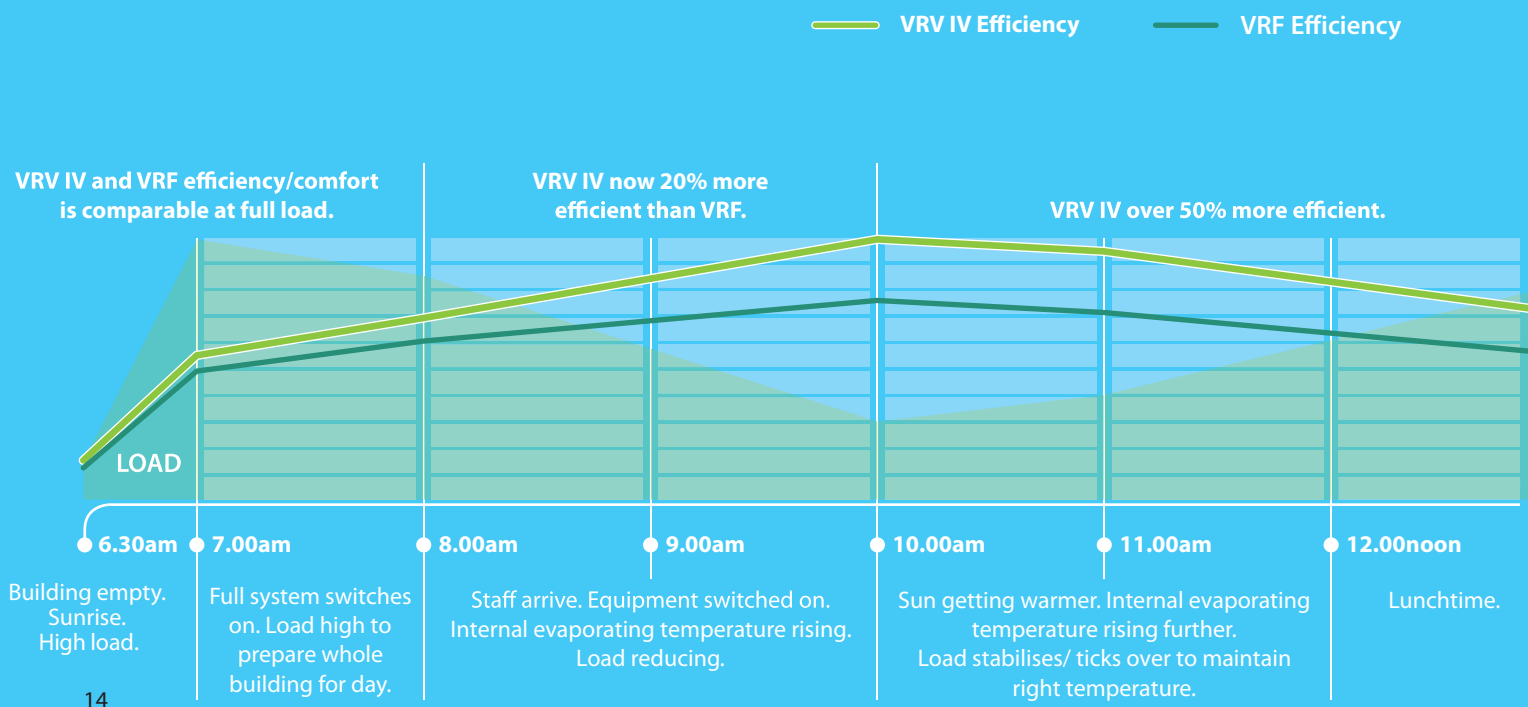
MORE
free heat

How VRV IV compares with a standard VRF* system

***Variable Refrigerant Flow**

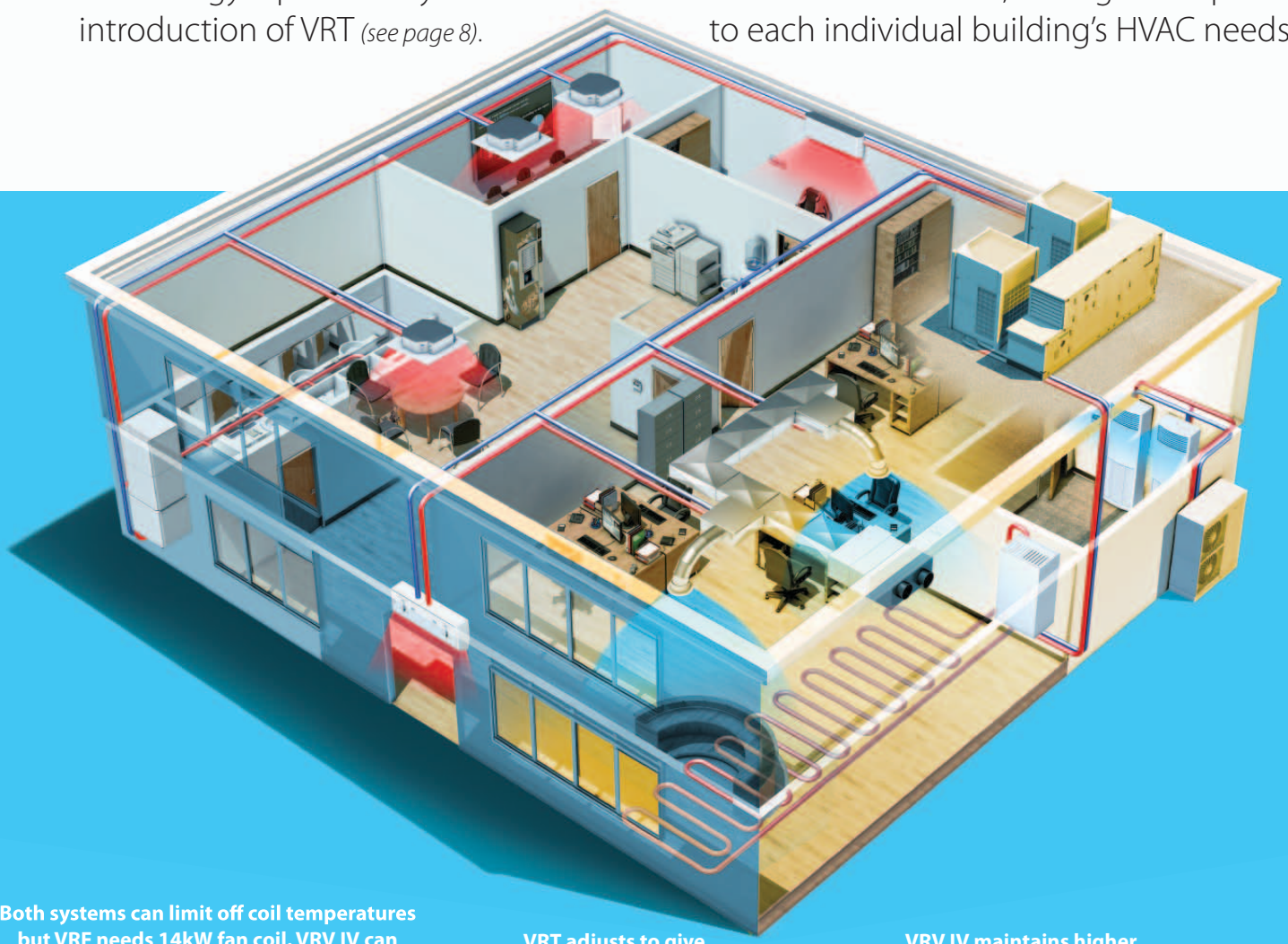
EXAMPLE: Multi-storey office block. Time: Summer

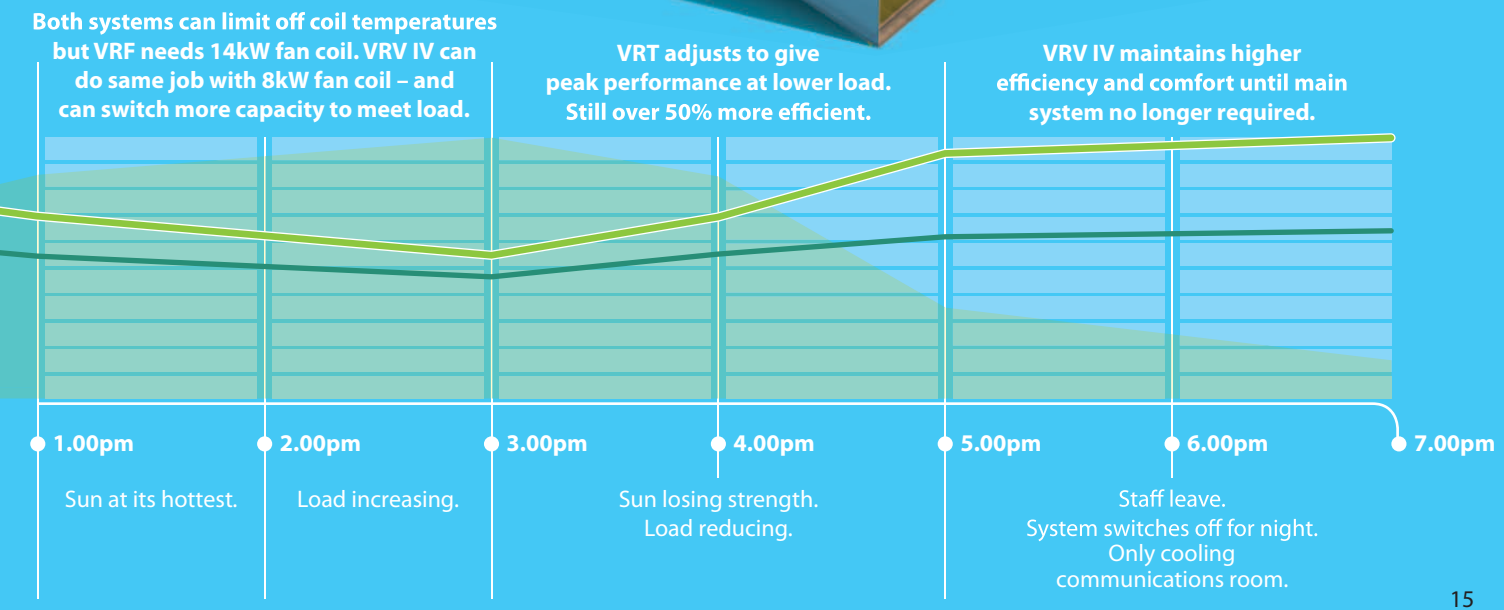
With reception area, cellular and open plan offices, meeting rooms, washrooms and communications room. Routinely occupied 08.00-19.00 Monday-Friday. Generally unoccupied outside these hours.



Daikin has found new ways to extend and enhance the capabilities of VRV technology – particularly with the introduction of VRT *(see page 8)*.

This now gives each installed system greater scope for smarter use of energy and a more sensitive, intelligent response to each individual building's HVAC needs.





Redefining efficiency in COMFORT and CONTROL

In an ideal interior environment, the temperature goes unnoticed because it is always comfortable. There are no draughts or noticeable dips or peaks in temperature. The installed systems adjust automatically and imperceptibly to the heat generated by operating equipment and to the presence of people – whether alone in a space, or together in large numbers. There is no stuffiness because the air is circulating and fresh. No energy is wasted in heating or cooling an unoccupied room.

Daikin technology now makes that ideal achievable for all types and sizes of commercial buildings – year-round.

Sophisticated controls, maximum comfort

Daikin VRV IV systems ensure that maximum efficiency is achieved while delivering consistent, total comfort for building occupants. The sophisticated controls can be local or remote, stand-alone or integrated into Building Management Systems [BMS]. Where required, they can incorporate other essential building functions as well as HVAC equipment – including lighting, IT and Air Handling Units [AHUs].

No comfort dips during defrost cycles

Whenever conventional heat pumps on building exteriors need their heat exchanger defrosted, typically heat is drawn from indoor units to melt the ice. Meanwhile, occupants' comfort level dips as the indoor temperature falls away from its designated level for a while.

This does not occur with Daikin VRV IV technology which now includes a unique Heat Accumulation Element. This supplies energy simultaneously for both defrosting and continuation of interior heating.

In heat recovery systems, continuous heating comfort is provided by defrosting one coil at a time in multi-modules.

Also, the lowest pass of the heat exchange is heated, which drastically reduces the opportunity for ice build up around the bottom of the condenser.

Adjustable VRT settings

With VRV IV, the VRT settings can be adjusted to limit off coil settings or change response times to suit the needs of every application or the preferences of every tenant.

Easier maintenance

The new Daikin technology makes it possible to disconnect up to 30% of fan coils from an installed system without affecting the rest of the installation. This means a unit can be maintained or changed while the rest of the system is still running.

The VRV configurator *(see page 13)* software includes a 7-segment indicator for fast-checking of basic system functions, review of operational data and easy-to-read error reports. It also allows systems in multiple sites to be managed in exactly the same way.

MAX
comfort

User friendly controls

I-touch Manager
complete control solution

RTD Controls RTD-20
for retail environments

RTD Controls RTD-10
for IT and office heating applications

Controls
for maximum operating efficiency

For maximum operating efficiency and comfort control

I-touch manager: touch-screen smart energy management of all installed functions.
It monitors planned energy use and helps detect where energy is being wasted. Its modular design makes it suitable for all sizes of applications, from small to large, from simple control to a small BMS*.

RTD controls: designed to manage installed systems for optimum operation so that the ultimate efficiency is achieved, with maximum energy savings and reduced emissions. Alternative versions are available for specific building types:

- **RTD-20** is designed for retail environments and can either be integrated into an existing BMS for supervisory control, or operated as a stand-alone control where no BMS is in place. It has pre-programmed functions and flexibility to take opening hours into account. It can also identify faults or incorrect operation – and alert the BMS.
- **RTD-10** is an interface for integration of Daikin systems into a BMS system that includes IT and heating systems, such as an office.

Commercial cloud control: a complete controls solution for the retail sector, particularly those with multiple branches or departments. Energy usage and fault codes can be monitored centrally for complete HVACR systems as well as lighting, boilers, fans, and other air handling units. This ability to change store level controls centrally means carbon-reducing policies can be quickly implemented at a unit cost per store that is significantly less than a traditional BMS system. This makes it viable for both large and small retail estates.

*Building Management System

Total support from Daikin UK

Alongside technological innovation, we offer the highest standards of service for all our customers: engineers and consultants, installers, property owners and developers.

So you can rely on our support being available at every stage from project design and specification through to completion and beyond.

Our services include:

System design assistance

Advanced software tools and apps to help select and accurately evaluate different system options within a building in order to identify and validate the most effective solution for each individual project.

+

Best practice training

Customised training and hands-on instruction to raise standards and expertise in installation, servicing and general maintenance of Daikin systems.

These sessions are conducted in our own industry-leading technology centres in Birmingham, Bristol, Glasgow, Manchester and Woking.

+

Dedicated aftercare service

A nationwide team of expert service engineers to ensure fast, local response, plus on-site support and advice whenever and wherever it is needed.

+

Industry-leading warranties

Every Daikin VRV system carries a 3-year standard product warranty. However, installations of our systems by Daikin Approved Installers have an extended 5-year warranty with cover that is unsurpassed in the UK. This automatically includes an annual health check and F-gas containment check, supported by our engineer network.

360° efficiency

Contact Details

Pre-sales enquiries

Please contact your local regional sales office

After sales technical support

0845 641 9200

Warranty	0845 641 9275
Training	0845 641 9260
Spares	0845 641 9230
Commissioning	0845 641 9229

your comfort. **our world.**

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