

Air-cooled Chilling Units

e-series

Case Studies





e-series Air-cooled Chiller

As a choice of HVAC system, chillers are widely used in versatile applications from commercial buildings to industrial use. With today's concerns on global warming and requirements to reduce energy use, building owners, as heavy energy users, are expected to choose energy efficient equipment.

Mitsubishi Electric's "e-series" chiller system is an air-cooled, inverter-driven and uniquely designed modular type of chiller with proven technology that offers comfort and energy conservation through daily operations.

Reliable

Founded in 1921, Mitsubishi Electric is a globally-renowned household name with a solid reputation for excellent products and services. Chiller products were first released in the 1960s for the Japanese market. Ever since then, we have focused on quality and on developing technologically advanced efficient products required in the market.



Energy efficiency

With DC inverter scroll compressors developed by Mitsubishi Electric and advanced inverter controls, the e-series ensures optimum operation according to the operation load and delivers high energy saving performance throughout the year.



Easy installation and space saving

The built-in header type is easy to install and requires less piping space.

Compared to a conventional chiller, the 90kW side-flow e-series requires less installation space, which is an advantage especially with renewals where plant space tends to be limited.

Unique modular approach

Adds flexibility and unique aspects to the e-series.



Back-up

Emergency operation allows units to continue operating, and thereby reduces the backup requirement.



Scalability

Staged installations and future expansions can be realized to meet the building's requirements.





Central air-conditioning for an office

Air Tahiti Nui Head Office

Tahiti, French Polynesia



The building's solution was to employ a mixed-use of the e-series and CITY MULTI VRF system.

The e-series fit well in the limited space and delivers high efficiency which was a clear requirement from the property.

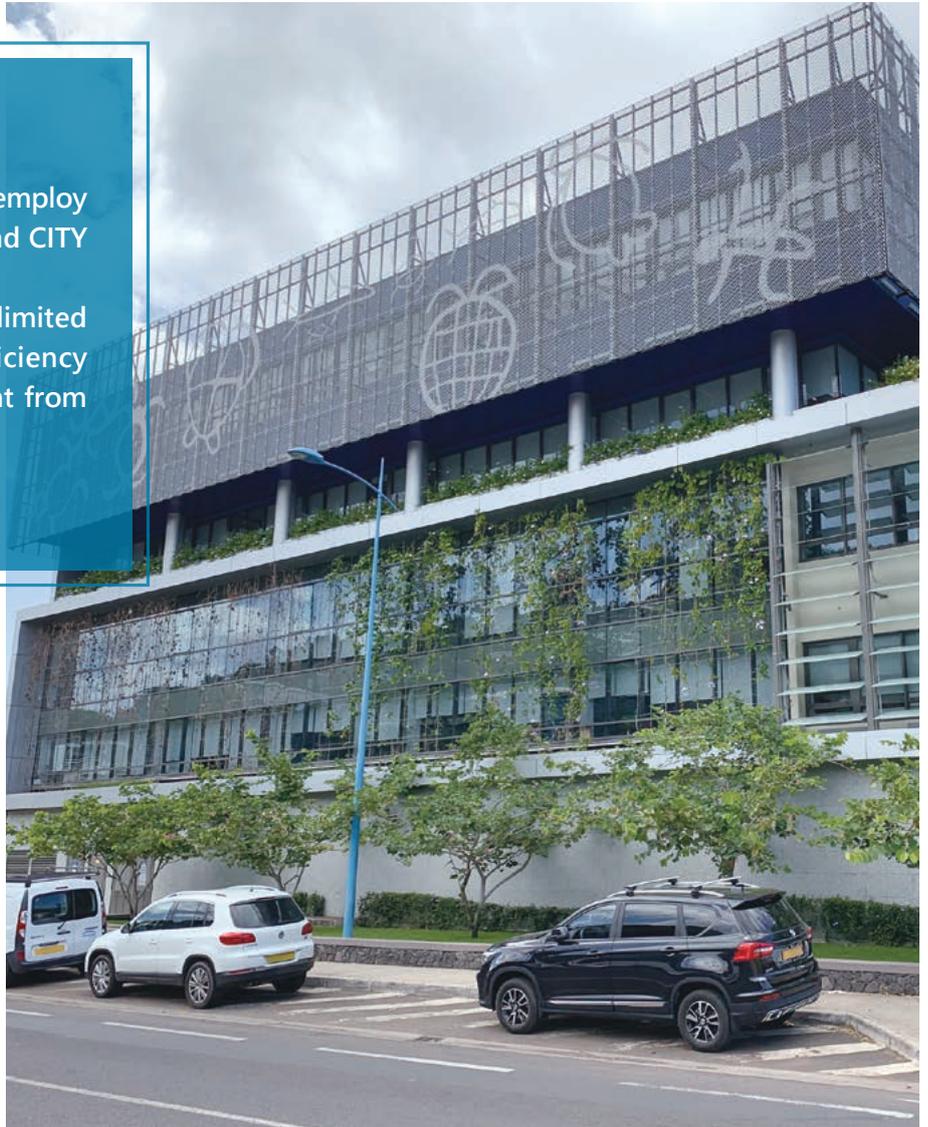
Installation

Air-source cooling only e-series chiller
EACV-P900YA-BS x 3

Centralized controller
AE-200E and PAC-IF01AHC
for Alpha controller
to control chiller pumps

<Other system>

CITY MULTI system
PUCY-P500YKA-BS x 1,
PEFY-P VMA-E x 12,
PLFY-P VFM x 4
PUHY-P250YKB-A-BS x 1,
PEFY-P VMA-E x 9,
PKFY-P VBM-E x 1



14,000m³ commercial building

Overview of the Project

Founded in 1996, Air Tahiti Nui provides air services to Tahiti from Paris, Los Angeles, Auckland and Tokyo. The newly built four-story commercial building includes the head office and is located adjacent to Faa'a International Airport. Multiple tenants occupy the building, and Air Tahiti Nui occupies four levels of the North building with a staff of approximately 360.

The Challenge

The property requested a system that would fit in the limited plant space and that delivers efficiency to minimize running cost. Depending on the number of tenants and changes in air-conditioning loads, system expansion was planned in the future.



Total of 175 fan coils connected to the e-series

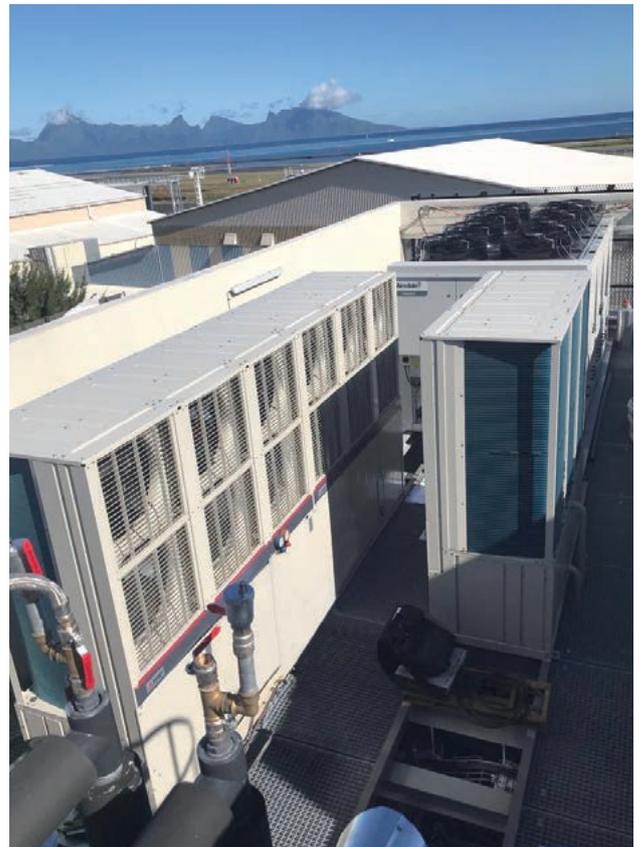
The Solution

The building's solution was to employ a mixed use of Mitsubishi Electric's modular e-series chillers for the open space and offices occupied by Air Tahiti Nui and the CITY MULTI VRF system for tenant office areas. The three e-series modules fit well in the limited space on the roof. They provide an ideal solution where plant space is limited, and yet deliver high efficiency. Considering the project's costal conditions, a heavy anti-salt corrosive model was selected to provide the necessary protection.

To achieve high performance for optimal energy savings, each module carries two inverter scroll compressors developed by Mitsubishi Electric and can operate optimally according to the load. As operation load differs depending on the time of day, high efficiency across the load was an important decision-making factor to minimize running cost.

There is also possibility to add one more e-series module if the cooling load for the building increases in the future. One of the advantages of the e-series is it's scalability based on the modular concept that enables staged installation.

The AE-200E centralized controller, controls the e-series and CITY MULTI VRF system. The e-series is controlled by the centralized controller to achieve the chilled water temperature with optimized efficiency. This is realized simply by connecting to M-NET, without the need for any additional control system.

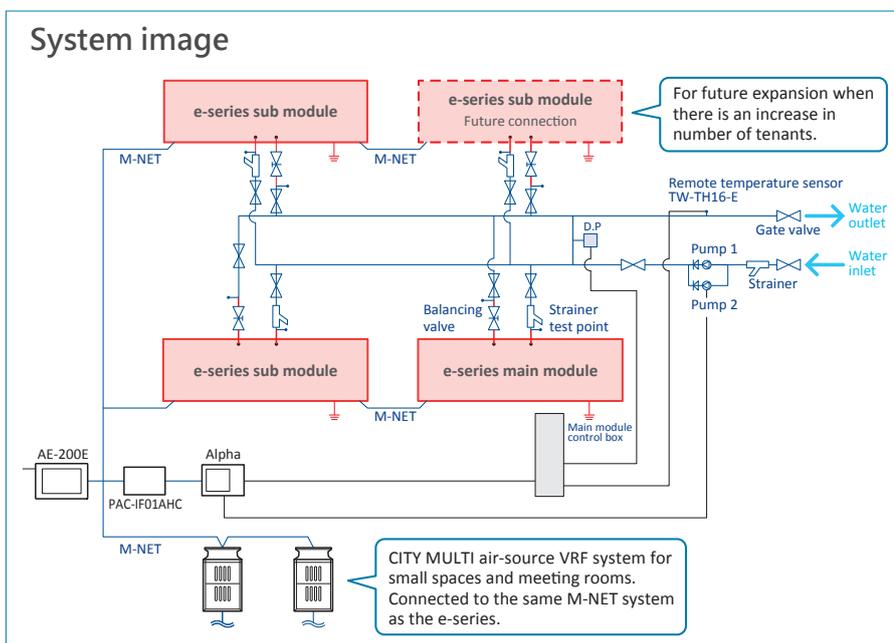


Rooftop installation of the e-series

e-series decision making factors

- Space saving and less construction work owing to the small footprint of the modules.
- Scalability based on the modular concept. This enables future expansions in stages.
- High efficiency throughout the year even at partial load minimizes running cost.

System image



CITY MULTI VRF system for tenant office areas



Central air-conditioning for an office

ASDA Head Office

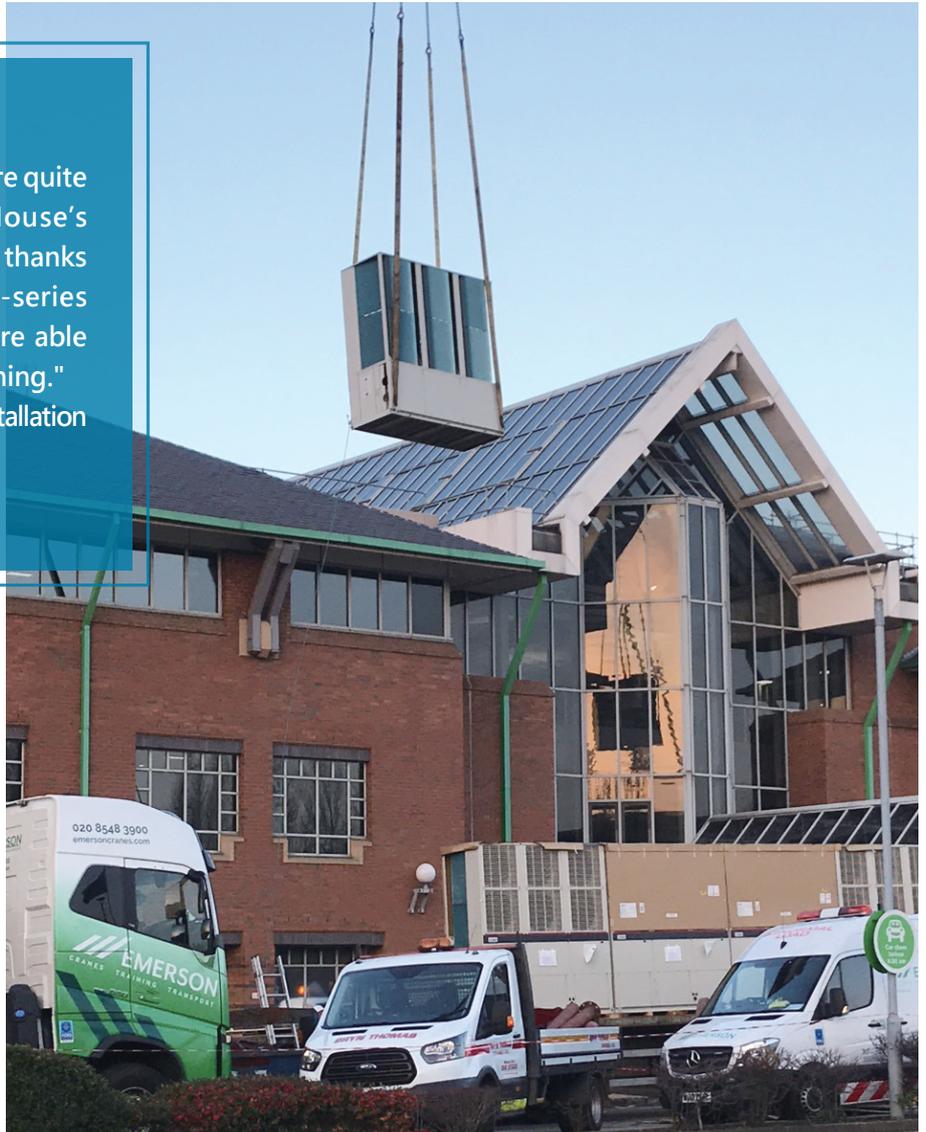
Leeds, United Kingdom



"The installation restrictions were quite challenging, given ASDA House's location in the city center, but thanks to the Mitsubishi Electric e-series chillers modular design, we were able to quickly get these up and running."
- Mentioned by a member of a installation company.

Installation

Air-source cooling only
e-series chiller
EACV-P900YA-N x 10



Overview of the Project

ASDA is a supermarket retailer founded in 1949, Leeds, United Kingdom. The site, ASDA's three-story head-office, operates as the central hub for the company and houses several functions, including office, meeting spaces, cafeterias, and customer support teams. The building needed a new, reliable, energy efficient chiller system to replace the existing outdated chiller system.

The Challenge

As the company's head office, ASDA House also needed its cooling system to be extremely reliable to deliver a comfortable working environment to the employees working in the offices and to be efficient as possible.

Also, with a site located in the heart of Leeds city center next to the river Aire, the site faces access restrictions, making ease and speed of installation a crucial factor. With only 8 hours on a Saturday available to remove the old units and install the new chillers, it was essential there was a modular solution that could work on a "plug-and-play" basis, sitting on the existing blocks and connecting to the building's existing duct work.

The Solution

Ten of cooling only e-series, total of 900kW were chosen as a solution to cool the building wing. The e-series with a common built-in header pipe helps to simplify the design, installation and maintenance of the range. It also helps to reduce space requirements, leading the e-series to be the perfect solution in a restricted urban environment.

Low noise levels were a key requirement for the same reasons: by using highly efficient components such as inflexed fan and heat exchanger designed for compact horizontal air flow, the e-series is able to offer the low noise level.

The e-series design also incorporates two high efficiency inverter-driven scroll compressors with broad operating range giving the e-series exceptional part-load efficiencies, which is how the system will operate for the majority of the time.

An important reason for the selection of the e-series was the product's resilience. This is delivered through the modular design of the system; and with over twenty compressors in the project, if a single compressor fails, 95% of the peak load can still be provided without interruption.



e-series delivered to site, carried to the rooftop with a crane.



Built-in header piping can reduce space and make water piping work simple.



e-series decision making factors

- Simple construction work and space saving with modular design and common built-in header piping.
- High efficiency throughout the year even at partial load minimizes the running cost.



Central air-conditioning for an office

Jaguar Land Rover

Warwickshire, United Kingdom



The facility manager at Jaguar Land Rover explains, "We pushed for modular due to the fact that if a unit went down, we would be able to keep the system running while that module was being repaired. It also needed to be a highly efficient system capable of looking after a design office containing 2,000 people. We looked at a number of chillers but the Mitsubishi Electric system met all of our requirements and was identified as the clear frontrunner."



Installation

**Air-source cooling only
e-series chiller**
EACV-P900YA-N x 8

Overview of the Project

Jaguar and Land Rover are two of the UK's most eminent car manufacturers, with the two brands being responsible for some of the most iconic cars in history. The Jaguar Land Rover Gaydon Center, is situated close to the village of Gaydon, Warwickshire, and is one of its principal engineering centers. The site has its own test track facilities and employs over 4,000 people.

The Challenge

Chiller systems have been used for decades to deliver controlled cooling to buildings. With increasing pressure on energy efficiency and running costs, the new system not only had to be more energy efficient, it also had to be reliable and quieter.

The Solution

Eight of cooling only 90kW inverter-driven e-series modular chillers were chosen to provide energy efficient comfort cooling to the facility. The e-series modular chiller has two inverter driven compressors that allow the unit to operate between a broad operating range. Along with its advanced inverters and sophisticated controls, the e-series can produce exceptional part load efficiencies which is where most systems will operate.

Modularity was a defining factor from the very start of the project. It enables continuous operation even when one unit requires maintenance which lessens the backup requirement.

The new system's noise level was also evaluated and contributed in offering a comfortable working environment.

With the system providing a more reliable and comfortable working environment, Jaguar Land Rover can focus its efforts on refining automotive technologies at a significantly reduced energy cost.

e-series decision making factors

- High energy efficiency throughout the year even at partial load, minimizing running cost.
- Back-up feature realized by the modular design.



Central air-conditioning for an office

Contour Homes

Manchester, United Kingdom



After experiencing ongoing problems with its old system, Contour Homes was delighted with the new e-series system, mentioning: "Mitsubishi Electric has provided us with a modern, reliable and energy efficient chiller that I'm sure will prove to be a great investment in the long term."



Installation

Air-source heat pump e-series chiller
EAHV-P900YA-N x 3

Overview of the Project

Contour Homes, part of the Symphony Housing Group, is one of Manchester's largest registered social landlords with over 12,000 properties under its ownership and management across 23 local authorities. Its main office, based on Christie Way, West Didsbury, comprises offices and meeting rooms and is staffed during office hours.

The Challenge

Contour Homes was looking for a new chiller due to ongoing issues with its old one and a system upgrade was considered. Cooling is one of the main contributors to energy usage in buildings, so Contour Homes' new system had to be energy efficient to help the building comply with modern efficiency requirements.

As well as the efficiency benefits, the level of noise was to be taken into account as employers have a duty of care to ensure that their workers are not exposed to excessive noise.

Another potential issue was the fact the existing plant space is extremely tight, making access to the area very difficult. Interruption to office opening hours and staff activity also had to be kept to a minimum.

The Solution

The e-series' unique modular approach not only achieves the efficiency required, it allows up to six individual units to be connected together to provide a system capacity from 90kW to 540kW. Using this modular approach reduces space requirements and simplifies lifting and installation.

The Managing Director at the installation company has commented: "The e-series chiller was a sensible choice as it was available immediately. The only concern we had was the tight working space, but the flexibility of Mitsubishi Electric's modular approach meant it could be easily manoeuvred into position."



e-series decision making factors

- High energy efficiency throughout the year even at partial load, minimizing running cost.
- Space saving and simple installation with the modular approach.



Central air-conditioning for an office

264 Mt Eden Road

Auckland, New Zealand



The e-series was the best fit for the narrow plant space down the side of the building, which was the key obstacle of the project, and to meet the short installation schedule.



Installation

**Air-source heat pump
e-series chiller**
EAHV-P900YA-N x 3

Controller
PAR-W31MAA-J x 1

Overview of the Project

264 Mt Eden Road is a commercial building in Auckland that has been redesigned and upgraded from a VRF system to a system that uses a hydronic chiller and fan coil units to satisfy the needs of the new tenants. The refurbished property includes offices and lab testing facilities for the new tenants.

The Challenge

A brand new 250 - 300kW cooling system was required to replace the existing VRF units to cater to the cooling demands of the building's new offices and laboratory. The new chiller was to be installed along the side of the building, which was converted into a plant space. A key obstacle of this project was that the available installation space was extremely narrow. The space needed to accommodate the new chiller with adequate clearance for air circulation and maintenance access. The project also allowed only an extremely short time frame for the new chiller to be installed, commissioned and operational.

The Solution

With a small footprint, three 90kW e-series chillers were ideal for the confined plant space providing 270kW of cooling.

The 90kW e-series chiller is 900mm in depth and has prepackaged built-in headers. As it only requires a 900mm clearance for electrical servicing (fan facing side) and a 750mm clearance for mechanical servicing (condenser coil facing side), it fit well in the space available. Also, with the incorporated field water pipe headers, not only could the external piping space be reduced, but also that on-site water piping work could be simplified and less time consuming.



Single-row installation of the e-series along the building



e-series decision making factors

- **Space saving** with the use of the built-in header piping model that would fit well in the narrow plant space.
- **Time saving** with the use of the built-in header piping model that includes headers to make on-site water piping work simple and less time consuming.



Central air-conditioning for a hotel

QT Wellington

Wellington, New Zealand



The hotel's choice was to use both a chiller and VRF system from Mitsubishi Electric's product lineup: the e-series chiller for the open floor spaces and the standard CITY MULTI VRF system for the guest rooms.



Rooftop installation of the e-series

Installation

**Air-source cooling only
e-series chiller**

EACV-P1800YBL-N-BS x 1

Overview of the Project

Established in 2011, QT Hotels & Resorts offers unique boutique hotels across Australia and New Zealand with a focus on art and design. QT Wellington is located on the Wellington waterfront and is renowned for its artistic design and quality accommodation and fine dining. It boasts a large collection of contemporary New Zealand art.

The Challenge

The mechanical work required for this project included the replacement of the 180kW air-cooled chiller pipework and ancillaries that were installed in 1990 and a modification of the plant platform on the roof.

The Solution

The e-series chiller was chosen for its high seasonal efficiency. Equipped with four high-efficiency inverter compressors developed by Mitsubishi Electric, the e-series ensures optimum operation according to the operation load. Also, the built-in header type was selected to reduce construction work and still provide the capacity needed for the existing 48 fan coil units.

The e-series system provided a solution for the open floor spaces, and standard CITY MULTI system for the guest rooms.



e-series decision making factors

- Less construction work especially with the built-in header model.
- High efficiency throughout the year even at partial load minimizes running cost.



Central air-conditioning for a hotel

Ancora Punta Cana Private Residence Yacht

Punta Cana, Dominican Republic



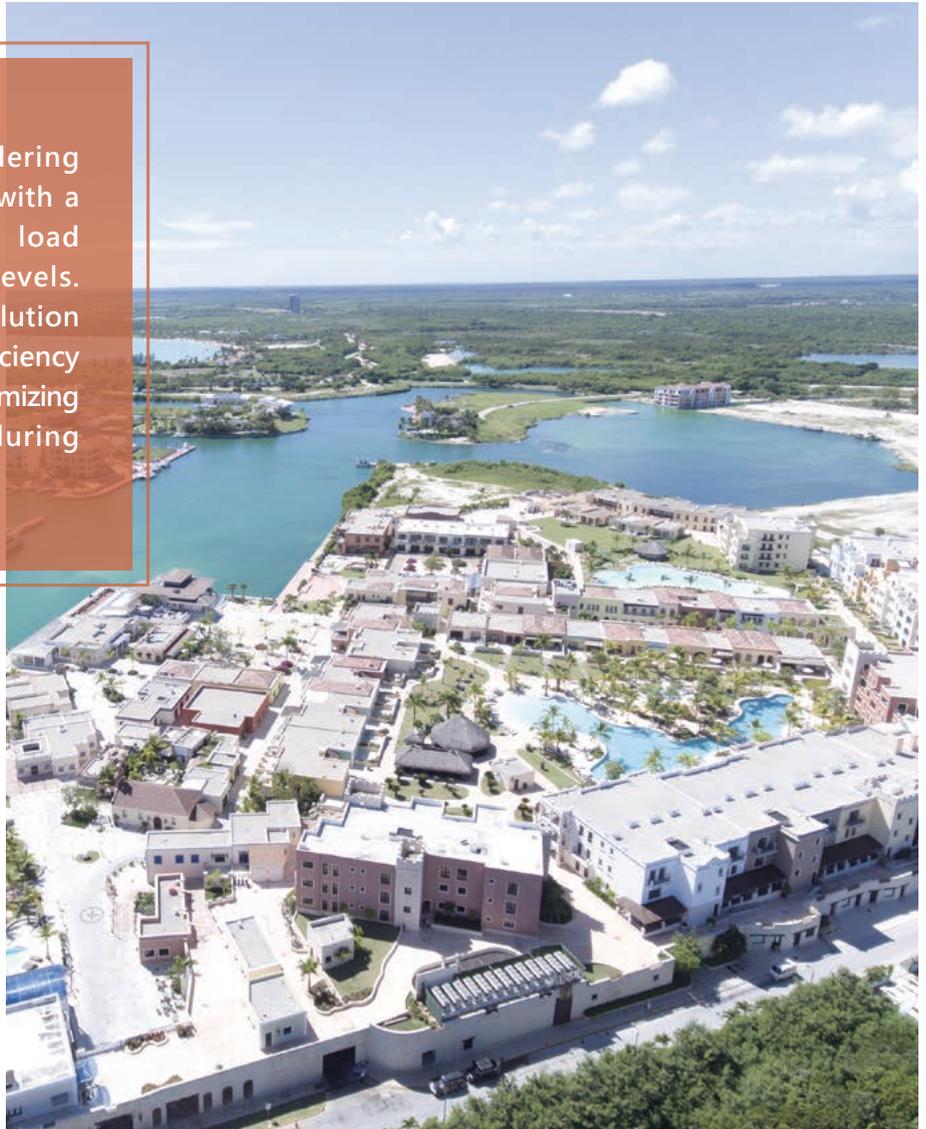
The property was considering replacing its HVAC system with a system with high partial load efficiency and low sound levels. The e-series was an ideal solution for ensuring high system efficiency across different loads and minimizing the risk of downtime during replacement.

Installation

**Air-source cooling only
e-series chiller**
EACV-P1800YBL-N x 13

* Using a power transformer,
local 480V is converted to 380V to
meet product specifications.

Centralized controller
AE-200E



Overview of the Project

Ancora Punta Cana is a residential/hotel property located in Cap Cana Marina, considered one of the largest and most luxurious marinas in the Caribbean. Surrounded by inland marinas on the Caribbean Sea, travelers can experience a luxurious resort time with ultimate service and facilities. The resort offers a total of 300 suites of different sizes, a variety of cuisines, things to do and amenities to its guests.

The Challenge

The property was considering replacing its HVAC system which originally consisted of water-cooled chillers. A new system was requested that would provide high system efficiency throughout the day even when the load changes between day/night and a low operating sound not to disturb the calm atmosphere. Another key consideration was to carry out the replacement without closing business.

Club and Marina



Collective installation behind the building.
Originally, the space was occupied by the cooling tower of the water-cooled chillers.

The Solution

Initially, two of another manufacturer's 400 tons chillers were considered, but Mitsubishi Electric made a last minute attempt by proposing the e-series as an ideal solution to the property's requirements.

Having the industry leading efficiency was one of the main reasons the e-series became the final choice. Since guests are out enjoying the Caribbean Sea during the day and back at night, the cooling load differs largely between day and night. The e-series system can efficiently operate across different loads with optimum frequency control between modules. By simply connecting to M-NET, the frequency of the inverter compressor is automatically controlled to maximize the efficiency of the whole system.

Also, the aspect of modular units minimizes the risk of downtime during replacement. The project was divided into two stages. Chillers were first replaced and connected to the primary pump system to supply cool water. Then, as a second step, the system was integrated with the secondary pump for optimal operation.

The property owner also highly evaluated the simpler maintenance without a cooling tower and the low operating noise level, which was an important factor for the hotel and residential properties. Utilizing highly efficient components, the e-series achieves low operating noise.

The e-series serves all the fan coil units and air handling units in the property's facilities, which include 299 hotel rooms/residences, 7 restaurants, bars and fitness centers.

Installed system image



System 1
180kW x 6 modules



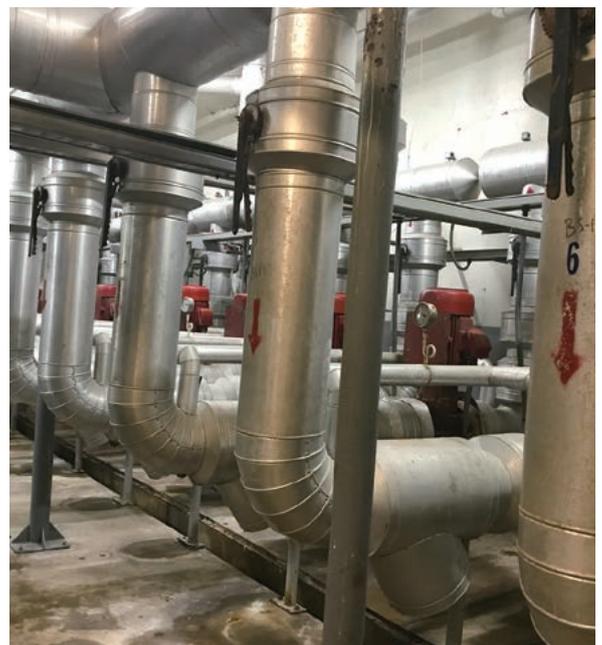
System 2
180kW x 6 modules



Backup
180kW x 1 module

e-series decision making factors

- High system efficiency across different loads with optimum frequency control between modules.
- No closing of business during replacement with staged installation realized by the modular concept.



Water pipes and pumps installed in the mechanical room located below the unit.

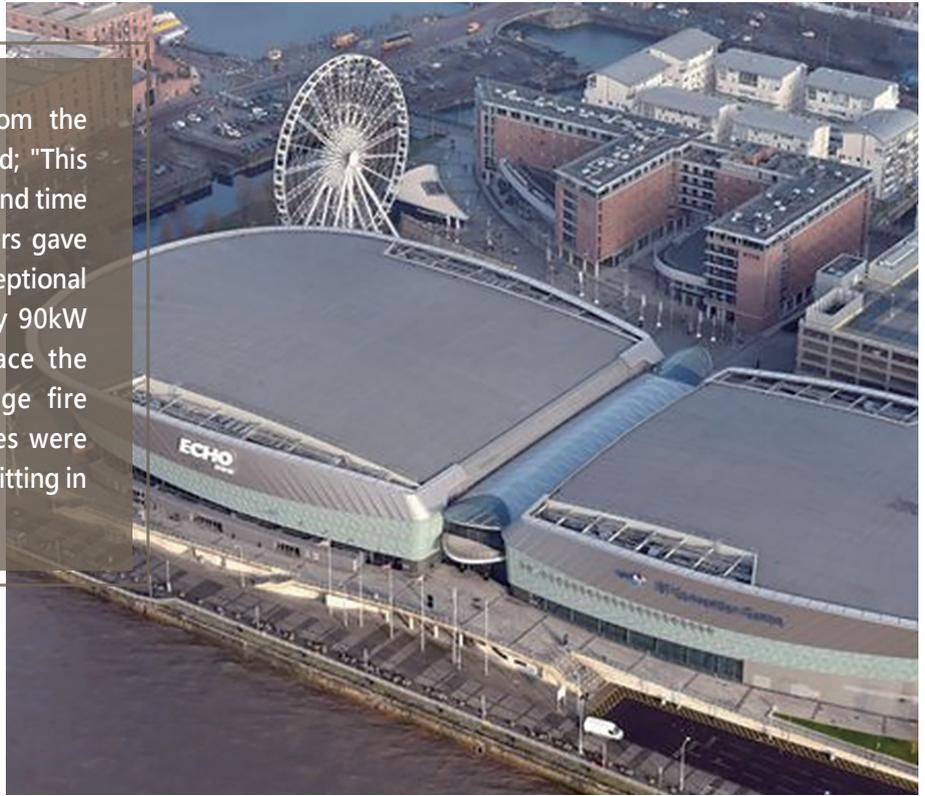


Central air-conditioning for entertainment and cultural facilities M&S Bank Arena (ACC Liverpool)

Liverpool, United Kingdom



The Senior Project Manager from the engineering company commented; "This was an extremely large, complex and time critical project, the e-series chillers gave us the ability to provide an exceptional solution." Forty six cooling only 90kW e-series were installed to replace the damaged chillers from the huge fire incident. Being modular, e-series were able to realize staged installation fitting in a narrow plant space.



Installation

**Air-source cooling
only e-series chiller**
EACV-P900YA-N x 46

Overview of the Project

The ACC Liverpool Group operates the Arena and the Convention Centre which are connected to each other. The Arena part provides live music, theater, sporting events and comedy performances with audiences up to 11,000. The Convention center consists of the exhibition space, break-out rooms and auditorium flexible to host different venues.

In December 2017, a huge fire devastated the car park adjacent to the arena, where the chiller system was housed, causing irreparable damage to the structure of the car park and damaging the chillers.

The Challenge

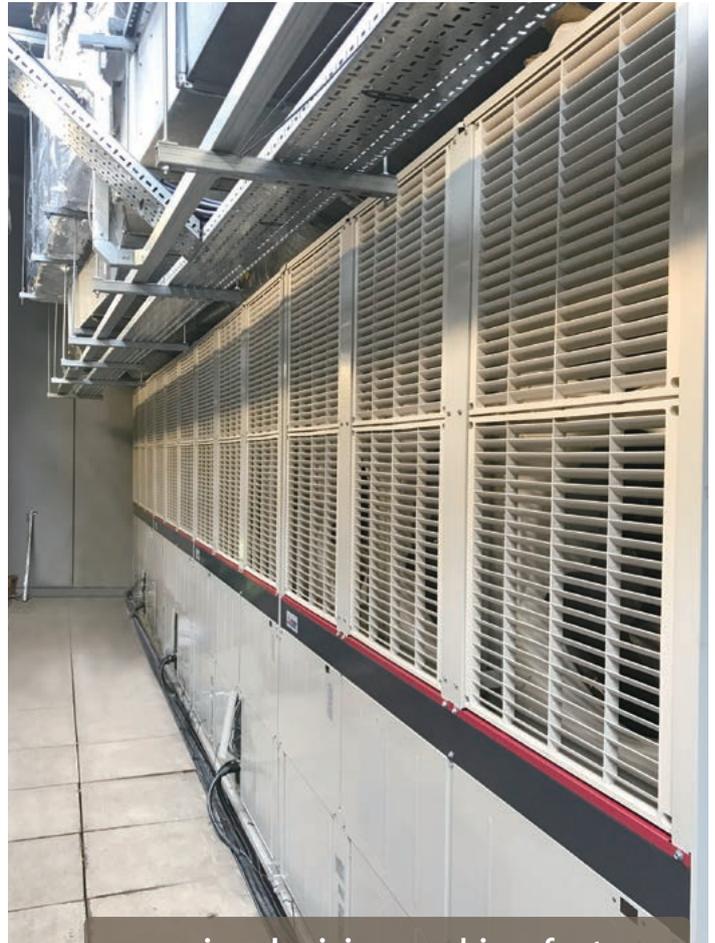
When deciding on a solution, the owners were faced with the challenge of limited space both on and around the arena for any new chillers to be located. The Arena's existing air handling units (AHU) were housed in four small rooftop plant areas, but the narrow walkways around the AHUs did not offer sufficient space for a traditional chiller system to be installed.

The Solution

Forty six cooling only 90kW e-series modular chillers were chosen to provide energy efficient comfort cooling to the Arena & Convention Center. Eleven units were installed on each of the four roof plant and connected to AHUs serving the Arena's open space and the Convention Center's meeting rooms and spaces. In addition, there are another two chillers installed on a gantry within the loading bay which serves the kitchens for the facility located in the basement.

The roof top plant areas of the Arena and Convention Center are very congested, having only small and narrow strips of unoccupied space available to receive any new or additional plant. With the e-series chillers being available in compact modular units, the e-series were an ideal solution for the project. Moreover, the built-in header type simplified the on-site water piping work. With the saved time, the venue was able to reduce the costs associated with the hire of temporary cooling.

The e-series also met the high energy efficiency standards, reducing operating costs. With two inverter-driven compressors each, the modules have a wide operating range providing significant real-life efficiency savings.



e-series decision making factors

- Space saving and time saving with common built-in header piping.
- High efficiency throughout the year even at partial load minimizes the running cost.



e-series installation on the plant decks



Process cooling for a farm

Annandale Dairy Farm

Tasmania, Australia



A key requirement for the chiller system was to maintain the temperature of the milk vat and be able to operate efficiently across the daily milking load of the dairy where anywhere from 30 to 300 cows are milked per day.



Installation

Air-source cooling only
e-series chiller
EACV-P900YA-N x 1



Milk vat and DX chiller



Milking parlors

Overview of the Project

Located in Tunbridge off the Midland Highway in Tasmania, the Annandale farm covers 2600ha of land, including a dairy that raises approximately 750 dairy cows. The dairy milk that is produced here is supplied for products across Tasmania and further across Australia.

The Challenge

In a dairy farm's cooling process after milking, it is critical to maintain the milk temperature to the industry standard, generally between 4°C and 6°C (39.2°F and 42.8°F).

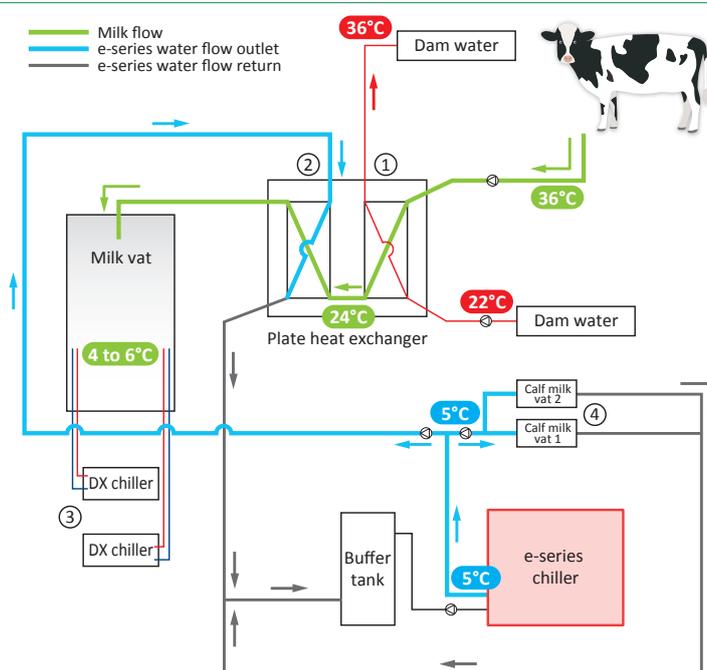
To reduce operating costs, a chiller system was strongly requested that could operate efficiently even at partial load, as anywhere from 30 to 300 cows are milked per day. The capacity for redundancy was also critical in this application, so it was time for an updated chiller system.

System image

The chiller is coupled to a plate heat exchanger, which supplies chilled milk to the vat.

- ① The milk is initially chilled through an economy cycle that uses dam water.
- ② The milk then passes through the second stage where it is chilled using with an ethylene glycol mixture from the e-series chiller and supplied to the vat at 5°C.
- ③ The once overworked milk vat DX chiller units, which were previously required needed to pull lower the entering milk temperature, are now only used to maintain the storage milk temperature.
- ④ Additionally, the e-series chiller can be diverted to two smaller vats for calf milk production.

*Equipment other than the e-series procured locally.



The Solution

The e-series was the ideal solution for the main chiller unit. Optimally controlling the compressor frequency, the e-series offers high rated and seasonal efficiency. With the daily milking load varying from 30 to 300 cows, having a high partial load was especially important to meet the requirement for minimized running cost.

The system's specification also provides for a wide range of water and ambient temperatures to cater to a broad range of process cooling applications.

For control, the Modbus® connection provides a high level of control to monitor the e-series chiller. Given the remote location of the farm, this enables the chiller to be monitored and controlled by a service provider located many kilometers away. The e-series chiller provides an effective solution for automated control, reliability and redundancy in an easily configured system.



Plate heat exchanger



e-series, buffer tank and calf milk vat 1&2 (from right)

e-series decision making factors

- High efficiency at partial load even when the load (number of cows) changes, minimizes running cost.



for a greener tomorrow

Eco Changes is the Mitsubishi Electric Group's environmental statement, and expresses the Group's stance on environmental management. Through a wide range of businesses, we are helping contribute to the realization of a sustainable society.

⚠ Warning

- Do not use refrigerant other than the type indicated in the manuals provided with the unit and on the nameplate.
 - Doing so may cause the unit or pipes to burst, or result in explosion or fire during use, repair, or at the time of disposal of the unit.
 - It may also be in violation of applicable laws.
 - MITSUBISHI ELECTRIC CORPORATION cannot be held responsible for malfunctions or accidents resulting from the use of the wrong type of refrigerant.
- Our air-cooled Chilling Units contain a fluorinated greenhouse gas, R410A (GWP:2088). This GWP value is based on Regulation (EU) No. 517/2014 from IPCC 4th edition. In case of Regulation (EU) No. 626/2011 from IPCC 3rd edition, this is as follows. R410A (GWP:1975)

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