

# Sydney Buildings Choose Dry and Spray Liquid Coolers Instead of Cooling Towers

David Goodwin

**A new commercial development in Sydney's north-western suburb of Macquarie Park, is the first in Australia to use LU-VE Dry and Spray Liquid Coolers.**

The development comprising two modern low-rise buildings, owned and managed by the Investa Property Group, were also the developer for the project. Both building 6 and 7 have five upper levels of office accommodation and four ground floor tenancies. The consulting engineer on the project was Roger Hurley of Umow Lai Enginuity who has worked for the company for the last ten years.



Left: building 6 and right building 7 at Macquarie Park

"The architect on the project was Ray Brown of Architectus and the builder was Buildcorp. My contact at Buildcorp was the construction manager, Brendan Dunkin," Roger said.

"The air conditioning tender was based on a design and construct contract and Umow Lai Enginuity had a watching brief for Investa. The project started in March 2006 and was completed in 2008. We are now coming up to the first year of operation.

"Investa brought our company in on the project and we did all of the services design up to 80% complete which was finished off by Buildcorp and their subcontractors. The mechanical services contract on the project was handled by mechanical engineer, Tim Hockey of J.L. Williams.

"There are two water cooled, variable speed drive, centrifugal chillers servicing both buildings in the rooftop plantroom of building six. A single boiler services both buildings.

"Pipes from the chillers link through the underground car parks of both buildings. The chilled water system is linked to central air handlers on the roof of building 6 and

separate floor air handlers for building 7

"There is a separate tenancy condenser water circuit served by the two LU-VE's WD10 Dry and Spray Liquid Coolers. Provision has been allowed for package air conditioning units on each floor giving supplementary cooling for each of the tenants.



The two LU-VE WD10 are 320 kW each

"A retail chilled water circuit has a conventional cooling tower attached on building six. It's important to keep all the retail air conditioning away from the commercial tenancies for the National Australian Built Environment Rating System (NABERS) which measures a building's operational impacts on the environment."

NABERS ratings are based on actual data relating to the performance of a building over 12 months and covers a wide range of issues, including lighting, greenhouse gas emissions and waste management etc., as part of the overall rating.

Roger was introduced to the LU-VE Dry and Spray adiabatic cooling systems as he was part of a group of consultants who visited the headquarters of the LU-VE Group in Ubuldo Varese in Italy, sponsored by the managing director of the Australian sales office, John Mignano, of LU-VE Contardo Pacific in conjunction with Cosair Products. "The quality assurance and R&D at their plant was just magical," Roger said.

"I had a huge challenge convincing the builder and contractor on the project that the system would be cheaper to run than cooling towers. It's always harder to get new equipment like this approved the first time.

"The LU-VE liquid cooler units service the tenancy condenser water circuit 24 hours a day, seven days a week. When we did the economic proposals with Investa we couldn't do it using conventional cooling towers on the tenancy water circuit. The

figures just didn't stack up on the amount of water the cooling towers would need throughout the year.

"The liquid cooler sprays are only needed three to four months in summer and early autumn, and the rest of the year the units generally work as air cooled closed circuit coolers. Because you don't have a complete load on the building you are in a better position to do air cooling. The expected water saving compared to a cooling tower is 70% with the LU-VE Dry and Spray Liquid Coolers," Roger explained. A conventional cooling tower is running constantly using water day and night.

"Fan noise was a consideration and Investa needed the units to run quietly. Air cooled closed circuit coolers can be a problem with noise. "What LU-VE has done is to design a unit complete with all its control modules built in. It has variable speed drive (VSD) and instead of the fans cutting in and out all the time they ramp up and down depending



The VSD fan controller

on the tenant's load requirements. Even though there are more fans than a conventional cooling tower the energy use is 5% less

"The beauty of the LU-VE liquid coolers is the VSD and spray control systems are all fully intergrated parts of one unit. If you were to buy a cooling tower you need to organise a separate supplier for the VS1 and make all the connections. There are often problems connecting up different systems. It's good that it's all in one package.

"One of the important things to remember that the equivalent of this system using

cooling towers would be that you would have to have heat exchangers and two sets of pumps because you can't pump open circuit condenser water, direct to the package units as the condenser fouling potential would increase dramatically.

"This system solves that problem because it is a closed circuit system. The condenser water is separated from the outside air and the sprays don't operate until the temperature goes over 20°C. The amount of water sprayed is totally evaporated and there is no basin. With the LU-VE Liquid Coolers' Dry and Spray system we don't have to worry about Legionella.

## The Advantages of Dry and Spray

The NSW distributor for LU-VE on the project was the managing director of Cosair Products, Matt Cosgrove. "The two LU-VE WD 10 Liquid Cooler units can be used two ways, condensing refrigerants in a DX system or as a liquid cooler with a 'Dry and Spray' adiabatic spray system for condenser water applications like the Macquarie Park project," Matt said.

"The new range of large capacity liquid coolers and its 'Dry and Spray' operating principle is the result of a long research activity and testing carried out in LU-VE laboratory with the supervision of scientific consultants from the Politecnico di Milan. The R&D and industrial research program was financed by the Italian Education, University and Research Ministry.



Left: Matt Cosgrove examines the working spray system with Roger Hurley on his right

"The WD 10 units are 320 kW each with fan dimensions of 800 mm diameter. The 10 sickle blade axial fans on each unit are all on inverter VSD control for greater energy efficiency. As the load comes off the fans are controlled by a water temperature sensor which is set at 29.5°C. As the water temperature increases it will in turn bring the fan speed up. The design temperatures of the system are 35°C./29.5 °C when the outside air wet bulb is 24°C

"The water in the tenancy condenser water circuit doesn't need to have Glycol added because of the ambient conditions in Sydney but if the system were in colder climates like Canberra glycol could be added because of the potential for the water freezing in winter if the system were to be down for any length of time.

The water temperatures entering the liquid coolers are 35°C cooled down to the set point temperature of 29.5°C," Matt explained.

"The unit's control system will operate the dry and spray cooler to maintain the supply water temperature regardless of the ambient conditions. Depending on the temperature at the time it will run fans up to 90% of their speed and then the spray system energised sequentially to maintain the set point temperature of 29.5°C."

The LU-VE system can be applied to water cooled chillers to cool the condensing water and for heat rejection in the refrigeration process, according to Matt. "It works the same way with package units. They have a refrigeration system and a water cooled condenser and reject heat through the Dry and Spray Liquid Cooler," he added.

## Water Treatment

The reasons for the water treatment for the Dry and Spray system on the LU-VE liquid coolers is to soften the water to remove any scale and to balance the PH. Scale impurities can build up on the fins of the coil. The water is stored in a 500 L tank and then distributed to the high-pressure pumps and travels up to the spray areas, According to Matt. "The water isn't recirculated. It's only used once and is replenished by a float switch," he said.

"The water treatment was to be an



The water treatment system

osmosis system, as used in Europe, but the quality of Sydney water is so much better than it is in Italy, we were able to cut down to a much more cost effective water treatment as devised by LU-VE Group engineers in Italy. It is maintained on a monthly basis by Integra Water.

"There are evaporative cooling pad systems on the market for closed circuit cooling but the dry and spray eliminates any maintenance issues associated with the buildup of dirt and debris on the pads, reducing efficiency, airflows and capacities as the pads load up and deteriorate.

"There is the spray control module and a fan speed control module on each unit. The system works by running dry up to 90% of full fan speed at which point the first spray sequence is energized and as further cooling is required it will bring on



Roger Hurley examines the spray system controller

the second sequence of sprays," Matt said.

"An ambient temperature of about 20°C will bring on the sprays but it also depends on the load requirements of the tenants. It's not only relying on the ambient conditions but the load profile as well.

"We are really impressed with the coils. They are made of aluminium but there is no evidence of corrosion or scale deposits



The spray system solenoid valve

due to the specially developed LU-VE water treatment system, Matt said.

"There is a solenoid control system with a high pressure pump. The spray water enters the system and is controlled by a solenoid valve. Water treatment is part of the supply package.

"Investa have a Web based EPT metering system on all their buildings and will be able to measure the water usage of the Dry and Spray Liquid Coolers throughout this summer to confirm how much water was used by the system," Roger said.

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