

The First Australian Hospital with the H-Series Air Handler

David Goodwin

Celebrating its 160th anniversary this year, The Royal Melbourne Hospital at Parkville, just north of the CBD, is the oldest hospital in Victoria, built just before the gold rush in 1848. It's also the first hospital in Australia to install the H-Series Surgical and Hospital Air Handlers designed in Italy by Tecnair LV, a LU-VE Group Company.



The Royal Melbourne Hospital

The Key Account Manager, Andrea Monti, for Tecnair LV told *Celsius*, to understand developments in hospital and surgical theatre air conditioning we need to go back to the middle of the 1960s. "Until then the surgical theatre was air conditioned the same as a laboratory, a hospital ward or a commercial office. "Like most buildings at that time, the heating and cooling of the air was with done using fan coils, and the ventilation by opening a window," he said.

At their factory at Uboldo, Varese near Milan in Italy, Tecnair LV engineers followed three guidelines when designing hospital air conditioning. "First, a lot of fresh air was needed to minimise the chemical contamination of mainly anaesthetic gases. The fresh air flow rate was governed by the local standards - on average around 1500 m³/h. Next, was the absolute filtration of the fresh air flow to prevent the entry of bacteriological contamination, and the third was to over-pressurise the room to avoid contamination entering if a door was opened," Andrea said.

"In this model there was a mixture of sterile air coming through an absolute filter, entering the room from above, with enough speed to create turbulence. The objective was to mix the sterile air with the contaminated air, reducing the contamination by dilution.

"The results of this design was reasonably good, but the contamination, even when reduced, was the same over the wound being treated as in the most distant corners of the operating theatre.

"In the 1990s this way of air conditioning was considered inadequate for the most delicate operations, such as orthopaedics (bone operations). In fact a bone, which is not irrigated by blood, cannot be treated with antibiotics. If there is an infection the

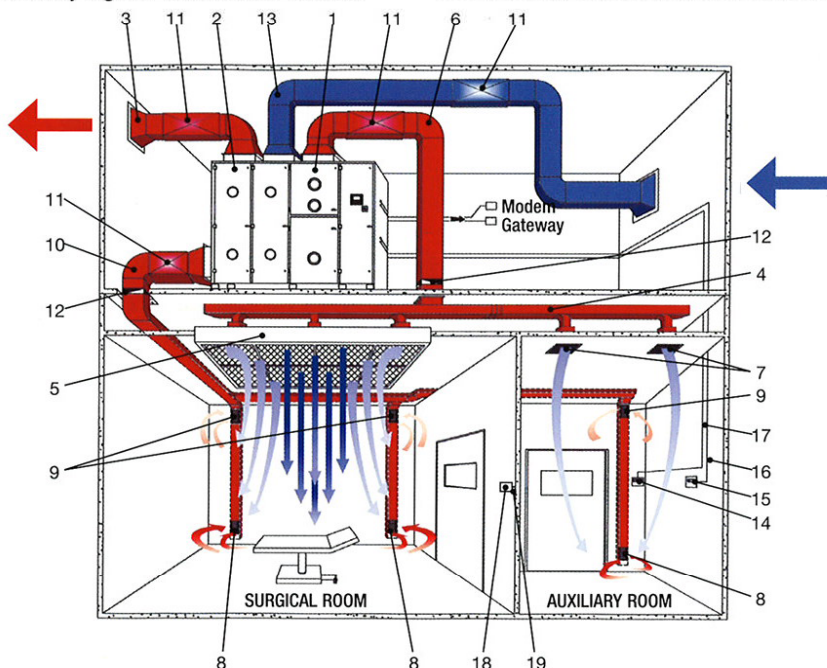
wound must be reopened and treated.

"We developed a new project for very high air quality surgical rooms. To get the best possible air quality (ASHRAE ISO5) a laminar air distribution system was designed where the air descends parallel to itself from the absolute filters to the wound making sure there is no possibility of contaminated air," Andrea said.

"The very high air flow needed was not

High Fresh Air Flow

"Chemical contamination from anaesthetic gas control can't be filtered but needs to be diluted with fresh air. Flow consistency is controlled by the microprocessor controlling the unit through the inverter on the air discharge fan. If the unit needs to supply to more than one room a constant pressure in the duct air flow system is needed using a differential pressostat on



1. Supply fan
2. Exhaust fan
3. Exhaust duct
4. Electric or water heating coil
5. Absolute filter H12 or H14
6. Supply air duct
7. Air diffuser with absolute filter
8. Lower filtered air intake (G4)
9. Higher filtered air intake
10. Air suction duct

11. Sound damper (hospital type)
12. Cut fire damper
13. Fresh air intake duct
14. Differential pressostat supplied loose
15. Interface for remote control (accessory)
16. Shielded cable for remote presostat
17. Telephonic cable for remote interface
18. Temperature and humidity feeler
19. Connection cable between the feelers and the unit

practical because of the cost so we create two different zones in the same surgical room. A central zone is called 'aseptic nucleus', where the surgeons are operating on the patient, the operating table and the instrument table are, protected to ISO5 and a second zone encircling it, where the air quality level comes up to ISO7."

The Components of the H-Series Air Handler

The Structure

Andrea described the structure of the H-Series: "The unit is made with welded steel plates, puttied for air tightness. A metal-coating and primer is applied after rigorous sandblasting and it is painted with a 60 micron white epoxy coating. The sealing and the surface gives maximum resistance to Legionella pneumophila and bacteria after steralisation.

"The H-Series unit has been designed for both indoor and outdoor installation," Andrea said.

the supply mouth of the air handler to measure the pressure inside the supply duct and adjustments are made where necessary, based on the set points programmed into the microprocessor," Andrea said.

Very High Filtration

"To eliminate bacteria contamination carried into the room by the fresh air flow pre-filtering (F6 efficiency) is necessary and post-filtering (F9 efficiency) of the air after the fan at the inlet of the air discharge. The unit supplies 800/1000 Pa static pressure for the outdoor air intake and discharge ducts. An absolute filter is installed in each of the supply air ducts to emergency procedure rooms or surgical theatres. The unit has an F5 filter at the inlet of the return air duct before the extract air fan to keep the unit clean," Andrea said.

"The H-Series is easy to use and unlike an air handler that is designed for one application the unit is plug and play and simple to use."

The Royal Melbourne Hospital Projects

A \$56.3 million redevelopment on the RMH Emergency Department (E.D.) got underway in 2007, to improve facilities and increase the size of the E.D., allowing the hospital to cater for population growth and the needs of the community.

The Victorian State Government funded project included a new front entrance for the hospital and retail spaces.

The current Emergency Department was built in 1993 and, based on service planning at that time, would accommodate up to annual 35,000 attendances a year. The project will be completed in 2009, when attendances are expected to reach up to 60,000. Although the H-Series air handlers were originally designed for surgical theatre applications they can be easily adapted for use in the Melbourne Hospital E.D.

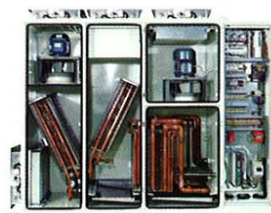
A.G. Coombs won the mechanical services contract for the project. The consulting engineers are Waterman International, headed by Philip Barnes, a Director of the company.

Philip told Celsius he has worked for the company for 15 years as a Mechanical Engineer and the upgrade of the Royal Melbourne was a Government tender won by our company in 2006.

"We have undertaken many hospital air conditioning projects in Melbourne. Robert Vogrig of Air Conditioning Systems, the distributor in Melbourne introduced us to the Tecnair LV H-Series Air Handler units before the Melbourne Hospital project started. When this project came up we thought they would be appropriate because the hospital needed a compact, proprietary clean room type air conditioning unit suitable for the controlled environments required within an Emergency Department. "The other issue was one of limited space because we were extending the emergency department within the foot-print of the existing hospital building. There was a project brief for a 100 or so extra E.D. beds but space was limited for additional plant room areas to house the eight H-Series units needed. The compact modular design of the H-Series meant they were an ideal selection for the project.

"The other advantage of the H-Series is the purging function. This function is used in case there is an infection outbreak and under purging mode we can run 100% fresh air and operate the spill air fan at high velocity to maintain a negative pressure within the area. This would contain any contaminants within the area and prevent the spread of unwanted germs to adjacent areas. The units also operate on 100% fresh air with a heat reclaim system which allow fresh air delivery to the spaces at all times and with the heat recovery provision energy usage can be kept to a minimum..

"The fact the H-Series air handlers had heat reclaim was one of the main criteria we needed for the hospital. It's a complete consolidated turn-key approach to air



The H-Series air handler with two heat recovery coils

handler design with all the components and controls in one compact foot-print. Everything is included, all in one box," Philip said.

We were introduced to Tecnair LVs Account Manager, Andrea Monti, when he visited Australia with Robert Vogrig..

"There are eight H-Series air handlers to be installed at the hospital. Six models where the air flow rate is 2500 m³ /s, one unit handling 3500 m³/s, that is for the corridor and wards and another smaller units in the isolation room which does 1000 m³ /s.

The first part of the emergency project has been completed with two of the units installed. The second part of the project will take around another 12 months to complete. The old E.D. will be moved into stage one of the E.D.

The Installation

Working on the project for the Mechanical Contractor, A.G. Coombs, was Andrew Johns who told Celsius he was responsible for the commissioning of all the mechanical services equipment for the the E.D. project.

"Andrea Monti came to the hospital and helped with the programming of the VSDs and the microprocessors in July.

"Before Andrea's visit we installed the first of the H-series connecting its ducts and heating and chilled water pipework and got the units running before doing the air balancing. Andrea helped us with the set points and the fine tuning. We had a problem with the speed control of the return air fan, and Andrea changed the inverter setup," Andrew said.

"The H-Series controller is a stand-alone unit which was high level interface for monitoring by the hospital's Siemens BMS so we can set a return air temperature and maintain it automatically.

"Pressure control is not what we have been using the system for so we have had to fix the exhaust air fan speed to a fixed position to maintain our required exhaust air flow rates. To set the supply air rates we can set it on the unit's controller to maintain the required supply air rates automatically.

"Patients with open wounds will be catered for once stage one of the E.D. is operational. There is a purge mode within these units so if somebody infectious who comes into the E.D. staff can just clear the air quickly. In this mode the exhaust air ramps up to 100% of the VSD speed range creating a slight negative pressure in the room and exhausting any germs in the atmosphere through the filters to atmosphere. Filtered outside air is drawn into the unit through two sets of high

efficiency filters," Andrew said.

"There is 100% outside air with heat recovery. The heat reclaim coil in the unit temper the outside air on cold mornings before it hits the coils."

One of the challenges, according to Robert Vogrig, was to simplify the H-Series for the Melbourne Hospital E.D. project because of the additional features for surgery theatre applications. This was done by A.G. Coomb's engineers and Andrea Monti. The humidity control was not needed for the E.D. wards.

Remote Control to the Unit

"The remote 'Lifeline' interface in the nurse stations is a miniature replica of the main control panel within the unit. It allows the nurses and doctors on duty to use the purge function which means the supply air stays at the same speed and the exhaust air fan ramps up to maximum speed on the VSD controller resulting in a slight negative. The emergency department is not 100% sealed," Robert said.



The Lifeline remote interface to control the H-Series unit in the ED

"Once the E.D. staff move in then A.G. Coombs will start work on stage two of the project.

Philip Barnes though the Tecnair LV H-Series air handlers was quite unique because of its complete turn-key design within a single box. "Each unit is pre-wired with all the controls really to go. It's a modular system that built off site, comes to the site fully censored and ready to plug in the J45 data outlet. It's a quality product that is extremely well built," he said.

"I think what's good about the H-Series is that it takes away the numerous people we need to deal with when installing a tradition air handler."

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