CASE STUDY

SERVING UP OPTIMUM CONDITIONS AT TENNIS'S TOP TOURNAMENT

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It was an emotional rollercoaster ride for British tennis fans as they watched an enthralling fourth round tie between Andy Murray and Stanislas Wawrinka at this year's Wimbledon Championship – the only match of the tournament to be played entirely under Centre Court's new retractable roof. In contrast to the highs and lows experienced by spectators, climatic conditions beneath the closed roof remained remarkably stable throughout the four hour encounter. Controlling the environment was a Trend IQ system supplied and engineered by PACE Services.

Over the last three years the All England Lawn Tennis Club (AELTC) and its main contractor Galliford Try Construction have carried out a major upgrade of the Centre Court stadium. This famous sporting arena now has a larger capacity (15,000), more comfortable seats, new catering facilities for debenture holders and the public - and a high-tech, translucent folding fabric roof. The new 5200m^2 roof, and the sophisticated air management system that operates when it closes, allow play to continue during inclement weather.

The first tennis to be played under the roof was an exhibition event in front of a capacity crowd in May this year. Its next and only other outing came on June 29th, the seventh day of the Wimbledon Championship, when rain interrupted play during the ladies' fourth round clash between Dinara Safina and Amelie Mauresmo. It remained in position for the whole of the following match, between Murray and Wawrinka. During the two matches temperature and relative humidity levels within the stadium bowl hardly varied, ranging from 23.5 to 25.4°C and 49-52% RH (the outside temperature and humidity averaged 27°C and 58%). It took less than ten minutes to fully close the roof and only a further 20 for conditions beneath it to stabilise.

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In the words of Gary Mayle, Projects Manager for the AELTC's Long-Term Planning Department: "On both occasions that the roof was in use, conditions produced in the bowl were exactly in accordance with the design parameters set".

Crucially, the grass playing surface was kept completely free of moisture. Preventing condensation, and thereby ensuring that the court is non-slippery and thus safe to play on, is the overriding priority for the ventilation system and its Trend controls.

High up in the fixed section of the Centre Court roof are 14 air handling units, which are individually controlled and monitored by Ethernet-linked Trend IQ3xcites. The AHUs deliver a combined air flow of 120,000l/s and discharge into three ductwork rings that circle the court. Tempered air is fed down into the stadium bowl through 64 elliptical nozzles and numerous diffusers, the nozzles being supplied via 18 variable air volume boxes. Further outlets push air across the underside of the roof to stop condensation forming on its surface and falling onto the court.

All the AHUs start up as soon as the roof begins to close. Their dampers are initially set to supply 100% fresh air and the VAV boxes are fully open – thus delivering maximum airflow to the grass surface. In addition, a small proportion of the diffusers are shut down. After a preset interval (20 minutes), the flow through the VAVs is reduced by 50%, the closed diffusers are opened and the AHU dampers are positioned to give 10% recirculation. However, this second mode of operation is only initiated if there is at least a 2°C difference between the temperature of the grass and the dew-point of the air.

There are six temperature sensors embedded in the grass around the edge of the court and eight attached to the roof trusses. A further 40 combined temperature/humidity sensors are located around the stadium, many of them in the passages leading to the seating. As well as measuring conditions, they repeatedly calculate the dew-point temperature, their readings being averaged by three IQ3xcites. The average dew-point is continually compared with the minimum grass and roof temperatures.

The temperature inside the bowl depends to an extent on ambient conditions and will inevitably be higher if the weather is very hot and humid. The plant's Trend controls aim to achieve an average space temperature of around 24°C and a humidity level of 50% +/- 10%, which should ensure there is no condensation on the grass or the roof (the temperature of the latter being further raised by the stadium sports lighting). Were the minimum grass or roof temperature to come within 2°C of dew-point, the controls would fully open the AHUs' cooling coil valves to dehumidify the air – as well as bringing on their reheat batteries to prevent the supply air temperature falling too far (below 14°C). In addition, if the grass was close to dew-point, the ventilation system would revert to its start-up mode and deliver maximum airflow.

The air handler fans are fitted with Trend NX variable speed drives and when all 14 AHUs are in operation they are run at 93% of maximum speed. Should one of the plants fail, the fan speed on the other 13 would be ramped up to 100% in order to maintain the volume of air delivered.

IQ3xcite controllers also enable and sequence the nine chillers that serve the AHUs and the 12 Centre Court boilers, and there are Trend VSDs on the chilled and hot water circuit pumps. The air conditioning serving the debenture suites, restaurants and other areas within the stands are Trend controlled too.

Two Trend 963 supervisors provide operator access to monitored data and control settings for the air management system. One is used by the AELTC's building controls engineer and the other by PACE Services, who had staff permanently on site both before and throughout the Championships. During the tournament the company had three engineers in attendance at Centre Court, as well as a further three looking after the Trend control systems elsewhere on the Wimbledon site.

PACE Services installed the first Trend controls at Wimbledon some 25 years ago and has gone on to fit them throughout what is a large and complex site. In total there are 677 fully networked IQ controllers, with more due to be added in the new No 3 Court, which is currently under construction. As on Centre Court and other recent projects, the controllers used will be Ethernet-based IQ3xcites and will be linked together over Wimbledon's IT network.

Throughout the development and implementation of the innovative Centre Court roof project PACE worked very closely with the AELTC, its main contractor Galliford Try Construction and its building services consultants M-E Engineers and Foreman Roberts – attending all meetings of the Club's Long-Term Planning Department. As a consequence it was able to make an important contribution to the design of the Centre Court controls and the project's overall success. The control philosophy was created by M-E Engineers.

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