Perfect match

Aermec has delivered unique air conditioning solutions for both Centre Court and No.1 Court at Wimbledon. Shortly before the coronavirus pandemic caused the cancellation of this year's Championships, David Todd visited SW19 to discover more about this growing partnership and the benefits when tennis returns.

Even on a chilly afternoon in early March, there is something special about passing through the gates at Wimbledon. It is not just stepping into another world... more like entering Narnia. This feels like a place where anything is possible and that is not confined to the sporting drama which captivates millions in any normal year.

Wimbledon, of course, is all about the tennis; all about the grass. And even though we are here to talk about air conditioning, that turf is at the heart of everything which follows.

I've arrived early for the meeting with Robert Deatker, Estate Director of The All England Lawn Tennis Club (AELTC), which leaves me free to explore the sprawling complex. I'm drawn to the four Championships courts, which sit between Centre Court and No.1 Court, because they look impossibly green, thanks to the heat lamps which aid growth on days when the sun fails to put in an appearance. Giant fans are positioned at each corner, ready to drive away excess moisture, and a member of the ground staff strides purposefully to-and-fro, delivering the daily feed.

But if these patches of grass appeared pampered, it is nothing compared to the care afforded to No.1 Court. Almost every air conditioning system ever installed is designed to keep people comfortable. And while the solution delivered by Aermec for the retractable roof can certainly do that when required, it's a side benefit rather than the primary objective.

Zero condensation

Deatker explains: "The whole point of the dehumidification process is to keep the grass dry, which allows those elite athletes to play tennis. Traditionally on the outside courts, we cover the grass and put the bubble over it. When the rain stops, we take the cover off and you will see the umpire go down and touch the court to make sure there is no moisture, because any moisture can make the surface slippery.

"The plan with No.1 Court, the moment the system is switched on switched it makes the whole environment more comfortable for everyone. But that wasn't the design parameter, the aim is to achieve a dry playing surface and zero condensation."

Graham Turner, Aermec's Technical Director, said: "Aermec is continually motivated to design solutions that meet clients' expectations no matter how challenging. We engineered a solution that addressed a unique set of criteria; noise, comfort of spectators, safety of the players and the moisture levels of the grass to prevent players from slipping."

The redevelopment of No.1 Court followed the installation of a retractable roof on Centre Court in 2009, for which Aermec also supplied the chillers. For the more recent project, Aermec provided a total of 26 super quiet chillers and 12 very low noise air handling units (AHUs). Noise levels were a major consideration, with 20 of the chillers and the AHUs positioned high in the structure of the stadium, with spectators in the higher tiers sitting just three metres from the plant rooms, which are located over the seats.

A prototype chiller was designed and built at Aermec's manufacturing and test facilities near Verona in Italy. Rigorous tests were undertaken, and once satisfied Aermec could meet the specifications and criteria, the AELTC was invited to witness test the prototype and sign-off the unit for manufacture.

Acoustic testing

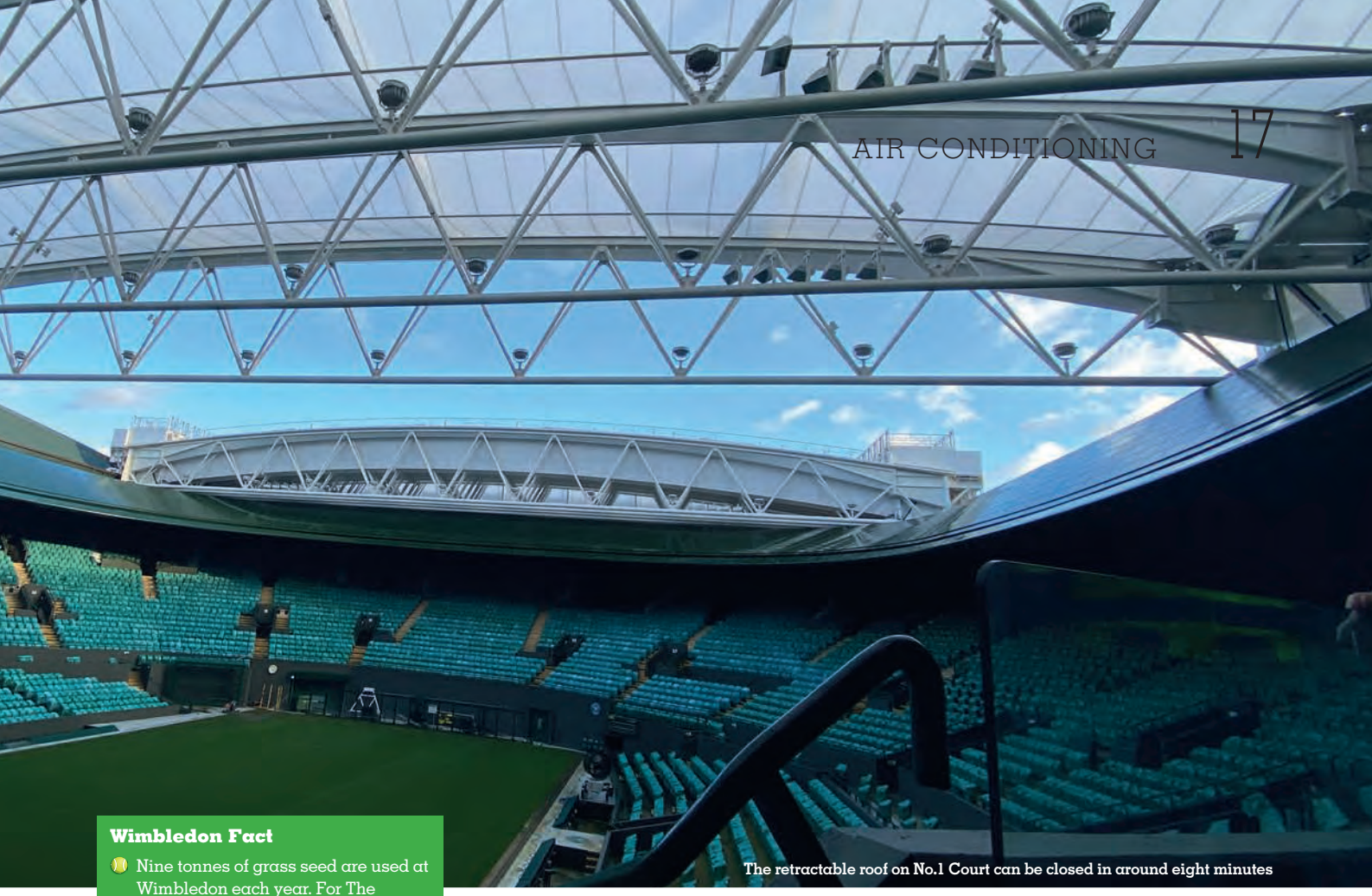
Not only were the performance levels tested, but more importantly extensive acoustic tests were carried out in Aermec's climatic chamber, which enabled site conditions to be simulated. Paul Lawrence, Managing Director of Aermec UK, said: "Aermec has extensive testing facilities on-site at our factory in Italy. Our labs are AHRI and Eurovent certified and we provided extensive acoustic testing under 'witness' conditions enabling the AELTC to see at first hand performance levels and that acoustic criteria were being met."

Deatker added: "I've had many years of

Robert Deatker on the roof of No.1 Court with the London skyline behind

Wimbledon Fact

The capacity of No.1 Court is an easy-to-remember 12,345 after the redevelopment increased seating by around 1,000.



The retractable roof on No.1 Court can be closed in around eight minutes

Wimbledon Fact

Nine tonnes of grass seed are used at Wimbledon each year. For The Championships, the grass is reduced from its winter height of 13mm to 8mm and is rolled and mown every day. At the end of summer, six tonnes of soil are put on each court to ensure playing surfaces are level.

working with chiller manufacturers and the way Aermec embraced the challenges and went back to basics and thought 'how can we build a chiller to meet this' really impressed me. We have a unique set of requirements and Aermec started from scratch to create a bespoke chiller."

Delivered in phases, the super low noise slim chillers each has a capacity of 300kW and fans capable of 320Pa ESP (External Static Pressure).

A similar process was adopted for the 12 large bespoke AHUs, each unit was designed with an air volume of 10m3/s. As spectators would be sitting underneath the plant rooms, Aermec's solution had to ensure that there would be no breakout noise from the bottom of the units, detracting from the matches and causing a nuisance for spectators. The AHUs were fully performance tested at design conditions, which was only possible again due to Aermec's investment in climatic chambers.

Aermec tested various acoustic materials over many months to ensure there was no breakout noise from the units. Once they had achieved the

Twenty of the Aermec super low noise slim chillers are housed in acoustic pods within the No.1 Court roof structure

desired results, Aermec embarked on the construction of substantial steel framework at the factory, which would enable the AHUs to be positioned 1.8 metres above the ground and sound measurements were then taken from underneath the units in situ.

The AHUs were arranged within custom-designed steel framework. Acoustic housings were unnecessary as the AHUs were designed appropriately to meet the noise specifications. Each unit has 50mm thick panels with mineral wool insulation 100kg/m³ and 1.2mm thickness galvanised steel internally and externally. The fan section has 150mm panels of extra insulation to reduce the radiated noise of the fan.

Because of the AELTC's location within a residential neighbourhood, sound levels were crucial. Extensive testing was carried out through the night to ensure that no background noise would be emitted.

Pressure control

There were a number of logistical constraints. As well as meeting sound criteria, sight lines for neighbours in the area were to be maintained where possible, so careful consideration was given to height of any rooftop plant and aesthetics.

Six of the chillers were located in the basement to support year-round cooling. The other 20 chillers were designed to fit within physical constraints of the No1 Court roof. To address the acoustic requirements, they were enclosed in five special acoustic pods. Each pod houses four chillers in a 2x2 double-deck arrangement on the north side of the court and directly above spectators. The pods were designed to accommodate air intake on one side only.

Aermec AHUs in No.1 Court

EC direct drive fans were used to ease commissioning and set design air volumes without the need for pulley and belt changes. Inverter pumps were also used with varying pressure control to ensure a constant flow rate as the quantity of chillers in operation increases and decreases.

The AHUs were located withing a complex network of steel and ductwork, with four situated on the east side of the court, four on the west side and four on the south side. The units were installed on the roof in sections and Aermec carried out the final connections once all sections were in place.

Elite athletes

The roof takes between eight and 10 minutes to close and the AHUs start up as soon as the roof is closed. Depending on the conditions, the air conditioning can take minutes to acclimatise the climate within the bowl and allow matches to restart.

Wimbledon Fact

Work started on No.1 Court's retractable roof in 2016 and was completed in time for The Championships in 2019. The first competitive match to be played with the roof closed was a Men's Doubles first round match featuring Andy Murray.

The redeveloped No.1 Court at Wimbledon

One of the key challenges was ensuring that the required levels of temperature and humidity could be met and the grass could also be insulated from moisture, preventing players from slipping during play. Sensors are embedded in the edge of the grass court and further sensors are located in the roof trusses to monitor moisture and temperature levels.

When the roof is closed, the system drives down the humidity level to around 50% RH to ensure no condensation can occur on the grass playing surface, or on the roof structure. The priority for the system is the grass and to ensure the air movement does not interfere with the movement of the tennis ball. All this has been modelled by ME Engineers using computational fluid dynamics.

Deatker explained: "The air has to be blown in such a way that there is no noise, no background hissing on the television broadcast. It has to be at a speed that keeps the grass dry but is slow enough that it doesn't affect the ball toss or ball movement. You're dealing with a number of different parameters, including the architecture of the court itself.

"Aermec has provided a solution which delivers in terms of air temperature, humidity, speed and noise to be projected by the nozzles down at court level. We're trying to deal with a sporting environment where professional athletes would notice if there was some unusual air movement."

The Wimbledon complex showing No.1 Court with the roof closed and Centre Court behind

Wimbledon Fact

Around 300 people work at the AELTC year-round, with an additional 6,000 employed for the duration of The Championships.

Deatker, who joined Wimbledon after the completion of the Centre Court project, says: "For me, it has acted as a working model. The architects and engineers studied different options and concepts and once it was decided that the cooling equipment would be better located in the roof, that's when we engaged with Aermec.

Energy centre

"Centre Court had the challenge to design a completely new type of retractable roof on a 100-year-old building, which maximised the sunlight on the court. No.1 Court was a different set of circumstances altogether. It was a challenge to expand the building and add a retractable roof, all within tight timescales and delivering an operational stadium every year for each Championships. The pressure was about certainty; the retractable roof, the new hospitality suites and the stadium acoustics."

"For Centre Court, all the chillers are located away from the stadium but there was no obvious location for No.1 Court. We decided to put them within the structure, which menat the acoustic requirements were significantly greater."

Although the two biggest show courts at Wimbledon are used exclusively for the two-week Championships, the cooling capacity is used elsewhere. Deatker said: "We have really looked at our whole sustainability policy and we are using the cooling plant as part of an estate-wide energy centre. All the cooling in the museum and offices will come from here and we will use the plant to feed other areas of the estate as we expand. The offices and museum will give it a base load all year round, so we can cycle the chillers to give them load to work against throughout year, which helps with maintenance and resilience."

Aermec's special relationship with the AELTC now looks certain to continue, with new chillers already delivered for a forthcoming planned upgrade of the Centre Court equipment. Deatker said: "Aermec has been a good company to work with and it was clear to see how much effort went into the whole project. To me that gives a great culture to the company that aligns with the culture we have here. We are about quality; delivering something that exceeds expectations and works when it needs to work. It was a good fit."

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