

## **Wilson Benesch White Papers**

### **Circle 25 Turntable & A.C.T. 25 Tonearm**

#### **The History of the Analogue Collection**

In 1989 a fledgling British startup company arrived in the world of High End Audio. Following several years of tentative feasibility studies and in depth materials technologies research, a business plan was formed and presented to the Department of Trade and Industry within Her Majesty's Government. The central concept within the business plan was the argument that vinyl was a superior medium to CD and that with the application of newly emerging advanced materials technologies, a product could be realised that would have a totally unique position and appeal. The grant application was a success and in 1989 Wilson Benesch was established. The first product was the 'Wilson Benesch Turntable'.

The design made waves within the audio fraternity, initially due to the unique design concepts and the use of advanced materials technologies that had seldom been seen in the High End Audio industry before.

#### **The Wilson Benesch Turntable**

The Wilson Benesch Turntable featured an advanced composite sub-chassis built from a Nomex core with a carbon fibre skin. It was the first carbon fibre component ever to be used in a turntable design. Whilst the concept of carbon fibre and its unique stiffness / damping properties might be commonly understood today, it is important to remember that this was 25-years ago and the year was 1989. Carbon fibre was very much the preserve of the aerospace industry and commercial products that incorporated this material were almost none-existent.



**The first Wilson Benesch Product in 1989: The Wilson Benesch Turntable**

The Wilson Benesch Turntable also featured a novel sprung suspension for the external rotor Papst Hysteresis motor system. As well as isolating motor noise from the deck the springs also placed the geometry of the spherical pulley at the centre of the motors movement. This clever design essentially nullified any vibrational energy transfer from the pulley to the belt. The Papst motor was a phenomenal component, and when the supply of this fundamental component ceased it effectively ended Wilson Benesch's production of the Wilson Benesch Turntable forever.

From the earliest developments and feasibility studies, research showed that hybrid construction and composites could provide real world improvements in performance over single material solutions. Briggs had documented much of these benefits as early as 1957, but in reality there were few products in the market at the time which were exploiting his concepts. The platter in the Wilson Benesch Turntable contradicted the high mass designs that were common place and took the form of a high precision hybrid construction based around a lossy polymer and a precision mated alloy component.

The fully sprung A.C.T. Sub Chassis was completely isolated by a fully adjustable sprung suspension that was also stabilised laterally by a Kevlar / Spring tie.

The motor power supply was both elegant and precise. Each phase was capable of being trimmed. Speed was fully adjustable incorporating a graduated startup and speed change so that the belt was never stressed or stretched.

Following a very successful launch the Wilson Benesch Turntable rapidly gained favour across the world and exceeded all expectations. It won countless awards globally. But it was the success in the key markets of Japan and Germany that solidified Wilson Benesch's status as a new player in the British High End Audio market.

The Wilson Benesch Turntable and A.C.T. One Tonearm won 'Reference' in Stereoplay in 1994 and 1995. In 1996 it won Stereoplay's 'Golden HIFI Award' and 'Best of Test Award'. Incidentally, 1996 was the same year that the A.C.T. One Loudspeaker took 'Reference' at Stereoplay. But it had been the success of the Wilson Benesch Turntable that fuelled the development of the A.C.T. One Loudspeaker.

## **The Circle Turntable**

The Circle Turntable was born of a very different concept from the Wilson Benesch Turntable. First announced in 1999, the Circle Turntable arrived at a time when the death knell for the vinyl medium was almost deafening and the digital era and its compact disc format was very much in the ascendancy. Wilson Benesch has always, and still to this day develops all its products using our Analogue reference systems. We believe that the vinyl medium is and always has been a superior format.



**The Circle Turntable with the A.C.T. 0.5 Tonearm**

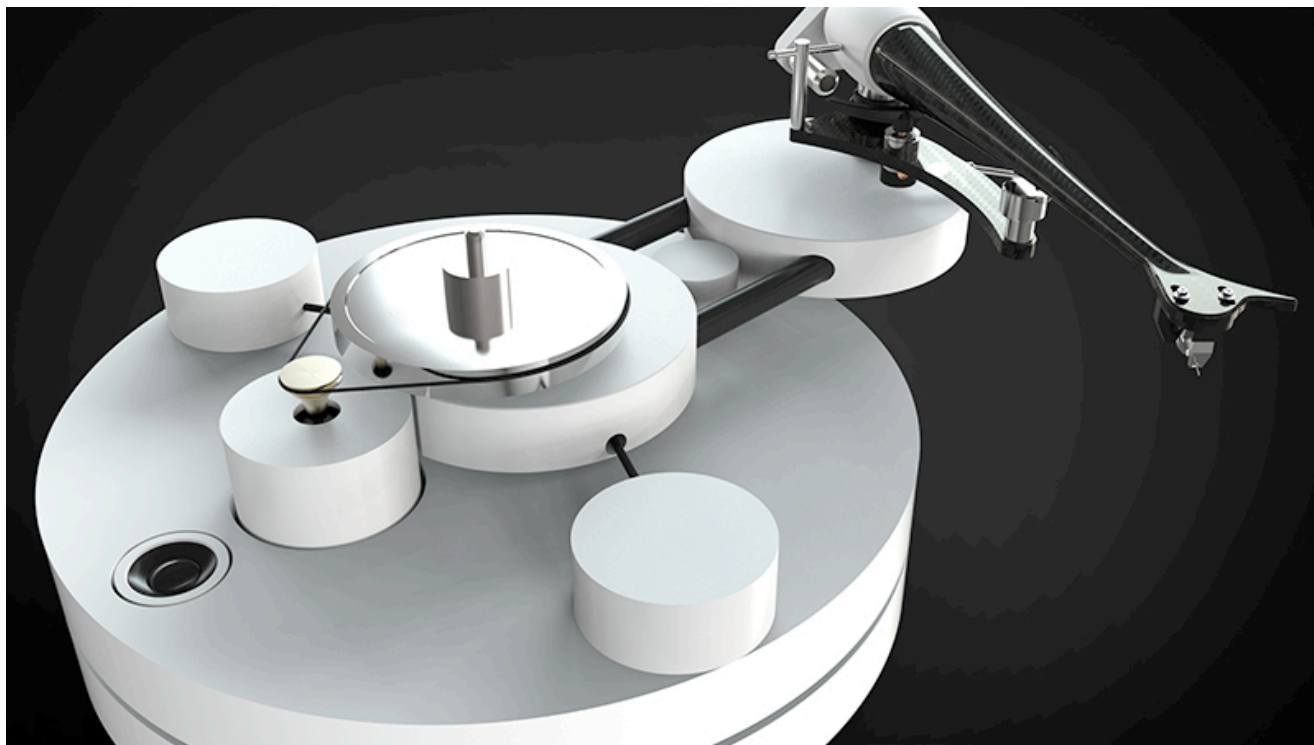
Wilson Benesch recognized the declining knowledge, expertise and passion for vinyl and analogue replay systems in the late 1990s. The Circle Turntable addressed this issue through beautifully simple design. Geometrically optimised in every aspect, the Circle Turntable was easy to set up and required little to no adjustment and maintenance.

The Circle Turntable features unidirectional carbon fibre cantilevers, which meet with alloy outposts to form a suspension that isolates the sub-chassis. The immensely stiff carbon fibre cantilevers act as spring that terminate low frequency energy as a result of their super high longitudinal specific stiffness. The low frequency energy from the motor is absorbed by lossy polymer feet that isolate the two circular slabs from one another. The lower slab that holds the motor is subsequently isolated from the upper slab that suspends the sub chassis.

The system is a low mass design, which if we quote from the Wilson Benesch Analogue Collection Manual, is a “tribute to the medium of vinyl and its unique position in the music lover’s life”.

## **The Circle 25 Turntable**

The Circle 25 Turntable is a celebration of Wilson Benesch's 25<sup>th</sup> Anniversary. The Circle 25 acknowledges the significance of the original Wilson Benesch Turntable and is a worthy addition to Wilson Benesch's longest running product line; the Analogue Collection.



**The Full Circle 25: A celebration of Wilson Benesch's 25-years of Design & Manufacturing excellence in High End Audio**

The design is also a testament to the incredible wealth of engineering and manufacturing knowledge that now exists within Wilson Benesch.

### **The Circle 25; Re-engineered throughout**

The Circle 25 features an almost complete rework of the original, improving upon the design in all areas.

### **Materially Superior**

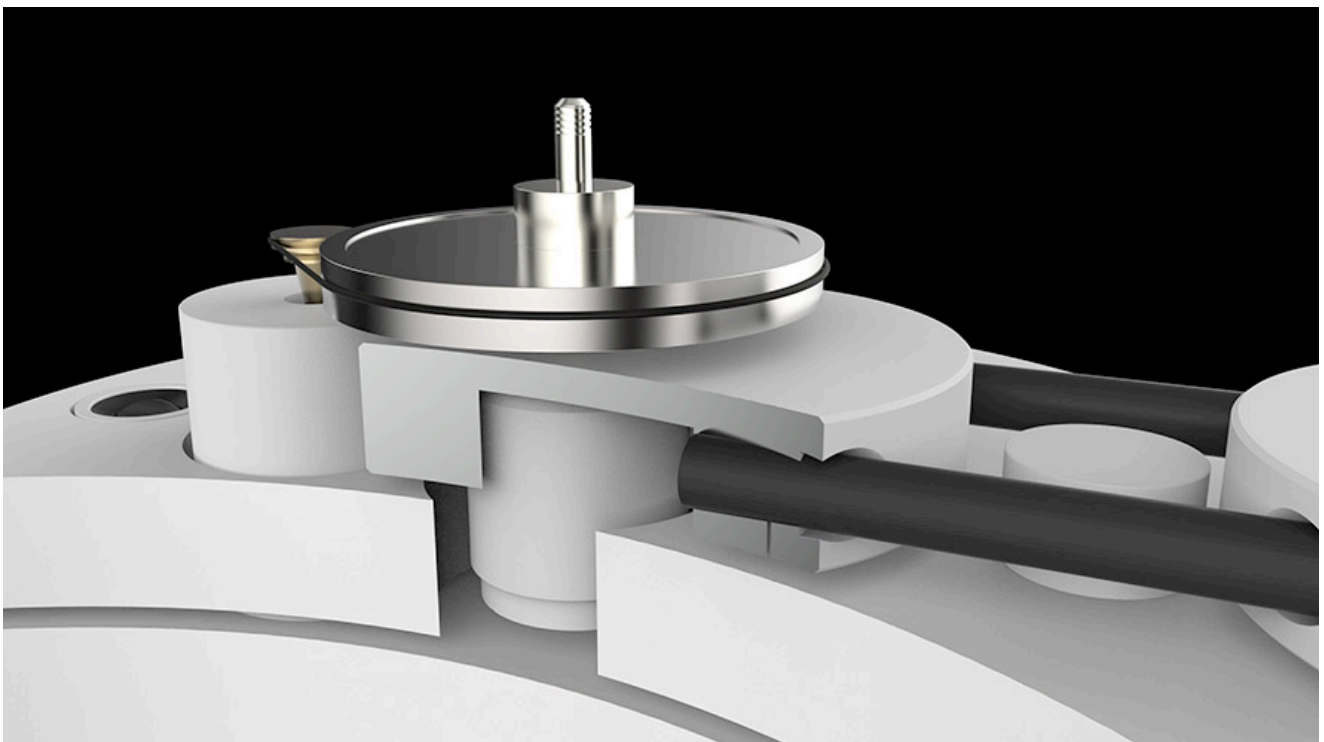
The Circle 25 features a materially superior body. The MDF body has been replaced by delrin, a high-grade engineering polymer. Delrin is stiffer, vastly superior in terms of damping and much denser. The new Circle 25 is 3-kg heavier than its predecessor. The added mass at the base of the structure improves the mechanical stability and damping of the Circle 25, providing the black background within the sound stage on which the instruments and voice place within.

## **In-House Build & Manufacturing**

90% of the components used to build the Circle 25 and A.C.T. 25 Tonearm are manufactured in-house. The new delrin body has allowed Wilson Benesch to refine the design, but furthermore take complete control over the manufacturing of this component. The Circle 25 is a proudly British, hand-built turntable, with a quality, fit and finish that is now synonymous with the Wilson Benesch brand.

## **The Circle 25 Bearing**

The Circle 25 bearing design looks to the past to redefine the future. The original Circle bearing, is a time proven, low noise design that was at the heart of the world famous Wilson Benesch Turntable.



**Redesigned Circle 25: The image presents the bearing housing in section**

In the new Circle 25 bearing, the principle elements of phosphor bronze and hardened steel remain. The steel sub-platter meets with a hardened steel shaft, which in turn holds captive, a hardened steel ball bearing in the base of the bearing hub. The bearing hub is machined from phosphor bronze, which comprises the shaft and the end cap, which forms the critical meeting point with the captive ball bearing. This component is phenomenally resistant to wear and has been highly polished to legislate for the lowest level of friction and noise within the bearing. Machined and finished in house on State-of-the-Art CNC machinery, these critical components are produced to exacting tolerances to guarantee the bearing at the heart of the highly sensitive analogue replay system is perfectly aligned and accurate every time.

Furthermore, the two metals have been carefully chosen to ensure that the bearing



will continue to function consistently at a wide range of ambient temperatures, a critical concern where hot, humid conditions prevail.

### **The A.C.T. 25 Tonearm**

With the exception of Wilson Benesch's own reference level, Nanotube One - The new A.C.T. 25 Tonearm is the world's lightest, stiffest and most highly optimised tonearm. Torsionally 10x stiffer than Titanium, half the mass of aluminium, 5x the specific stiffness of steel and with a damping coefficient an order of magnitude greater than any conventional engineering material - Carbon Fibre is truly one of the world's wonder materials.

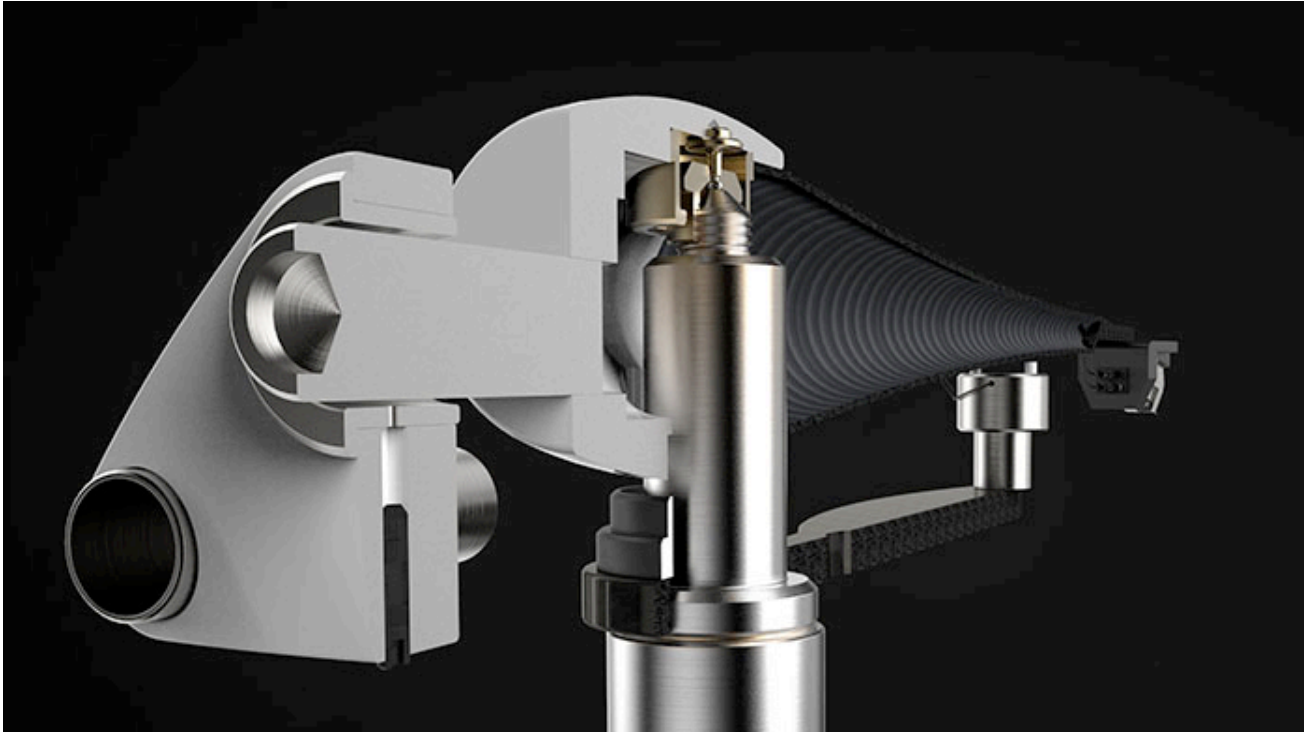


**Advanced Materials Technology: The A.C.T. 25 tonearm mounted to the Circle 25 turntable**

Thanks to a high-grade pre-preg carbon fibre, the A.C.T. 25 Tonearm is 15% lighter than the A.C.T. 0.5 Tonearm, with no loss in stiffness. The quality of the finish is exemplary, Meanwhile the A.C.T. 25 Tonearm draws directly from the reference level Nanotube Tonearm with an all carbon fibre bias plate.

## The A.C.T. 25 Tonearm Bearing

The A.C.T. 25 tonearm bearing features the same highly innovative kinematic bearing that was used in the original A.C.T. One tonearm in 1989. It has been in all subsequent Wilson Benesch tonearms since.



**Kinematic Bearing: The A.C.T. 25 Tonearm Bearing in section**

The kinematic bearing features, three x 1mm carbon-chrome ball bearings, which are held captive in a brass ball cap located at the end of the arm stem. A fourth ball is retained by a brass mount located in the egg shaped housing at the end of the tonearm. The shape of the eggshell derives stiffness and strength through its geometric form. When mated the fourth ball is held in a high pressure triangulated frame of reference ensuring that the centre of movement can never change regardless of the age of the system or the ambient temperature. In theory the contact surface is a single molecule. It is a beautifully simple, yet stable and high precision design.

Central to the concept of the tonearm and its bearing design is the theory that the stylus is a highly sensitive measuring device capable of measuring a single molecule in the groove of the vinyl. Having grasped this concept, it is easy to understand why the tonearm, its stylus, bearing and all other components must be considered as one highly optimised measurement device.

In order to make an accurate measurement of the groove and faithfully reproduce the information within it, the bearing must be both dynamic so that the stylus can trace the groove (whilst at the same time exhibiting no stiction or friction), and it must also

remain precisely fixed in space during any movement. In theory the distance from the pivot to the stylus should not change at all.

Any deviation from these two specifications will impact directly on the function of the system.

The kinematic design has numerable advantages over other commonly used designs such as the unipivot or the roller bearing.

In the unipivot the spike head and the mounting plate become worn at the point where the two surfaces meet. As a result such designs are prone to chatter, which becomes worse as the bearing wears.

The roller bearing was designed for systems where the bearing rotates at hundreds or thousands of RPM, such as in a bicycle crank, which is where the design excels. In a tonearm bearing, where incredibly small and precise movements are required as the stylus tracks the vinyl groove, the roller bearing is prone to stiction.

## **STICTION**

### **NOUN** - *Physics*

- the frictional force to be overcome to set one object in motion when it is in contact with another.

By resisting the movement of the tonearm bearing the roller bearing introduces inaccuracies within the tonearm tracking. Furthermore the roller bearing is prone to changes in geometry and performance with temperature changes and cannot therefore be considered a stable bearing for a high tolerance tonearm design.

The kinematic bearing is phenomenally wear resistant; such is the success of the design and consistency in performance that not one single bearing has failed in the 25-years since it was first introduced in the A.C.T. One tonearm. The kinematic bearing is also totally stable in normal operating temperatures from 10 – 50 degrees Celsius.

Wilson Benesch celebrated the kinematic bearing with the launch of the Cardinal and the Endeavour. The bearing can be observed on a much larger scale in the 'spike' and floor protectors, where the captive ball bearing in the 'spike' kinematically locates into three captive ball bearings in the floor protector.