



# DEFY LAB

**The Manufacture presents the world's most accurate mechanical watch.  
Zenith is writing its future... and the future of Swiss watchmaking.**

**A new oscillator representing a major innovation in the watch industry since the 1675 invention of the balance and hairspring principle by scientist Christiaan Huygens.**

**The 21<sup>st</sup> century Defy Lab achieves exceptional performance making it a master of mechanical precision powered into a whole new dimension.**

*Le Locle (Switzerland), Thursday September 14<sup>th</sup> 2017* – Zenith is writing its future and starting a new chapter in the history of the Swiss watch industry. Manufacture Zenith has been making mechanical watches for 152 years and currently has the capacity to produce around 40 different movements (featuring various shapes and equipped with complications), reflecting its exceptional expertise.

Connoisseurs will scarcely need reminding of the paternity of the Swiss watch industry's first ever automatic chronograph introduced in 1969, which also featured a function that had not yet been seen nor even imagined at the time. Nobody was capable of measuring tenths of a second, the unit of time naturally stemming from a 5 Hz oscillation frequency. It represented a kind of watchmaking Holy Grail! The El Primero movement is often cited and has indeed become a Swiss watchmaking legend that vividly reflects Zenith's enduring attachment to innovation and the quest for precision.

Zenith is now renewing ties with innovation and fundamental research by presenting Defy Lab and its new oscillator – an invention that challenges nothing less than the operating principle of mechanical watches invented by Christian Huygens in the 17<sup>th</sup> century.

The announcement was made at a press conference held at the Manufacture Zenith in Le Locle and hosted by **Jean-Claude Biver**, President of the Watch Division, along with Zenith CEO **Julien Tornare** and **Guy Sémon**, CEO of the Science Institute LVMH. This innovative watch was developed through achieving effective synergies between the skill sets cultivated by the brands composing the group's Watch Division, an endeavour overseen by Guy Sémon.

## A few key points:

- ✓ Defy Lab is the first and **only mechanical watch embodying both an evolution** and an improvement of the sprung balance principle presented in January 1675.

Since 1675, the principle of the coupled balance and hairspring (sprung balance) that Christiaan Huygens presented to the French Royal Academy of Sciences in the form of a clock has remained unchallenged. While it has definitely been improved and is undoubtedly now optimised to the greatest possible extent, it has nonetheless never called into question as such, instead regarded as both timeless and invariable.

- ✓ A new oscillator **forming a monolithic whole**, made of monocrystalline silicon (with details finer than a human hair), replaces the sprung balance. The 30 or so components of a standard regulating organ (which requires assembly, adjustment, timing, testing



and lubrication) are thus replaced by a single element measuring just 0.5 mm thick (compared with the usual 5 mm.)

- ✓ This breathtaking development beats at the **incredible frequency of 15 Hertz**, with an amplitude of +/- 6 degrees, and is endowed with an almost 60-hour power reserve – more than 10% more than that of the El Primero – despite a three times higher frequency.
- ✓ This frequency endows it with **an exceptional – almost 10 times higher – degree of accuracy**. Its mean daily rate is precise to within just 0.3 seconds. (By way of example, one of the criteria for COSC “chronometer” certification is the average daily rate on the first ten days of testing: from -4 seconds to +6 seconds, meaning up to 10 seconds per day).
- ✓ Moreover, it remains accurate far beyond 24 hours of operation (the moment when mechanical watches begin to lose their energy and thus their accuracy). This new oscillator **maintains the same degree of precision for 95%** of its power reserve.
- ✓ **No need for oil:** no more contact means no more friction or wear, and thus no need for lubrication.
- ✓ **Insensitivity to temperature gradients, gravity** and magnetic fields eliminates the key weaknesses of the current balance-and-spring assemblies that are subject to deformation and/or dilatation, thereby leading to diminished precision.
- ✓ **Triple certification**, including chronometer certification displayed by the viper’s head emblem awarded by Besançon Observatory, on behalf of the International Bureau of Weights and Measures. With regard to thermal behaviour, the spectrum of the ISO-3159 standard has been broadened: variations of around 0.3 seconds per day and per degree Celsius of deviation are certified, which is twice as good as the recommended figure. Finally, the watch meets the ISO-764 magnetic criteria, exceeding them by 18 times (for the completed watch), meaning it can withstand 88,000 Amperes per meter or 1,100 Gauss.
- ✓ This mechanism opens up whole new vistas and enters a new dimension, representing no less than a reinvention of the Huygens principle with another mechanical system.
- ✓ The first ten ZENITH Defy Lab watches (10 different versions, each is different) are sold in an exceptional collector’s gift box. All are already pre-sold.

#### Exterior of the Defy Lab:

- ✓ First watch with a case (44 mm in diameter) made from Aeronith, the world’s lightest aluminium composite material.
- ✓ This new material resembling an extremely solid metal foam was developed using an exclusive high-tech process and features a density of just 1.6 kg/dm<sup>3</sup>, which is 2.7 times lighter than titanium, 1.7 times lighter than aluminium and 10% lighter than carbon fibre.



## **Zenith is writing its future... and the future of Swiss watchmaking.**

### **Reinventing the mechanical watch**

In 1675, the Dutch astronomer, mathematician and physicist Christiaan Huygens demonstrated the principle of regulating time by means of a coupled balance and spring fitted inside a clock, a concept that still forms the basis of all current mechanical watches. This invention was partly based on the work of the learned mechanical scientist Ignace-Gaston Pardies, who corresponded with Newton. Pardies presented the theory of the isochronism of mechanical vibrations to the French Academy of Sciences in 1673, but unfortunately died before being able to publish his proofs. In 2017, a new scientific endeavour conducted by Guy Sémon challenges the principle invented by Christiaan Huygens 342 years earlier: namely the regulation of mechanical watches by means of a balance and hairspring assembly.

### **Performance, simplification and aesthetic impact**

For the first time in the history of watchmaking, a technological breakthrough supersedes the Christian Huygens principle in terms of performance, aesthetic impact and simplicity. This is truly uncharted territory.

The acknowledged champion of high-frequency chronographs, thanks to its fabled El Primero movement, the Zenith brand shifts up to ultra-high accuracy with the Defy Lab watch representing a true quantum leap in terms of performance and engineering.

### **Committed to tradition**

1969: Zenith makes its stellar contribution to the chronograph saga by presenting the El Primero (meaning 'the first' in Esperanto): an integrated automatic column-wheel mechanism beating at the high frequency of 36,000 vibrations/hour (5 Hz) enabling it to reach chronometer-certified tenth of a second precision. It is to this day the world's most accurate series-made chronograph.

March 2017: A new record, yet based on the same DNA. Zenith is introducing a 1/100th of a second series-made watch: the Defy El Primero 21. This chronograph displays hundredths of a second via a central hand, and, with a frequency of 50 Hz, is ten times faster and more accurate than its illustrious predecessor. It marks the first time that the 1/100th of a second chronograph has been released as a series-made watch. It also marks the birth of the brand new "Defy" line of Zenith watches, defined by the innovation which lies at their heart. This line is the first of many fruits to stem from Zenith's revival.

September 2017: Precision and reliability are firmly embedded in the DNA of the 1969 El Primero movement as well as in the new Defy El Primero 21. Given that the brand holds a record-breaking 2,333 chronometry prizes, it is hardly surprising that the ZO 342 calibre powering the Defy Lab reflects Zenith's ongoing quest for innovation and high precision.

By adopting an entirely new scientific approach in modelling and innovating with regards to the mechanical watch, and by using new modern mechanical methods, the LVMH Watch Division R&D Institute has completely renewed the very concept of this type of watch.



Impressive key characteristics demonstrate the scope of this stunning development: an oscillator consisting of two components made of monocrystalline silicon, an unbelievable 15 Hz frequency with an amplitude of +/- 6 degrees, as well as a 60-hour power reserve, which is 10 percent more than that of the El Primero in spite of tripled frequency.

Moreover, the new Zenith Oscillator takes the form of a single piece without any mechanical linkages, instead of the customary 30 or so parts that require assembly, adjustment, setting, testing and lubrication.

### **High Tech & High Mech**

With the Defy Lab, Zenith introduces a completely revamped movement called the ZO 342. This calibre measuring 32.8 mm in diameter and 8.13 mm thick reveals its distinctive nature at first glance: the barely 0.5 mm thick Zenith Oscillator appears beneath the dial.

Its functionality has been considerably optimized: the Zenith Oscillator is an all-of-a-piece organ without mechanical linkages that replaces the 30 or so ordinarily assembled, adjusted, regulated and controlled parts.

The absence of conventional mechanical couplings eliminates contact, friction, wear, slack, lubrication, assemblies and dispersions. The wheel replacing the escape wheel has a specific design and its cycle does not correspond to the traditional behaviour of a Swiss lever escapement. It is made of silicon showing superficial oxidation.

### **Extremely high frequency**

The Zenith Oscillator beats at a frequency of 15 Hz (108,000 vibrations per hour) frequency, three times higher than that of the historical El Primero movement, while enjoying a 10 percent higher power reserve. There is no sign of jerking and the permanent running seconds hand rotates smoothly around the dial. This simple comparison makes it possible to appreciate the improvement in energy consumption compared to a conventional balance & hairspring system. The amplitude is +/- 6 degrees, as against the more than 300 degrees of a conventional system.

### **Committed to precision**

The precision of the Defy Lab “naturally” meets the requirements of the ISO-3159 standard and in fact exceeds them. Never before in watchmaking history and in no chronometry contests has a serially produced mechanical watch ever attained such a degree of precision.

Isochronism in serial production amounts to +/- 0.5 seconds from 0 to 48 hours. By way of comparison, the best conventional serial-production systems show a variation in the range of +/- 2 seconds over just 24 hours. Beyond that, precision logically diminishes in accordance with a purely physical phenomenon. The precision of a sprung balance is dependent on its amplitude, which is not the case with the Zenith Oscillator technology.



### **Triple certification**

The Defy Lab is a watch bearing the “viper’s head” emblem, meaning it is chronometer-certified by Besançon Observatory on behalf of the International Bureau of Weights and Measures.

The Zenith Oscillator is in the process of being certified as non-magnetic and meets high criteria in terms of temperature variations.

With regard to the thermal behaviour the LVMH Group Science Institute had to extend the spectrum of the ISO-3159 standard. Variations of around 0.3 seconds per day and per degree Celsius of deviation, which is twice as good as the standard recommends, are certified. This variance is also measured on the thermal spectrum  $-7^{\circ}\text{C}$  to  $+53^{\circ}\text{C}$ , whereas the standard is limited to  $+8^{\circ}\text{C}$  to  $+38^{\circ}\text{C}$ .

The watch obviously meets the magnetic criteria of ISO-764. It even exceeds them by nearly 18 times (the completed watch), that is to say 88,000 Amperes per meter or 1,100 Gauss. And there is no need for an extra inner case to achieve this.

### **A new material named Aeronith, a nod to Zenith’s longstanding aeronautical tradition**

Aeronith is a new material – for which a patent has been filed by Hublot’s R&D department under the supervision of its director Mathias Buttet – mainly distinguished by its lightness.

This characteristic is a nod to Zenith’s longstanding aeronautical tradition, notably featuring the first victorious Channel crossing by Louis Blériot in 1909 wearing a Zenith watch, as well as the extraordinary feat accomplished by Felix Baumgartner in 2012 – the highest human freefall jump from an altitude of 38,969 metres. In the process, he became the first man to cross the sound barrier in freefall, again with a Zenith watch on his wrist.

Thanks to its mastery of the Art of Fusion, Hublot has developed this material made of aluminium foam and a special polymer. The result is a new hybrid material (rather than an alloy) that is 2.7 times lighter than titanium, 1.7 times lighter than aluminium, and 10% lighter than carbon fibre.

### **An open-pore metal foam, rigidified by a special polymer**

The production process for this hybrid material involves cutting-edge technologies and begins with heating aluminium to melting point. Known for its use in naval applications, Alu 6082 has been chosen for its excellent corrosion resistance.

It is poured into a mould where a procedure internally developed by Hublot transforms it into an open-pore metal foam. These interspaces are then filled with an extremely light special polymer resistant to ultra-violet rays and anti-allergenic when in contact with the skin.

The resulting material is cooled and becomes extremely light and highly resistant, endowed with mechanical properties entirely suited to a watch case, while minimising its density and thus its weight. Its machining is as easy as with traditional precious metals.



## **Mechanical watches enter a whole new era**

The material used for the Zenith Oscillator is monocrystalline silicon coated with a layer of silicon oxide. The absence of conventional mechanical couplings in this system eliminates contact, friction, wear, slack, lubrication, assemblies and dispersions.

Less parts, made from pioneering materials and featuring cutting-edge technologies, deliver improved functionality, resulting in the most precise mechanical watch in history. The future of the watch industry is in the making. Like all major innovations, only 10 of these watches have been produced. Serial production is the next goal towards which the in-house teams are already working, notably with a view to creating a different and original design.

## **The Defy Lab watch is sold in the form of 10 exceptional gift boxes**

Already pre-sold to collectors, Defy Lab is introduced in the form of 10 exceptional gift boxes to mark the event. Each of them (each is different) contains:

- ✓ A personal invitation to attend the launch press conference.
- ✓ A personal invitation to visit the Manufacture Zenith, for the client to receive his watch, notably including an entirely organised stay and a personalised welcome by Messrs Jean-Claude Biver, Julien Tornare and Guy Sémon.
- ✓ And to round off this set of experiences, an exceptional tasting to celebrate history and heritage, with the world's most prestigious sweet white wine, Château d'Yquem Sauternes, featuring the opening of a 19<sup>th</sup> century bottle.

For as Jean-Claude Biver likes to say:

***“Without tradition, there is no future”, but also “Without innovation, there is no future”.***

### **Press relations**

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## DEFY LAB

### Technical details

Reference: 27.9000.342/78.R582

10 unique pieces (each is different)



### ZENITH OSCILLATOR (CALIBRE ZO 342)

Monolithic regulating organ (Zenith Oscillator) made out of Silicon  
Calibre 14 $\frac{1}{4}$ '''

Diameter: 32.80 mm

Movement thickness: 8.13 mm

Components: 148

Jewels: 18

Frequency: 108,000 VpH (15 Hz)

Power-reserve: approx. 60 hours

Finishing: Oscillating weight adorned with "Côte de Genève" motif

### FUNCTIONS

Hours, minutes and central seconds

### CASE, DIAL & HANDS

Diameter: 44 mm

Opening diameter: 35.5 mm

Thickness: 14.5 mm

Crystal: Domed sapphire crystal with anti-reflective treatment on both sides

Case-back: Transparent sapphire crystal

Material: Aeronith

Water-resistance: 5 ATM

Dial: Openworked

Hour-markers: Rhodium-plated, faceted and coated with black varnish

Hands: Rhodium-plated, faceted and coated with black varnish

### STRAP & BUCKLE

Black rubber with alligator leather coating

Titanium double folding clasp