



## THE PARACHROM HAIRSPRING

### GUARDIAN OF TIME

In a mechanical watch, the oscillator is the guardian of time. Comprising a hairspring and a balance wheel, this organ determines the precision of the watch by the regularity of its oscillations.

To guarantee excellent precision, in 2000 Rolex introduced a hairspring in an exclusive alloy of niobium, zirconium and oxygen: the Parachrom hairspring.



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Entirely manufactured in-house by Rolex, the Parachrom hairspring, barely one centimetre in diameter, is a strategic component that presents major advantages for the precision timekeeping of the movement: it is insensitive to magnetic fields, offers great stability in the face of temperature variations, and remains up to 10 times more accurate than a traditional hairspring in case of shocks.

In 2005, Rolex introduced a new patented process to modify the surface of the Parachrom hairspring and thereby further reinforce its long-term stability. It is this same treatment that produces its characteristic blue colour.

### A TECHNOLOGICAL CHALLENGE

Ensuring the oscillator's regularity is no easy task: measuring time to within one second a day is like measuring a kilometre to within one centimetre. It can only be achieved by minimizing the effects of environmental disturbances, particularly temperature variations – which cause metals to expand or contract – magnetic interference and shocks. Only a few materials have the very special properties required to manufacture hairsprings: generally iron-, nickel-, cobalt- and chrome-based ferromagnetic alloys. Although these alloys offer great stability in the face of temperature variations, they present two major drawbacks in that they are sensitive to magnetic fields and to shocks.

### AN INNOVATION BY ROLEX

The alloy perfected by Rolex allows the Parachrom hairspring to overcome the main weaknesses of ferromagnetic hairsprings. In addition to being extremely stable when exposed to temperature variations, the Parachrom hairspring is insensitive to magnetic fields and remains up to 10 times more accurate if subjected to shocks. These exceptional properties significantly enhance the oscillator's regularity and consequently the watch's precision.

The development of the Parachrom hairspring called for several years of research by physicists and materials engineers at Rolex, and required the most advanced scientific techniques. This work resulted in two patents: one for the chemical composition of the alloy and another for the surface treatment process which, while enhancing long-term stability, gives the Parachrom hairspring its distinctive blue colour.

Rolex developed its own high technology to manufacture the Parachrom hairspring, thus ensuring perfect quality and independence.



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### PRODUCTION TOLERANCES TO WITHIN MICRONS

The Parachrom hairspring is finer than a human hair. Uncoiled, it forms a 20 cm long ribbon with a rectangular cross-section, approximately 50 microns thick by 150 microns wide.

Manufacturing begins with the fusion of niobium and zirconium under vacuum at approximately 2,400 °C, in an electron bombardment oven that was developed specifically for this purpose. A precise quantity of oxygen is introduced to obtain the alloy.

The resulting alloy rod, which measures 30 cm long and 10 mm in diameter, is transformed during a series of operations to obtain a 3 km long wire with a diameter of 0.1 mm. This wire is then flattened into an even finer ribbon, approximately 50 microns thick. This thickness must not vary at any point along the wire by more than 0.2 microns. The hairspring's performance depends on scrupulous observation of these stringent tolerances. The ribbon is then cut into 20 cm long segments, each of which is coiled. The hairspring's shape is fixed using a high-temperature thermal vacuum treatment.

Every aspect of each finished Parachrom hairspring is inspected. The hairspring is then given a Rolex overcoil, which ensures its regularity in any position.

### PRESTIGE AND PERFORMANCE

The Parachrom hairspring was introduced in 2000 on calibre 4130 equipping the Cosmograph Daytona, and then gradually integrated into other Rolex movements.

While the Parachrom hairspring's blue colour is a direct result of the surface treatment process used since 2005 to enhance its stability, it also contributes to the prestige of the watch. In the history of watchmaking, blued hairsprings have been reserved for the movements of the most precise and exclusive timepieces. The blue Parachrom hairspring is a worthy representative of this tradition.