The Oyster Perpetual

SEA-DWELLER 4000

ROLEX

Reference
116600

MODEL CASE

MODEL CASE
Oyster, 40 mm, steel

OYSTER ARCHITECTURE
Monobloc middle case, screw-down case back and winding crown

DIAMETER
40 mm

MATERIAL
904L steel

BEZEL
Unidirectional rotatable 60-minute graduated, scratch-resistant Cerachrom insert in ceramic, numerals and graduations coated in platinum

WINDING CROWN
Screw-down, Triplock triple waterproofness system

CRYSTAL
Scratch-resistant sapphire

WATER-RESISTANCE
Waterproof to 1,220 metres / 4,000 feet, helium escape valve

MOVEMENT

MOVEMENT
Perpetual, mechanical, self-winding

CALIBRE
3135, Manufacture Rolex

FUNCTIONS
Centre hour, minute and seconds hands. Instantaneous date with rapid setting. Stop-seconds for precise time setting

OSCILLATOR
Paramagnetic blue Parachrom hairspring

WINDING
Bidirectional self-winding via Perpetual rotor

POWER RESERVE
Approximately 48 hours

PRECISION
-2/+2 sec/day, after casing

BRACELET

BRACELET
Oyster, flat three-piece links

BRACELET MATERIAL
904L steel

CLASP
Folding Oysterlock safety clasp with Rolex Glidelock extension system. Fliplock extension link

DIAL

DIAL
Black

DETAILS
Highly legible Chromalight display with long-lasting blue luminescence

CERTIFICATION

CERTIFICATION
Superlative Chronometer (COSC + Rolex certification after casing)

How Rolex conquered the deep

SEA-DWELLER 4000

When the Hydra VIII mission by Comex (Compagnie Maritime d'Expertises) set the world open-sea diving record at a depth of 534 metres in 1988, the watch that accompanied the divers on their mission was a Rolex Oyster Perpetual Sea-Dweller chronometer. This model was standard equipment for the world leader in marine engineering.

It was the only watch the firm's elite divers fully trusted on their saturation dives to great depths – when precise timing is of vital importance at every stage – and the watch they had used on thousands of successful underwater missions in extreme conditions. Thanks to its Rolex-patented helium valve, this legendary watch was instrumental in the conquest of the deep. It is being reintroduced in an updated version that benefits from Rolex's latest technical innovations while remaining faithful to the iconic aesthetics of the original model.

The Sea-Dweller 4000

THE ORIGINAL HELIUM ESCAPE VALVE, THE KEY TO THE DEEP

Developed in 1967, waterproof to a depth of 610 metres (2,000 feet) initially and then to 1,220 metres (4,000 feet) in 1978, the Sea-Dweller is the watch for the pioneers of the deep. Those who were once known as aquanauts, explorers of the hydrosphere – the waters which cover some 70 per cent of the Earth's surface. Like them, the Sea-Dweller had to adapt to the artificial breathing mixes devised for great pressure environments and composed of light gases such as helium or hydrogen. The watch has to face the same long decompression process as the diver undertakes in order to safely eliminate those gases without injury and avoid potentially fatal decompression sickness, or 'the bends', before he returns to the surface. With this in mind, in 1967 an important innovation developed and patented by Rolex was introduced on the Sea-Dweller: the helium escape valve. This ingenious safety valve, set in the watch case, played an all-important role in the development of deep-sea diving, a field in which Comex was the most renowned player. The company's late founder and president, Henri-Germain Delauze, a pioneer of deep diving, said of his favourite watch: "A diver breathing hydrogen can't live without his Rolex," adding; "In diving, time is a crucial piece of information. Be it operations, changing gas mixes, timing decompression stops, entering and exiting the diving bell, it's all a matter of seconds. Having a precise, robust, reliable watch was of vital importance."

Henri-Germain Delauze

IN DIVING, TIME IS A CRUCIAL PIECE OF INFORMATION. HAVING A PRECISE, ROBUST, RELIABLE WATCH WAS OF VITAL IMPORTANCE.


ROLEXROLEXROLEX
20
30
10
SEA-DWELLER
1000ft = 1220m

Under pressure

CONQUERING THE DEEP

To understand the importance of the Sea-Dweller, we need to look back to the heyday of man's attempts to conquer the deep, in the early 1960s. The depth limit for scuba diving with compressed air was some 60 metres, principally for physiological reasons as the pressure beyond such a depth causes the air to become toxic. Nitrogen, which makes up almost 80 per cent of ordinary air, can have a severe narcotic effect – commonly known as the 'rapture of the deep' – which alters the mind of even the most experienced divers. From 66 metres down, oxygen also becomes dangerous as hyperoxia affects the nervous system, leading to seizures and loss of consciousness.

Counteracting these gas build-ups is not simply a question of returning quickly to the surface, because the diver risks the bends: 40 minutes spent at 60 metres below sea level requires a slow ascent of two hours interspersed by several decompression stops, which must be scrupulously respected to allow the release of the inert gases that have built up in the body – with the accompanying problem of needing sufficient air to stay underwater as long as that takes. And decompression time increases exponentially with depth. To overcome the 60-metre barrier, other solutions were clearly needed.

These emerged in the early 1960s with two innovations: the development of alternative breathing gas mixtures to avoid the toxic effect of air, and the concept of saturation diving which would reduce decompression time and the attendant risks.

Synthetic air

If ordinary air becomes toxic for the human body under the effect of pressure, why not breathe something else? The development of synthetic breathing mixes unlocked the gates to the deep sea. Ordinary air is composed of approximately 80 per cent nitrogen and 20 per cent oxygen, but only oxygen is metabolized by the body and is therefore essential. However, nitrogen becomes toxic and divers fall victim to nitrogen narcosis at depths of 40 to 60 metres, depending on the individual. Scientific research has shown that the proportion of nitrogen in the air may be replaced by helium, and that an artificial helium-oxygen mix (heliox) can be breathed by human beings without any physiological effects. It does not cause narcosis at pressure either. Oxygen toxicity could furthermore be avoided by increasing the proportion of helium in the mix. As a result, the 60-metre barrier could be crossed.

Later, other limitations – such as high-pressure nervous syndrome caused by prolonged diving at more than 150 metres using heliox – were circumvented by using gas cocktails with differing quantities of hydrogen, oxygen, helium and nitrogen. With a combination of gas mixes – using different mixes at different stages of the dive – diving limits were pushed even deeper from the early 1960s onwards and decompression times reduced. In 1961, a dive in open water was made to 222 metres in Lake Maggiore in Switzerland. The following year, a diver reached a depth of 313 metres in the Pacific Ocean, off the coast of California. A record that surprised the whole diving community at the time and paved the way for new marine exploration.

Living underwater:

SEA DWELLERS

To dive ever deeper is not the sole ambition of the conquest of the underwater world. The idea of being able to remain underwater for extended periods, or even live there, has long captured the human imagination. In the 1960s, experiments with underwater dwellings in France and in the United States freed mankind from the second constraint of marine exploration: decompression. The very name Sea-Dweller, chosen for the highly resistant divers' watch conceived by Rolex at the time, reflects those experimental programmes. A major problem in diving is that decompression exponentially curtails useful diving time, with an impact on the depth deep-sea divers can reach as well as on the length of their stay underwater.

For example, after some 15 minutes at a depth of 90 metres below the surface, a diver must spend almost two hours in decompression stages before it is safe to return to the surface. Ten minutes at 300 metres would theoretically require more than 20 hours of decompression. A dive lasting a mere few minutes longer or just a few metres deeper leads to a considerable extension in decompression time.

The problem here is also physiological: decompression sickness, a condition which can lead to paralysis or even death. When at pressure under water, the human body can be likened to a bottle of sparkling water. Gases under pressure dissolve in water, and, since the body is composed of almost 65 per cent water, part of the gas that is breathed dissolves in the blood and body tissue. An ascent without decompression is equivalent to shaking the bottle of water hard and opening it suddenly: the gas is released in an explosion of bubbles. In the human tissue, the bubbles of gas can cause serious lesions. To release the gas safely, the bottle must be opened gradually and very gently. The purpose of decompression stops is similar, allowing the body to eliminate the accumulated gas in a controlled manner.

Saturation diving

In the mid-1950s, a scientific discovery proved crucial for the development of deep diving for extended periods. Experiments demonstrated that human tissue has a given capacity for gas absorption when the gas is under pressure. It implies that once the human body has reached its point of saturation with the breathing mix, decompression time remains the same whether a diver stays underwater a few hours, a few days, for weeks or even for months. Only the depth and the type of gas breathed are of consequence for decompression. The discovery led to the development of saturation diving, a technique that literally involves saturating the divers with breathing gases and keeping them in a pressurized environment for long periods of time. As a result, they can carry out a number of deep dives and only need to undergo a single decompression procedure at the very end of the mission. Between dives, they live in an underwater habitat or chamber, a kind of sea house on the seabed, in which the air pressure is maintained at a pressure equal to that of the water at this depth. The divers breathe a synthetic gas mix containing helium, both during the dives and in the chamber. In 1965, an American aquanaut stayed 30 days under the sea, living in a dwelling installed at a depth of 62 metres.

During their stay under water, divers saturated in the gas they breathe become completely acclimatized to the pressure at great depth. They can no longer return to surface atmospheric pressure without spending a long period of decompression – dozens of hours – in a hyperbaric chamber. This inescapable process, inherent to the life of a sea dweller, prompted Rolex to develop a special function for its highly resistant new-generation divers' watch at the time: the helium valve, which provides an escape route for the gas and allows the helium-saturated watch to safely undergo decompression, not unlike the divers who wear it.

Highly resistant to external and internal pressure

In 1953, during the early days of scuba diving, Rolex created the archetypal divers' watch: the Oyster Perpetual Submariner, waterproof to a depth of 100 metres. The Submariner's waterproofness was doubled to 200 metres in 1954, offering a comfortable safety margin for those diving with air, who rarely descended beyond the 60-metre limit.
The watch's performance and reliability soon put it on the wrists of elite divers, with whom Rolex worked closely to continually improve its watches. In 1962, after the record-breaking dive to a depth of 313 metres in California, it became obvious that a new generation of divers' watches was required, one that would be able to resist the pressure at depths below 200 metres. Rolex – having fixed an experimental watch to the bathyscaphe *Trieste* and successfully sent it almost 11,000 metres down to the deepest part of the ocean in 1960 – had the technology at its disposal to increase the Submariner's performance.

In 1966, Comex made the first industrial dive to a depth of 160 metres. The French company developed a technique for saturation diving comparable to the idea behind the underwater housing projects, with the difference that the hyperbaric chambers were installed on ships that could sail on missions anywhere around the world. Saturation divers are taken down to working depth in the sea in pressurized diving bells and they return to the warm and dry pressurized chamber on board the support boat by the same method after their dive. Final decompression takes place only at the very end of their tour of duty. Comex, which came to be considered the leader in the field of commercial deep-sea diving, aimed to send its divers to 300 metres by the end of the decade. Rolex decided to make its next divers' watch waterproof to a depth of 2,000 feet (610 metres). But in addition to increasing its resistance to external water pressure, thereby allowing the watch to descend deeper, feedback from saturation divers had uncovered a hitherto unsuspected requirement: the need to enhance the watch's ability to withstand excess internal pressure.

The Rolex-patented

HELIUM ESCAPE VALVE

In habitats at overpressure, which are filled with breathing mixes composed largely of helium, the watches behave in a similar manner to the divers' bodies. The inner part of the watch case becomes saturated with helium as the pressure inside the watch case equalizes with that inside the chamber. Due to the extreme volatility of this light gas, which has the smallest molecules on Earth, the helium gradually penetrates the watch through the gaskets. During the decompression phase, helium is eliminated from human tissue at a faster rate than it can escape from a waterproof watch, with the result that pressure effectively builds up inside the watch case. Divers often observed during decompression that the watch crystal could pop out like a champagne cork from a bottle, due to this internal pressure. The watch must also be able to eliminate the excess helium inside the case.

Instead of attempting to make the watch impervious to helium, a practically impossible task, Rolex developed a unidirectional valve on the side of the watch case. It is activated automatically above a certain level of internal pressure to allow the gas to escape from the case, without affecting the waterproofness of the watch. Patented in 1967 by Rolex for its new professional divers' model, the Oyster Perpetual Sea-Dweller, the helium valve proved invaluable to the rise of deep-sea saturation diving. Comex swiftly adopted the Sea-Dweller as its official watch, as its divers continued to push ever further the limits for manned deep dives. The open-sea record of 534 metres set in 1988 was followed by another record in 1992 at an experimental depth of 701 metres in a hyperbaric chamber, with a 24-day decompression period – a record which still stands today.

The new Oyster Perpetual

SEA-DWELLER 4000

In 2014, Rolex is bringing a legend of professional diving back to life with a brand new, updated Oyster Perpetual Sea-Dweller 4000. This 40-mm-diameter technical model, waterproof to a depth of 1,220 metres (4,000 feet), features all the latest Rolex standards of innovation: Cerachrom bezel insert in a ceramic virtually impervious to scratches and ultraviolet rays; Chromalight display with long-lasting luminescence; paramagnetic blue Parachrom hairspring; Oysterlock safety clasp; and the Rolex Glidelock extension system. Not forgetting, of course, the groundbreaking function for which the Sea-Dweller is renowned, the helium escape valve.

Features

SUPERLATIVE CHRONOMETER

The green seal accompanying every Rolex watch is a symbol of its status as a Superlative Chronometer. This exclusive designation attests that it has successfully undergone a series of specific final controls by Rolex in its own laboratories according to its own criteria, in addition to the official COSC certification of its movement. This unique testing of the chronometric precision of the cased-up movement, as well as of the watch's waterproofness, self-winding and power reserve, pushes back the boundaries of performance and makes Rolex the benchmark for excellence in mechanical watches. The green seal is coupled with a five-year guarantee which applies to all Rolex models.

Where to buy a Rolex

THE OFFICIAL ROLEX RETAILER

Only official Rolex retailers, distinguishable by this official green plaque, are allowed to sell and maintain a Rolex. With the necessary skills, technical know-how and special equipment, they guarantee the authenticity of each and every part of your Rolex, not to mention its reliability over time, helping you make the choice that will last a lifetime.

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