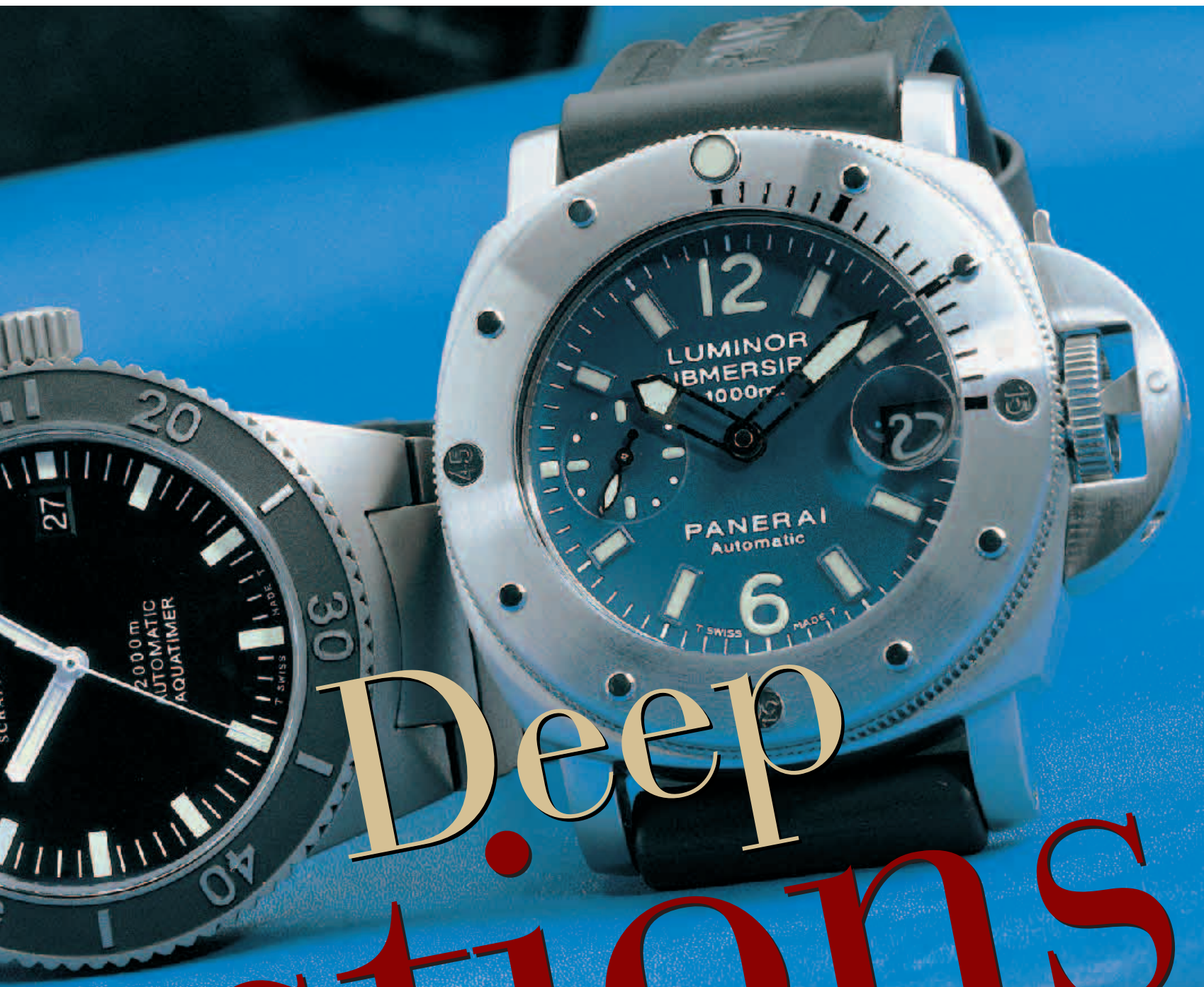


Face it: anyone who dives with an expensive mechanical watch strapped to his wrist isn't likely to descend more than 120 feet deep. Still, the Extreme never ceases to fascinate. ALEXANDER LINZ surveys plungers made by Breitling, IWC and Panerai that remain water-resistant to an astonishing 1,000 meters (3,281 feet) below the surface.



Qu



Deep Questions

COMPARATIVE TEST: DIVER'S WATCHES FROM BREITLING, IWC AND PANERAI

If you took the time to add up the maximum depths to which you could take the Panerai Submersible 1000 m, the Breitling Super Ocean Professional 1524 m and IWC's Aquatimer 2000 m, you would come up with an impressive 3,524 meters, or nearly 2.2 miles down in the briny deep. Those impressive figures are not mere estimates or idle boasts on the dial: the manufacturers' pressure tests guarantee that these watches will indeed remain water-resistant to their specified depths. Of course, it's highly unlikely that anyone outside a bathyscaphe pilot will be immersing himself to such depths anytime soon. Nonetheless, a few manufacturers of mechanical timepieces pride themselves on building extraordinarily robust and reliable timepieces.

To test watches in such unreal surroundings, it takes very elaborate equipment of a sort that's seldom found, even in the watch industry. The test is conducted inside a chamber that creates a vacuum and then measures whether or not any gas has escaped from the watch. Prior to conducting this test, we thought about some devilishly tough ordeals to which we might subject our three candidates. Ultimately, however, we couldn't put our ruthless ambitions into practice because we couldn't find an appropriate pressure chamber that could simulate such extreme depths. Search as we might, 500 meters was the absolute maximum. Even well equipped workshops like the one operated by Hübner Master Watchmakers in Vienna, Austria can only measure water-resistance to a depth of 100 or at most 200 meters. A genuine pressurized-water chamber costs a small fortune and can be found only on the manufacturers' premises, so our dream of conducting our own independent tests will simply have to wait.

Even though there's really no good reason not to believe the claims printed on these watches' dials, we wanted to see for ourselves, and on numerous occasions had the opportunity to be an eyewitness at arduous in-house pres-

Two different concepts to seal the case: Panerai's watch uses a locking lever; the Breitling and IWC watches rely on screw-down crowns.



sure tests. Most recently, for example, about a year ago at IWC in Schaffhausen, Switzerland we saw every newly assembled Aquatimer plunged into a pressurized-water chamber and subjected to a pressure of 200 bar—an equivalent of 1.8 metric tons of weight. More than a few timepieces that have been kept in the “conserved” department testify to the fact that IWC takes its work very seriously indeed. The models from Breitling and Panerai undergo similar torture, where watchmakers admitted to us that one or another sad specimen will occasionally fail the arduous ordeal.

But before we plunge our trio of watches into the pressure tank, let’s examine them for their technological innovations and exquisite craftsmanship.

Each watch manufacturer has designed massive, robust cases, special sapphire crystals and elaborate gasket systems for the crowns. Each case is constructed so that it will be able to withstand a pressure of at least 100, 150, or 200 bar. As said before, the IWC model, for example, can withstand a pressure of 200 bar by being able to support a weight of 1.8 metric tons! Breitling and Panerai use a high-quality stainless-steel alloy that goes by the technical denomination AISI L 316. IWC uses grade 2 titanium for the case and a titanium-aluminum-vanadium-4 alloy for the back. The titanium alloy mixed in this chemical formula not only has an attractive appearance; it’s also extraordinarily robust. These qualities make it an interesting alternative to stainless steel, especially because titanium is approximately one-third lighter than steel. In addition to the thickness and special crafting of the cases, technicians must also devote particular attention to the dimensions of the crystals and case backs. For the Aquatimer, IWC determined that the screw-in back must be at least four millimeters thick in order to withstand the aforementioned weight of 1.8 tons. The back of the Breitling watch’s case is 3.5 millimeters thick—while the Panerai’s back is three millimeters thick. The weights of the backs are also worth mentioning: Breitling and IWC use case backs that weigh 21 grams each, and Panerai’s large-

A genuine pressurized-water chamber costs a small fortune, so our dream of conducting our own independent tests will simply have to wait.

diameter “manhole cover” weighs a full 30 grams. If you’re asking yourself why the titanium back of the IWC watch, which is nearly the same diameter as that of the Breitling, also weighs just as much as the Breitling’s steel back, well, that’s a good question. The explanation is as simple as it is logical: in order to make a titanium alloy that can be engraved, this relatively soft metal must be alloyed with other chemical substances that help to increase its hardness. Hence, vanadium is added and its admixture results in a heavier material that can be elaborately engraved with the words “International Watch Co. Schaffhausen” and with the Aquatimer’s typical submarine design.



After the pressure test, the candidates are heated. If the watch isn’t hermetically sealed, then a drop of cold water placed atop the crystal will cause a droplet of water to condense on the underside of the sapphire pane.

A conventional sapphire crystal couldn’t withstand the pressures to which our test watches are subjected (depths of 1,000 meters or more), so a company had to be found that could deliver special crystals for the deep-diving trio. For Porsche Design’s Ocean 2000,

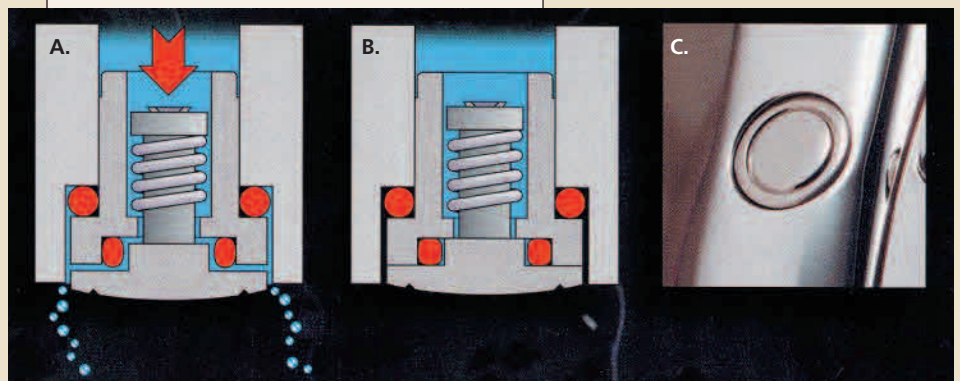
THE DEPTH TEST KNOWS NO MERCY

Merciless tests separate the contenders from the pretenders. The manufacturers test each and every one of their watches in vats full of pressurized water. Inside these torture chambers, the pressure can be adjusted to any desired level (usually 100, 150, or 200 bar)—because a watch is only truly water-resistant if it can survive this ordeal and live to tell the tale. Testing vats of this kind are quite costly and correspondingly rare; only a manufacturer who really needs one bites the budget bullet and buys one. “Ordinary” water-resistant watches are tested with the help of vacuum devices. These simpler machines test a watch’s seal in the reverse direction: they determine whether any gas has escaped from within the case.



This Aquatimer failed its 200-bar pressure test. The watch’s 3.7-mm-thick crystal shattered. Sometimes the tiniest hairline faults, invisible to the naked eye, are enough to doom a crystal.

- A. Tiny bubbles which have slipped through the seal and into the interior can escape again through the valve.**
- B. In its “closed” position, the helium valve is absolutely impermeable.**
- C. Here’s how the valve looks from the outside.**





Beautifully decorated and C.O.S.C.-certified: the ETA 2824-2 inside Breitling's watch for divers.

Advantages

- + Solid case
- + Chronometer-certified movement
- + Good adjustment
- + Favorably priced

Disadvantages

- Sharp-edged cursors on the bezel
- The bezel doesn't rotate easily



No less attractive: the ETA 2892-A2 inside IWC's watch has been modified in accord with IWC's precise specs.

Advantages

- + No-frills design
- + Rotating bezel is protected against inadvertent shifting of position
- + Low weight

Disadvantages

- Costly compared to the Breitling candidate
- Sapphire crystal is not antireflective



Panerai indulges in the luxury of transforming a chronograph caliber into the motor for a three-handed watch.

Advantages

- + Retro design with cult status
- + Limited edition
- + Perfect workmanship
- + Exclusive mechanism

Disadvantages

- Very costly
- Very heavy



DATA PAGE

Breitling Super Ocean Professional 1524 m

Manufacturer: Breitling S. A., P. O. Box 1132 CH-2540 Grenchen

Model: Super Ocean Professional

Reference number: A17345; case number 409632

Functions: Displays the hours, minutes, seconds, and date.

Movement: Breitling Caliber 17, constructively identical with the ETA 2824-2; diameter = 25.6 mm (11₁ lignes); height = 4.06 mm; 25 jewels; 28,800 v/h; Nivarox I flat balance-spring; monometallic balance with smooth rim; fine regulation via Etachron index corrector; ball borne rotor winds mainspring in both directions of rotation; one barrel (Nivaflex 1 mainspring); 42-hour power reserve (±5%); Incabloc shock absorption; stop-seconds function; official rate certificate from C.O.S.C.

Case: Massive, tripartite, brushed steel case; fully threaded, screw-down back and crown; 3.7-mm-thick sapphire crystal is antireflective on both its surfaces; water-resistant to 5,000 feet (1,524 meters); helium valve.

Wristband and clasp: Rubber wristband with pronged buckle.

Results of running test when fully wound:

(deviations in seconds per 24 hours)

| | |
|-----------------------------|------|
| Dial up: | +1 |
| Dial down: | +1 |
| Crown left: | -1 |
| Crown up: | -1 |
| Crown down: | +2 |
| Greatest deviation of rate: | 3 |
| Average deviation: | 0 |
| Average amplitude: | 291° |

Dimensions and weight: Diameter = 41.5 mm; height = 14.9 mm; weight = 113 grams (with rubber wristband).

Price: \$1,700



Both Breitling and Panerai opted for rubber wristbands; IWC preferred to equip its model with a Velcro band. All three bands are light in weight and very kind to the skin.



DATA PAGE

IWC Aquatimer 2000 m

Manufacturer: International Watch Co. AG, Baumgartenstrasse 15, CH-8210 Schaffhausen

Model: Aquatimer

Reference number: 3536-V01; case number: 2834901.

Functions: Displays the hours, minutes, seconds, and date.

Movement: IWC Caliber 37524 based on an ETA 2892-A2; diameter = 25.6 mm (11₁₆ lignes); height = 3.6 mm; 21 jewels; 28,800 v/h; Nivarox I flat balance-spring; monometallic balance with smooth rim; fine regulation via Etachron index corrector; ball-borne rotor winds mainspring in both its directions of rotation; one barrel (Nivaflex 1 mainspring); 42-hour power reserve (±5%); Incabloc shock absorption; stop-seconds function.

Case: Massive, tripartite, titanium case; fully threaded, screw-down back and crown; 3.7-mm-thick sapphire crystal; water-resistant to 2,000 meters.

Wristband and clasp: Velcro wristband.

Results of running test when fully wound: (deviations in seconds per 24 hours)

| | |
|-----------------------------|------|
| Dial up: | +3 |
| Dial down: | 0 |
| Crown left: | +1 |
| Crown up: | +4 |
| Crown down: | +2 |
| Greatest deviation of rate: | 4 |
| Average deviation: | +2 |
| Average amplitude: | 296° |

Dimensions and weight: Diameter = 42 mm; height = 14.5 mm; weight = 82 grams with Velcro wristband.

Price: \$3,795 with titanium bracelet; (Velcro wristband, \$95.00)

which debuted in 1982 and which was the predecessor model of the Aquatimer, a spherically polished sapphire crystal with a thickness of 3.7 millimeters was developed by Switzerland's Stettler firm, which continues to deliver this item to IWC. We're not entirely certain, but it seems quite likely that Stettler, as the watch industry's recognized specialist in this field, also supplies the crystals for the Breitling (3.7 mm thick) and Panerai models (5.1 mm thick).

After the dimensions of the case and crystal have been calculated, the next challenge is to solve the problem of sealing the crystal, back, and crown. Here the manufacturers no longer limit themselves to solutions from classical watchmaking, but rely instead on solutions adapted from the world of machine building. Special O-shaped gaskets enable the technicians to achieve the necessary seal. Breitling's Super Ocean and IWC's Aquatimer each have an O-ring fit into a pre-

After the dimensions of the case and crystal have been calculated, the next challenge is to solve the problem of sealing the crystal, back, and crown.

milled groove in their cases. This prevents the elastic ring from becoming deformed and enables it, in collaboration with the firmly screwed case back that rests securely atop the ring, to produce an absolutely water-resistant, hermetically sealed unit. Panerai's Submersible relies on two O-rings arranged one behind the other. One of the two is seated in the case back; the other in the case itself, thus producing a double barrier against intrusion by unwanted water.

When they set out to unite the sapphire crystal with the case, design engineers inevitably run up against physical limitations, especially if the design calls for the crystal to be pressed into the case. To achieve an optimal union between crystal and case, the crystal isn't simply pressed into place, but is first coated along its rim with a special, age-resistant, single-component glue. The pre-glued crystal is then pressed into place atop the case, and the

entire gluing process occurs inside a chamber that's been heated to 100° Celsius and that's nearly devoid of air. These special glues are highly resistant to acids and provide the desired adhesive power of approximately 25 N/mm².

The design engineers once again proved themselves in the construction of the crowns. Rather than locating the threads on the winding-stem's tube in the wet area, the threading is situated instead inside the tube, where it's protected by two gaskets. When the crown is screwed down (on the Breitling and IWC models) or when the patented locking lever is flipped closed (on the Panerai model), these twin insulators are pressed firmly together, thus ensuring optimal protection from intrusive water or dirt. Although the pressure declines exponentially after each successive gasket, a third gasket, which fits directly onto the crown-box, ensures that the protection is carried to the highest extreme.

Why does the Aquatimer have no helium valve, which the other two candidates possess? The purpose of these valves is to allow helium, which penetrates into a watch during a deep dive, to escape from its case afterwards. (During the dive, the diver inside the diving bell breathes an artificial oxygen-helium atmosphere.) Helium molecules are so small that they can penetrate even the tightest seal on a well-sealed case. After helium has entered the interior, and after the diver returns to the surface, this gas must be allowed to escape in order to equalize the pressure differential between the interior of the watch and the exterior environment. On the Breitling and Panerai models, pressurized helium escapes through a special valve: when the interior pressure reaches a range of about 2.2 to 2.5 bar, this valve becomes active and opens towards the outside. The Aquatimer was able to do without this safety device because it's constructed so that its crystal can withstand an inner pressure of up to 10 bar. A helium valve also creates certain disadvantages. IWC's technicians explain: "We don't need an additional valve because although helium diffuses into the watch, it also diffuses out of the watch again.

Manufacture snobs can look down on them all they want – but ETA movements are the most reliable calibers in the world.

This watch can easily cope with the pressure that's created inside the watch during the emergence (or "decompression") phase, which typically lasts several days on dives to such extreme depths."

Tried-and-Tested ETA Technology

If a manufacturer that doesn't make its own movement-blanks wants to be certain that its watch not only looks robust but can also cope with tough conditions, then that manufacturer must choose the "motor" of its watch with special care. After all, what would be the use of a caliber, whether made by the manufacturer itself or bought from a third-party supplier, if that caliber were unable to withstand the ordeals to which a diver's watch is apt to be subjected? Some hard-core *manufacture* fans might deprecate ETA movements now and again, but as far as reliability is concerned, there's hardly any alternative to the calibers available from this company. Perhaps the only viable alternative is the caliber made by Rolex, but as is well known, this item is ex-

clusively reserved only for watches that bear the name "Rolex" on their dials. So it's no mere coincidence that all three of our candidates rely on ETA calibers: Breitling is powered by the ETA 2824-2; IWC uses the 2892-A2; and Panerai opts for a modified version of the Valjoux 7750, which likewise comes from ETA. The Cal-

iber 2824-2 makes a very neatly cultivated impression inside the Super Ocean's case. Breitling uses only the highest-quality chronometer version, and further embellishes this already very good item with pretty decorations on its bridges and plates. This particular caliber's advantage is its robustness and reliability: No other automatic movement in the ETA family features such massively constructed details as the 2824-2. A large balance, stable design of the automatic-winding system, and a robust construction make it the best movement for the toughest situations. IWC toyed with the idea of using the 2824-2 inside its Aquatimer, but space-related factors impelled the designers to opt instead for the



DATA PAGE

Panerai Submersible 1000 m

Manufacturer: Officine Panerai Italia S.p.a., Via Ludovico di Breme, 44/45; 1-25/56– Milano

Model: Submersible

Reference number: OP 6541; case number 1015528.

Functions: Displays the hours, minutes, seconds, and date.

Movement: Panerai Caliber OP III, based on a Valjoux 7750; diameter = 30 mm (13_ lignes); height = 7.9 mm; 21 jewels; 28,800 v/h; Nivarox I flat balance-spring; monometallic Glucydur balance with smooth rim; fine regulation via Etachron index corrector; ball-borne rotor winds mainspring in both its directions of rotation; one barrel (Nivaflex 1 mainspring); 42-hour power reserve (±5%); Incabloc shock absorption; stop-seconds function; official rate certificate from C.O.S.C.

Case: Massive, tripartite, brushed steel case; crown protected by locking lever; 5.1-mm-thick sapphire crystal; water-resistant to 1,000 meters; helium valve.

Wristband and clasp: Rubber wristband with pronged buckle.

Results of running test when fully wound: (deviations in seconds per 24 hours)

| | |
|-----------------------------|------|
| Dial up: | +3 |
| Dial down: | +3 |
| Crown left: | +5 |
| Crown up: | +2 |
| Crown down: | -1 |
| Greatest deviation of rate: | 6 |
| Average deviation: | +2 |
| Average amplitude: | 292° |

Dimensions and weight: Diameter = 44 mm; height = 16.8 mm; weight = 179 grams with rubber wristband.

Price: \$4,950 (this price also includes a second, interchangeable wristband)

slightly more slender 2892-A2. Even though the Aquatimer seems quite large when viewed from the outside, the space inside the massive case is rather cramped, where the need to cope with a burden of 200 bar (1.8 tons) cannot but take its toll.

COMPARATIVE TEST: DIVER'S WATCHES FROM BREITLING, IWC AND PANERAI

Like the 2824-2, the 2892-A2 has proved itself inside millions of watches. ETA continues to refine and improve both calibers wherever possible. IWC made more than a few changes in the base movement, the most important of which was the removal of the original barrel, which, in IWC's informed opinion, supplied too much energy. Although a weaker barrel puts less stress on all of the bearings and wheels, it also demands extra effort in the adjustment, which, in turn, results in better behavior in terms of the isochronism.

The proverbial cake, however, is taken by Panerai because the design engineers, technicians, and watchmakers at Les Manufactures Suisses V.L.G. (the abbreviation stands for Vendôme Luxury Group) in Neuchâtel have totally rebuilt the Valjoux 7750 chronograph cali-

ber that powers the Submersible. They disassembled the entire chronograph mechanism, and altered the barrel, barrel-bridge, and automatic-bridge. The result of their interventions is a solid, large, self-winding movement with a small seconds display beside the "9" and a date display beside the "3." As far as reliability goes, and especially in terms of its ability to accept fine adjustments, the Caliber 7750 performs like a dream. This excellent performance no doubt motivated Panerai to choose this caliber to serve as the basis for their extensive modifications.

The IWC Aquatimer comes closest to embodying the ideal of a readily legible and eminently practical diver's wristwatch. Special mention should be made of the ingeniously constructed rotating bezel, which turns in one direction and can be rotated only when simul-

taneously depressed. This worthwhile safety feature preempts the possibility of inadvertent mis-adjustment. We were also very impressed by Breitling's Super Ocean, but the watch lost a point or two because of the relatively sharp edges on its bezel, which likewise rotates in only one direction. Panerai's contestant is bulky, heavy, and big. Of the three watches Tested, it's the least suitable for use as a diver's watch. As far as technology and appearance go, it's definitely got its finger on the pulse of the times, so this trendy and fashionable timepiece is just the right choice to serve as an eye-catcher on the wrist of a maritime enthusiast. There can be no doubt that it's the perfect après-sailing power tool when enjoying a few stiff ones at the yacht club bar. And it will surely serve its owner well if he ever decides to use it while diving.



TEST RESULTS

Breitling Super Ocean Professional 1524 m

Wristband and clasp (max. 10 points): 10
Beautiful rubber wristband with pronged buckle perfectly matches the watch.

Operation (5): 3
Setting the watch occurs very accurately via the screwed crown, but the bezel rotates only grudgingly.

Case (10): 7
Solidly crafted, with interesting details and screw-in back; the sharp-edged cursors on the rotating bezel are bothersome on a diver's watch.

Design (15): 12
Typical, contemporary Breitling design with the look of a diver's watch.

Legibility (5): 5
Good legibility of the time under all conditions.

Wearing comfort (10): 8
A heavy watch, but comfortable to wear thanks to the rubber wristband.

Movement (20): 12
Robust ETA 2824-2 with date display; certified chronometer quality caliber with very pretty finishing.

Results of running test (10): 10
Satisfactorily adjusted; the watch ran an average of one second fast per day on the timing machine.

Overall value (15): 13
A very reasonable price for a technically discriminating watch; it will probably be difficult to resell as a used watch, because it's a rather atypical timepiece for Breitling.

Total: 80 points ★★★



TEST RESULTS

IWC Aquatimer 2000 m

Wristband and clasp (max. 10 points): 9
Functional and visually appealing Velcro wristband.

Operation (5): 5
The screwed-in crown provides for accurate setting of the displays; the craftsmanship of the rotating bezel is exemplary; the bezel is protected against inadvertent mis-adjustment.

Case (10): 9
Solidly crafted titanium case with interesting details; screwed-in back with beautifully engraved submarine.

Design (15): 12
The design has been reduced to the bare essentials for a diver's watch; very functional and without frills.

Legibility (5): 5
Good legibility of the time under all conditions.

Wearing comfort (10): 9
A lightweight watch that's very comfortable on the wrist thanks to its Velcro wristband.

Movement (20): 12
ETA 2892-A2 with satisfactory IWC finishing and diverse technical modifications.

Results of running test (10): 9
Was adjusted to run slightly ahead in all positions; overall, it ran two seconds fast per day.

Overall value (15): 13
A technically interesting wristwatch, crafted from titanium, and reduced to the bare essentials.

Total: 83 points ★★★



TEST RESULTS

Panerai Submersible 1000 m

Wristband and clasp (max. 10 points): 7
The outer surface is pretty, but the inner surface makes a cheap impression; the buckle is too bulky.

Operation (5): 5
Functions can be flawlessly adjusted via the crown, which isn't screwed-in, but is protected instead by a locking lever.

Case (10): 9
Very elaborately crafted L 316 stainless steel case with screwed-in back.

Design (15): 12
Retro design is epitomized here, but it's also augmented by many modern stylistic elements.

Legibility (5): 5
Thanks to its large size, this watch remains perfectly legible under all conditions.

Wearing comfort (10): 5
A very large wristwatch; still acceptably comfortable despite its heavy weight.

Movement (20): 14
Unusual: A Valjoux 7750 chronograph movement is used as the basis for a three-handed watch; elaborately modified, very well adjusted and beautifully decorated.

Results of running test (10): 8
Typically good results, just what you'd expect from a Valjoux 7750.

Overall value (15): 10
Not inexpensive by any stretch of the imagination! But, the high image value and the fact that only 500 specimens are made per year help to compensate for the less-than-ideal cost-benefit ratio.

Total: 75 points ★★★