

dolphins, probably because in dolphins it's evolved over millions of years. We human newcomers to the aquatic realm have a lot of evolutionary catching up to do, but, in the meantime, if you want to conserve air and have long dives, don't use these fins. However, if underwater aerobics and full-body conditioning are what you're after, an 80 c.f. tank should give you a great 20-minute workout.

There was plenty more to see, from a new mask-snorkel set with

the snorkel running up between the diver's eyes to a virtual-reality dive mask, a nifty number retailers can take to the mall to invite lines of 13-year-olds to line up and experience the underwater world. The biggest draw may have been the tan-through swimsuits demonstrated by a few nubile young saleswomen. These brought out the scientist in at least half the attendees, who flocked over to learn whether a tan-through suit is also a see-through one, proving once again that the world will beat

a path to your door if you build a better — or sillier — mousetrap.

The fanfare is over for now, but early next year we'll be back at DEMA, stalking the halls in search of icons to shatter, old and new alike. Maybe there will be something really innovative to report on. Hell, I might even get up the gumption to ask the young woman modeling the tan-through suit what SPF it is.

The Editors

Aging Aluminum Tanks

is the tank on your back likely to blow up?

When an 80 cubic foot, 3000 psi aluminum tank explodes, the force is roughly equivalent to that of a hand grenade — a pretty alarming thought when you're talking about something that's hanging on your back.

While such explosions are — thankfully — uncommon, the situation is serious enough that the U.S. National Institute for Occupational Safety and Health (NIOSH) has issued an advisory notice warning that certain aluminum cylinders are susceptible to ruptures that can result in "serious injury, death, and/or property damage."

NIOSH is aware of 12 such ruptures in the U.S., half of them involving scuba cylinders. Bill High, president of Professional Scuba Inspectors, Inc., tells us that his organization logged six failures of aluminum scuba tanks here and abroad in the past two years. Generally, the tanks exploded while being filled.

These incidents represent a tiny percentage of the million-plus aluminum scuba tanks manufactured since 1971. Fortunately, the problems seem to be concentrated in tanks manufactured before 1990 from aluminum alloy 6351-T6. The chief culprit here is a phenomenon known as Sustained Load Cracking (SLC), or

the tendency for 6351-T6 tanks to develop cracks in the neck and shoulder areas. While initially the cracks may be too small to be detected in traditional inspections, they can grow and travel. If they expand both inwards and outwards, a porous condition develops which can rupture under pressure.

Several recent incidents have generated conflicting opinions about how to deal with this problem. In New Zealand, where a 1998 cylinder explosion blasted the owner of a Tairua dive store through the wall of his shop, blowing off his right leg and maiming one hand, tanks are hydrostatically tested every two years. However, some industry observers there have questioned whether hydro testing with tanks being filled to 5,000 psi may actually contribute to cracking.

Other questions were raised following a 1998 blast at a Riviera Beach, Florida, shop in the Force-E chain that tore off most of a dive shop worker's hand, including his thumb and index finger. The worker wasn't filling the tank that failed, merely checking it for pressure before topping it off. The tank was also well within its current hydro and visual inspection periods, an indication that these tests are not foolproof.

Some folks believe that cracks may spread faster than industry research had previously determined, but Dan Strachner, marketing and public relations manager for Luxfer Gas Cylinders, the largest manufacturer of scuba tanks, insists that tests have never uncovered a crack less than four years old. If so, then it is likely that the crack or cracks that led to the Riviera Beach explosion failed to show up upon inspection.

Following that catastrophe, the Force-E chain initiated new tank-filling policies:

- Tanks whose initial manufacture hydro dates are not visible are not eligible for filling.
- Cylinders 10 or more years old must have evidence of having been visually inspected within 6 months.
- Cylinders 15 or more years old will not be filled. Though the cylinder cannot be condemned without the owner's permission, the owner will be encouraged to grant his permission.

Until January 28, DOT was accepting public comment on a bevy of proposed revisions to the Hazardous Materials Regulations designed to reduce the likelihood of cylinder explosions (see sidebar). Although they have released the list of comments they've received, which can be reviewed at www.dot.gov, there clearly will be plenty of give and take before they change current regs.

One DOT insider told us, “the weather vane is still spinning.”

Why so much controversy? Because no one really has all the answers. As one shop owner put it, the dive industry is still so small and relatively new that “all divers are beta testers.”

What Can You Do?

When renting tanks, check the markings on the tank’s shoulder for the earliest hydro test date (the date of manufacture). Also look for the most recent hydro and visual inspection stamps; for cylinders in heavy use (filled several times a day), Luxfer recommends a visual inspection every four months. If the tank was made before 1990, request a newer one, just to be on the safe side. If no newer tanks are available, look for the manufacturer’s name and the exemption or permit numbers, and stay away from those listed in the sidebar.

Of course, if a dive operator hasn’t replaced his aluminum cylinders in over ten years, perhaps you should consider switching to a different operator.

Whether renting or getting your own tank filled, make sure the fill station is in a suitable enclosure, that tanks are immersed in cool water when filled, and that they aren’t fast-filled or overpressurized. (If a tank stays warmer than it was before the fill for up to 45 minutes, that’s a bad sign.) You might even plan another errand while the tank’s being filled, and pick it up later.

Owners of older aluminum tanks and anyone buying a used tank should inspect the markings as described above. If the tank is on the list in our sidebar, or if you have any reason to worry about it, **do not fill it** until it has been visually inspected. And don’t rely on the old VIP testing, either.

Meet Eddy Current. Find a shop with technicians trained in eddy current testing, a new technology marketed under brand names such as Visual Plus, Visual Eddy, or Simple Eddy. This system uses electromagnetic waves to detect cracks in the thread region of the tank that might

be invisible to the naked eye. Be sure to repeat this test at least every year (or every 6 months, for an extra margin of safety).

Don’t suck your tank dry.

Besides the other obvious hazards, when cylinder pressure is reduced to ambient pressure, water can inadvertently enter and cause corrosion.

If your tank loses pressure for no apparent reason, don’t refill it until it passes an inspection.

Remember that the purpose of a dive cylinder is as a safe container for compressed air, not as an object of art. There is never a reason to repaint an aluminum bottle or to use it as a place to show off souvenir dive stickers. However, if you feel compelled to show off for the fish, be sure your tank is painted by a professional and that they do not heat it in the process. Avoid stainless steel bands, which can set up destructive galvanic action with aluminum. Keep your bottle clean and sticker-free (except for the current “evidence of inspection” sticker) as this allows an inspector to visually inspect the exterior of the bottle without unnecessary obstruction. And, of course, follow the basic

guidelines of tank maintenance: rinse thoroughly after each dive and be sure no excess moisture collects in the boot; store tanks at 300-500 psi in a cool, dry place, either lying down (the preferred storage position for aluminum cylinders) or standing up. Avoid dropping or banging the tank or valve. And check regularly for odors, sloshing, rattling, gouges, dents, or corrosion.

If your tank is condemned. Luxfer will replace cylinders found to have either a manufacturing defect (any imperfection that fails to meet product specifications at the time of manufacture) or SLC, according to the following policies:

- If the cylinder is 10 years old or less (based on the original hydro test date), Luxfer will replace it at no charge — but not if it’s been damaged, whether the damage occurred in normal use or because of abuse or mistreatment.
- If it’s more than 10 years old, you can buy an equivalent replacement for US \$50 for cylinders manufactured in the United States. For Luxfer aluminum cylinders manufactured elsewhere, the price is determined in the country of origin based on local currency rates.

Suspect Aluminum Tanks

The Department of Transportation, which regulates cylinder manufacturing and filling, has released the following list of scuba tanks that are most likely to be made from the 6351-T6 aluminum alloy to which a disproportionate number of tank explosions are attributable:

- All DOT3AL tanks manufactured under one of the following exemptions or special permits: 6498, 7042, 8107, 8364, 8422;
- All composite cylinders manufactured under one of the following exemptions: 7235, 8023, 8115;
- All Walter Kidde DOT3AL scuba tanks;
- Cliff Impact DOT3AL scuba tanks made before July, 1990;
- Luxfer 80.8 cu. ft. scuba tanks (S80.8) made before May, 1987;
- Luxfer 72 and 100 cu. ft. scuba tanks (S72, S100) made before August, 1987;
- Luxfer 80 cu. ft. scuba tanks (S80) made before January, 1988;
- Luxfer 50 and 92 cu. ft. scuba tanks (S50, S92) made before April, 1988;
- Luxfer 30 and 63 cu. ft. scuba tanks (S30, S63) made before May, 1988;
- Luxfer 40 cu. ft. scuba tanks (S40) made before June, 1988;
- All other scuba tanks made in the U.S. before February, 1990 (except Catalina);
- All scuba tanks not made in the U.S.

● You must return the condemned tank to Luxfer at your own expense. Call their customer service department at 909-684-5100 for complete instructions. Luxfer recommends that you pack your tank in an old shipping container from your dive shop and send it via UPS' trackable ground service for \$10-\$18.

Unfortunately, the warranty on Walter Kidde tanks, which Luxfer had been honoring, expired at the end of last year. While Luxfer once offered a rebate for trading in old tanks for new ones, that offer has expired. Warranties on Cliff cylinders have expired as well, so if one is condemned, the only recourse is to buy a replacement at full market price. That may seem expensive, but it's a small price to pay for peace of mind.

The statistically insignificant ratio of scuba cylinder explosions to number of bottles in service is comforting — unless you happen to be involved in one of the terrifying and horribly destructive failures. To put things into perspective, however, it's good to remember that the two primary reasons for cylinder failure are human errors (corrosive abuse, overheating cylinders during a repainting process, etc.) or a defect in the alloy present in some cylinders that allows the development of sustained load cracking. So here are a couple of suggestions that should keep you safe. First, learn enough about cylinder care to avoid human error. Bill High's book *Inspecting*

What's DOT Going to Do?

All the controversy on tank explosions has caught the attention of the Department of Transportation (www.dot.gov), which is considering taking restrictions even further, as government agencies are wont to do. They're currently reviewing a slew of proposed revisions to the Hazardous Materials Regulations, including:

Utilizing shear wave ultrasonic testing either in place of hydro tests or as an added option to supplement them. Supposedly, ultrasound will detect subsurface faults, but the testing equipment is not yet available. And, as Bill High points out, ultrasound doesn't detect some problems that hydro-testing does, such as the impact of continual overpressurization and the tendency of aluminum to soften under high heat.

Marking tanks in metric units to bring the U.S. in line with international standards.

Marking tanks with the test pressure instead of the service-pressure markings with which newly manufactured tanks are currently marked. This is a proposal that worries Bill High. He's concerned that printing a higher number on tanks will merely encourage overfilling, leading to even more explosions.

Allowing a 10-year interval for requalifying new aluminum and steel scuba cylinders (those that would be marked in metric units under the previous proposal). Currently, U.S. tanks must be hydro-tested every five years. Folks in the U.S. dive industry, some of whom are now calling for *annual* hydros, seem dumbfounded by this proposal.

Discontinuing authorization for filling a cylinder with a specified service life. The term could be as short as 10 years or as long as 20, although it's worth noting that many aluminum tanks made as far back as 1971 are still in service and have caused no problems.

Registering hydro and ultrasound inspectors. Beefing up registration requirements would give DOT more clout in the training, control, and enforcement of inspection standards. Bill High, whose company has trained over 10,000 cylinder inspectors, concedes that although the scuba industry has developed its own inspection standards, there is currently no legal requirement that inspectors must be trained or follow industry protocols. As an example, visual inspections must be performed before each hydro test. PSI recommends that another visual be done after the hydro to be sure all water has been removed and no damage has occurred during testing. But there is no way of ensuring whether this procedure is being followed by each inspector.

Cylinders is a good resource. Second, be nosy. Look for certificates of training and make certain that those who do your filling, visual inspec-

tions, and hydro-tests are up-to-date in both training and equipment.

— D. L.

Letters to the Editors

drifted away, sucked down, or left behind

Dear Editor:

We keep reading your comments about divers lost off the Barrier Reef, most recently in your 2/00 issue. We were on the live-aboard *Nimrod III* on the Reef a few years ago when we were swept

out to sea when the tide changed mid-dive. The Australian dive guide checked before the dive and told us there was no current, yet, as soon as we entered the water, we encountered a very strong current which pulled us laterally and down. When we hit 110', we aborted the dive and

surfaced. The boat was a long way off and there was no watch on the aft part, so no one saw our signal as we were swept between two islands and into the deep blue water.

We were lucky. We managed to get back on the reef, Karl crammed his finned left foot into a hole in it, and we clipped our BC straps together. We held there despite the tide. Fortunately we stayed calm and focused and tried to think instead of losing hope, panicking,