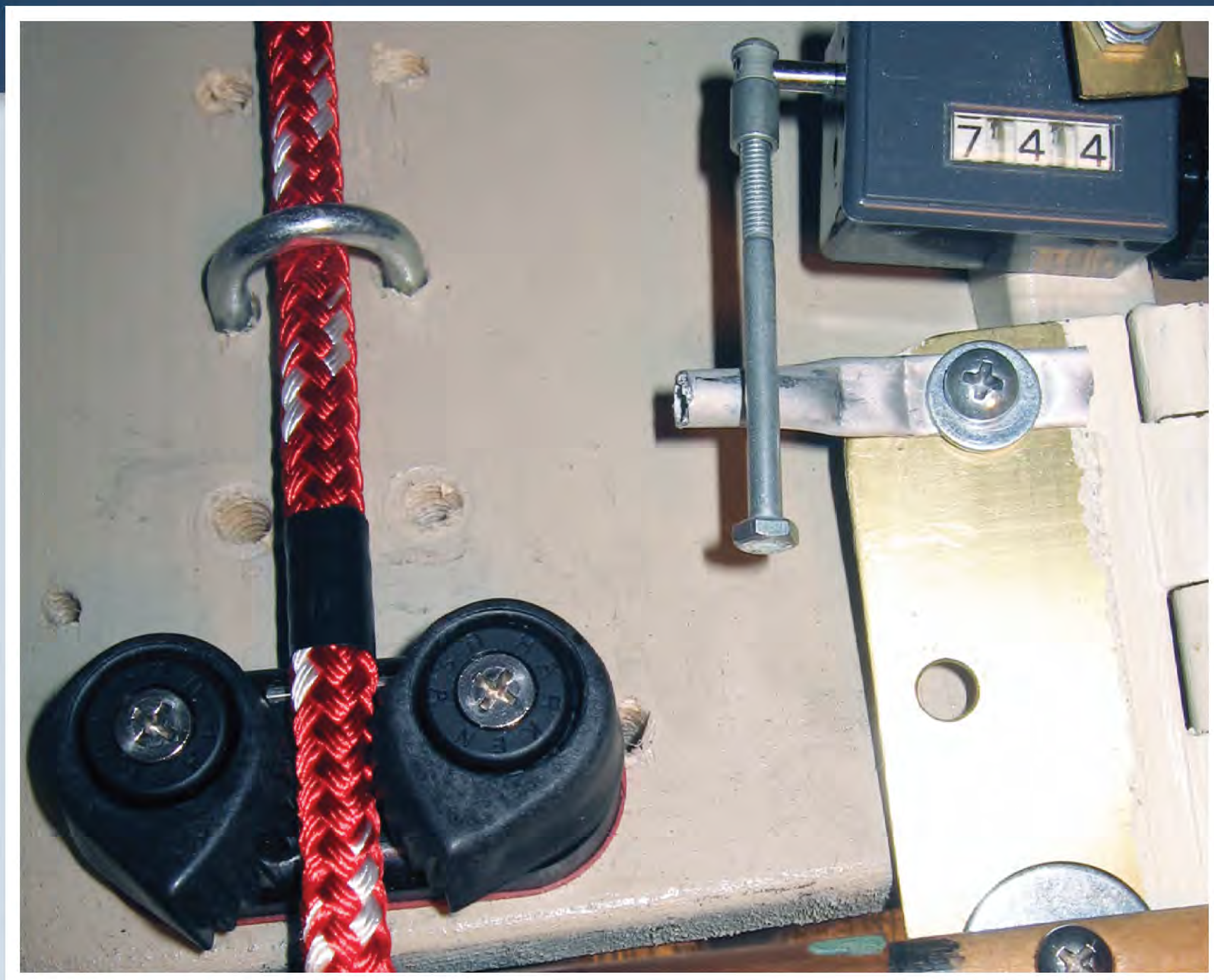

Testers ran each cam cleat through 1,000 cycles of loading and pulling with 3/8-inch Sta-set from New England Ropes.

What Does *Doomsday* Say?

Fuzz, neck, and pull tests tell us what to expect from a cleat after a season or so of use.

Boatowners in the market for a cam cleat first will want to determine what size or working strength is appropriate for the intended application. Other important criteria will be how rugged the product is and what kind of damage it will cause to the line it's being used with. The *Doomsday Machine* was designed to examine these factors by imitating real-world use through a large number of cycles in a short period of time.

Unfortunately, in its current configuration, *Doomsday* could only apply light loads to the line and the cam cleat. (To test the cam cleats to anywhere near their advertised safe working loads would require a motor and gearbox with industrial torque.) Still, 1,000 cycles is 1,000 cycles and certainly gives an indication of where the wear and tear is likely to manifest itself in real-life conditions.

Essentially, the machine pulls the line over the cam cleat and, as the wheel rotates, pulls it down into the cleat and a short way through it. (See photo page 16.) A bungee provides the load for the machine to pull against. After a brief pause while the bungee attempts to pull the line back, the machine trips the line out of the cleat. This is where the machine's geometry failed us a little: The line then drags back over the top of the cleat until the cycle starts again. However, the part of the line we were interested in—the length that pulls through the cams and is held in them—wasn't affected by this.

What the machine cannot do is pull a lot of line through the cam cleat, something that in the real world can happen often.

We examined two characteristics of each test line: the appearance of a "neck" at the point where the line was held stationary in the cam and the nature of line abrasion, if any, where the line was pulled through the cams. (This took the form of a slight fuzzing of the line in the region that was pulled through the cams.)

Of lesser value was the condition of the line where it ran across the cams before slipping between them, because this section of line also ran over the trip bar, which was either copper or brass and deposited some oxide on the bottom of the line.

It could be argued that in actual use, most of the line damage comes from the on/off tension on the load side of the rigging, not from pulling line into the jaw, but since the test imparted small but repeated loads, we believe it would roughly correlate with the results of higher load test.

EVALUATING THE NECK

Some testers suspected that the neck might be a result of the radius of curvature of the cams, but results didn't bear that out. In real life, it's unlikely you'd have the cam cleat repeatedly gripping the same exact spot in the line anyway. Testers found a correlation between a pronounced neck and pronounced fuzz with only two of the test products, the Seldén 201 (composite) and the Garhauer (aluminum).

The Ronstan cam cleat was the first to go through the *Doomsday Machine.* Testers first noted it developing a slight neck at 500 cycles. The Harken 150 showed signs of necking at 100 cycles. The key difference between these two samples is that cams on the Ronstan are carbon-fiber-reinforced resin; on the Harken, they are aluminum. The cams have similar radii of curvature. The teeth on the Ronstan have a 3-millimeter pitch and are asymmetrical; on the Harken, their pitch is 3.5 millimeters and they are symmetrical.

Another "softy" was the Seldén 433-301-01, which has aluminum cams. Its tooth pitch is 4 millimeters, and its teeth are more noticeably asymmetrical than those on the Ronstan.

With the Garhauer sample, the neck became perceptible at 100 cycles and by 1,000 cycles was "pronounced." The tooth pitch is 4 millimeters, but it's surprising how much harder the teeth feel than on the Seldén 301. Because the cams are cut from an extruded aluminum section, they have parallel faces where all the other cams are cast or molded and have a few degrees of draft. Hence, their emphatic grip.

The Schaefer 70-27 caused the most pronounced necking, and it was plainly visible at 100 cycles. This is a comparative brute of a cam cleat with teeth a shark would be proud of. It has a safe working load of 500 pounds, which is far higher than we would like to discover pulling a line out of the cleat.

GAUGING FUZZ

The fuzz we were interested in appeared on the sides of the line just ahead of the neck, in the region where the line was pulled down into the cam cleat and through it a short distance. This is where the line would likely suffer wear in real-world use—where the cams pinch it as it's pulled and released.

None of the cam cleats did any serious damage to the line after 1,000 cycles. A little fraying of the very outside fibers is to be expected at any repeated chafe point. What the results show is how gentle these devices are. The least gentle were the Garhauer and the composite

The neck is just ahead of the tape, and the fuzz is an inch or so ahead of the neck. The dark color on the underside of the line is in most cases from the trip bar. The dark mark on the top of the line is the point where the line pulls down into the cams.

Seldén 201. The most gentle were the Spinlock and the Schaefer, the former because, once it's released, the cam no longer is in contact with the line and the latter perhaps because of a combination of its size and the voluptuous shape of the tops of the cams.

Check out the test results in the tables on pages 20-21. Note that even a "pronounced" fuzz rating does not indicate significant damage. A "pronounced" neck disappears if the line is worked and the "fuzz" appears to be strands that have pulled rather than broken.

THE PULL TEST

Because *Doomsday* could exert only a 10-pound pull before its motor threatened to stall, we devised another simple test to get a better feel of how the cleats perform in the real world. We installed the cleats on a horizontal surface and raised a series of weights off the floor to see whether the cleat added to the effort required to raise the load and whether the resistance was affected by the amount of the load. Raising a 30-pound weight gave us plenty of exercise and definitely was felt when released.

As it turned out, the resistance added by the cleats was small and fairly consistent across the range of weights and the cam cleats. The Spinlock stood out as having more inherent friction than any of the others, but it made up for it with one key advantage: The line can never escape from it, or be inadvertently tripped.

The pull test presented an opportunity to look at a couple of other behaviors, including how easily the line slips into the cleat and how easily it is tripped.

All of the conventional cleats behaved perfectly well when it came to slipping the line between the jaws. As long as we added a little downward pressure while pulling against the load (however light that was), the line slipped nicely between the cams. The slightly troubling feature was that when we lifted the working end just a hair while holding it against the load, the line would slip out just as easily. To see whether a line guide made any difference, we fitted one to the Seldén 301. (Seldén sent a whole battery of accessories.) It didn't make a difference.

Like many onboard setups, ours was maybe not perfect in that the lead into the cam cleat was from a couple of degrees above vertical. In the most common applications, such as when a cam cleat is integrated into a multi-part mainsheet or vang control, this will never be an issue as the lead into the cleat is fixed. In other applications, such as a jib-furling line, it would be prudent to fit a fairlead or bullseye to ensure a lead from horizontal or even from a little below horizontal.

Note that this easy out only occurs when the cams are being pulled open. All of the conventional cleats with the exception of the Seldén 433-201 (with the resin/fiber cams) clung grimly onto an unloaded tail past a 90-degree trip angle, suggesting that an accidental trip of an untended line would be unlikely.

The other side of this is that they all clung onto a loaded tail. To release the line, we had to haul on it to unload the cams. In use, if a line comes under excessive load, it will be hard to dislodge it from a standard cam cleat without a carefully aimed kick with a well-shod foot. The exception was the Spinlock PXR, which only had to be clicked open.

The angle of lift required to trip the line while holding it under tension but with the cleat still closed varied. At the lowest load (15 pounds), the Garhauer tripped at less than 15 degrees but under higher loads, that angle increased to 30 degrees. Most of the cleats tripped in the 15- to 30-degree range.

THE PINKY TEST

A truly subjective test anyone can perform is the "pinky" test. (You can even do this in the marine store with the cam cleat attached to its hang card). Step 1: Pull your little finger into the cam cleat as though it were a line being pulled through it. The pain you feel is a measure of how easily a line will slip between the cams.

In this test, compared to the silky smooth Ronstan, the Garhauer belongs in a medieval torture chamber. Even the Schaefer, the biggest model in our test, was gentle in comparison. This test is a measure of both the design of the cam entry and the strength of the internal springs, and the results reflected (in a subjective way) the no-load resistance we measured (see table).

Step 2: Pull your finger through the other way. This is a measure of how aggressive the cams are and, to a lesser degree, the strength of the springs. Again, the Garhauer inflicted the most pain while the Ronstan could be worn as a bizarre form of jewelry for quite some time before the fingertip turned blue. The aluminum Harken was also fairly comfortable, but its weight was more noticeable.

Neither of these tests could be performed with the Spinlock because of the location of the cams inside the body.