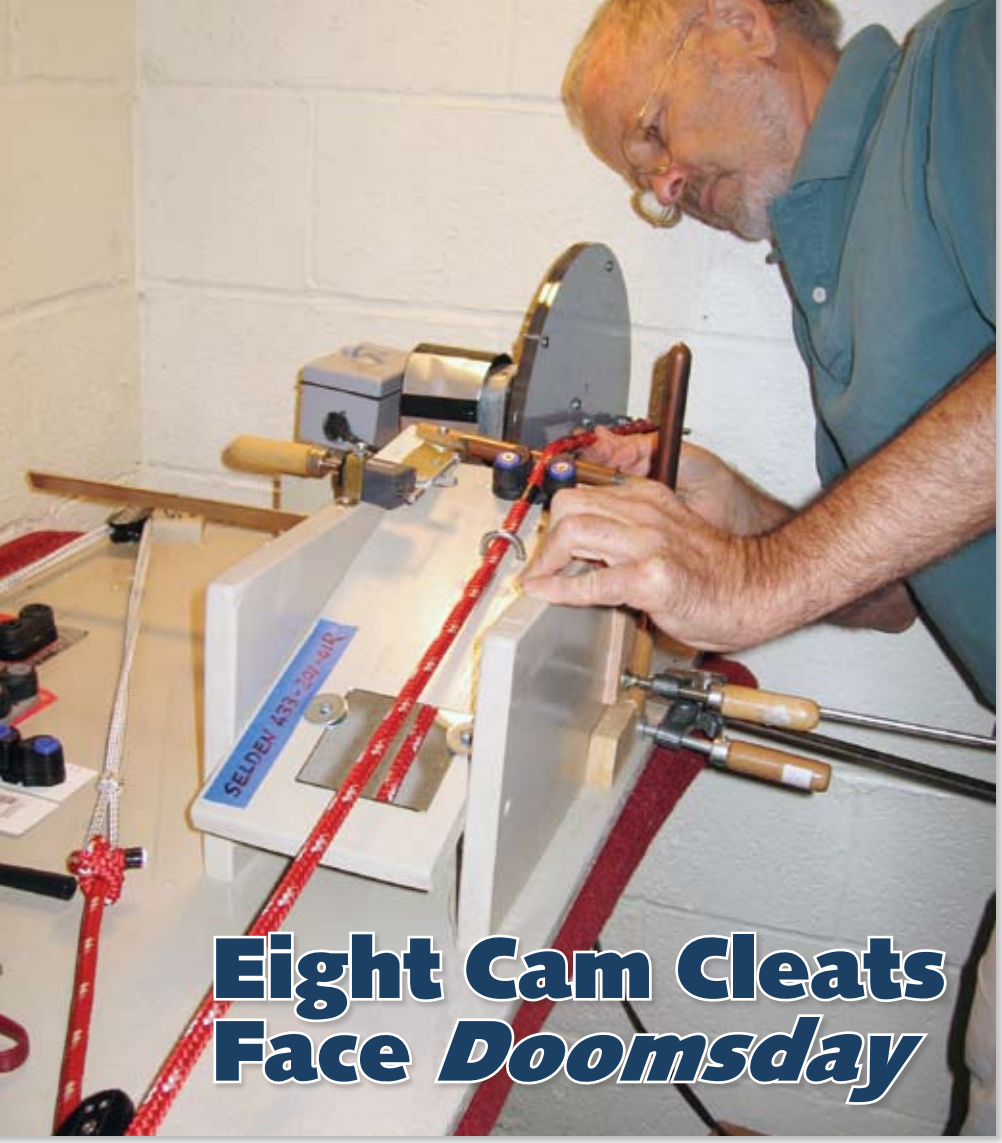


Eight Cam Cleats Face *Doomsday*

Meet Doomsday, *the machine* PS *testers constructed to put a selection of cam cleats through their paces.*

Photos by Jeremy McGeary

Tests mimic real-world use of cleats from Harken, Garhauer, Seldén, Spinlock, Ronstan, and Schaefer.

Cam cleats are everywhere on sailboats. You can hardly put a hand near a modern rig without touching one. They really are useful little devices—even an entrenched dead-eyes-and-lanyards sailor can find uses for them—but they have their drawbacks.

The most significant problem with cam cleats is that they can grip a much higher load than the average sailor can hold on to. On small boats, this isn't much of an issue because the potential loads are small. But for reasons of convenience, and perhaps their low cost, cam cleats are being fitted in greater numbers on larger boats.

Typical applications are at the boom vang and mainsheet on sport boats and even larger cruising boats. Both are controls that may need to be eased in a hurry when the load on them is high. And a cam cleat is most likely to inflict a boat bite when a user is trying to ease or release a highly loaded line from it.

But there's no denying the usefulness of cam cleats, which is why *PS* takes a look at them and their applications from time to time—we even developed a machine just for testing them: *Doomsday.*

There's no telling what fate befell the original "Doomsday Machine" constructed by *Practical Sailor*'s backroom crew for the Aug. 1, 1997 report on cam cleats, but its successor (built for this round of tests) was no match for the current generation of cam cleats. Although the machine is not as tidy a photographic subject as it once was, it survived putting a selection of cam cleats through 1,000 cycles of pull, hold, and release.

What did we hope to discover by dragging lengths of New England Ropes' 3/8-inch Sta-set over and over again through the tested cam cleats? Our principal goal was to learn in about five hours of testing what otherwise might take a boatowner a season of sailing: How much does a cam cleat beat up the line it's working with and vice versa. Is the victim the cam cleat or the line?

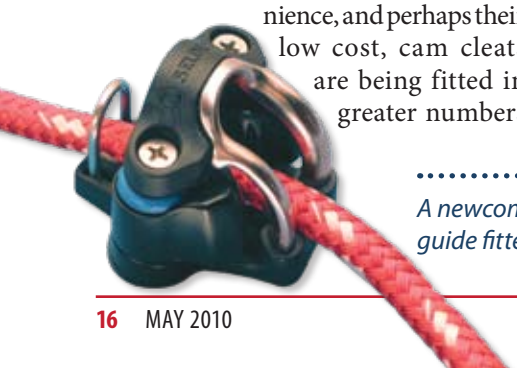
We were able to test a few samples from a range of manufacturers side by side and make some objective and subjective observations about their physical and functional characteristics. To read more about what the Doomsday trials were able to tell us, see "How We Tested" on pages 18-19.

WHAT WE TESTED

We requested manufacturers send us samples of production cam cleats designed to handle 3/8-inch line. In response, we received products from Harken, Seldén, Ronstan, Garhauer, Schaefer, and Spinlock.

Both Harken and Ronstan have a long reach into the sailing market and compete fiercely for business from both racing and cruising sailors. This is good for consumers as the competition has led to improvements in products and a degree of standardization. Their cam cleats (those designed for similar applications) use the same size fasteners on the same spacing, so they are interchangeable.

Although Seldén has been an original equipment manufacturer (OEM) supplier of spars and furling gear for



A newcomer to the retail market, Seldén sent a host of accessories with its test products like this line guide fitted to the Seldén 301 cam cleat PS *tested.*

PS VALUE GUIDE **CAM CLEATS**

MAKER / MODEL	PRICE	LINE SIZE	WEIGHT	CONSTRUCTION	SWL	BL
RONSTAN RF5010 MED. C CLEAT	$22	1/8 to 1/2 inch	1.76 ounces	Carbon-fiber composite cams, plastic base	276 pounds	551 pounds
HARKEN 150 CAM-MATIC	$30	1/8 to 1/2 inch	2.5 ounces	Cast aluminum cams and base, anodized	300 pounds	750 pounds
HARKEN 365 CARBO-CAM ✓	$23	1/8 to 3/8 inch	1.44 ounces	Carbon-fiber reinforced comp. cams, plastic base	200 pounds	500 pounds
SELDÉN 433-301-01 ✓	$32	3/16 to 1/2 inch	2.47 ounces	Cast aluminum cams and base, powder-coated*	400 pounds	NA
SELDÉN 433-201-01	$22	3/16 to 1/2 inch	1.12 ounces	Carbon-fiber reinforced comp cams and base	265 pounds	NA
GARHAUER $	$18	1/4 to 7/16 inch	5.3 ounces	Extruded aluminum cams, stainless base	600 pounds	NA
SPINLOCK PXR 0810/T ✓	$53	5/16 to 3/8 inch	3.6 ounces	Carbon-fiber reinforced comp. body, alum. cams	440 pounds	880 pounds
SCHAEFER 70-27 FAST ENTRY CAM	$30	1/4 to 5/8 inch	4.8 ounces	Cast aluminum cams and base, hard-coat anodized	500 pounds	NA

✓ Recommended $ Budget Buy

* Seldén 301 test sample was powder-coated; production version is hard-coat anodized aluminum.

decades, it's a newcomer to the retail accessory market. It began manufacturing blocks, travelers, and other gear to provide one-stop shopping for boatbuilders like Hunter, Hallberg-Rassy, and Bavaria, and now is making its hardware, including cam cleats, available to boatowners through distributors.

Garhauer occupies a different niche and specializes in stainless-steel and aluminum hardware. It supplies a lot of OEM equipment to Catalina Yachts and to cruising sailors looking for bulletproof gear.

Schaefer has a long history of providing solid gear to both cruising and racing sailors, and items like cam cleats complement an extensive range of products including mainsheet systems.

Spinlock, headquartered in the UK, is probably best known for its line of deck hardware and accessories, but it also manufactures safety gear for performance sailors.

Once you trip a line out of the cleat, you are left holding a heavily loaded line, making these devices best suited for use on dinghies or smaller keelboats. On larger boats, they are acceptable for applications where they are not subjected to loads higher than a normal person can control (about 50 pounds).

Among our test products, the lightest safe working load (SWL) specified was 200 pounds. A line loaded that heavily would make short work of several layers of skin if you were to attempt to hold it or simply weren't expecting the heavy load. Manufacturers list SWL specs to give users an idea of what the cam cleat can handle in the event of an unforeseen overloading, not as a recommendation of what the cleat should be regularly subjected to.

RONSTAN RF5010

The only test cleat with interchangeable cams was the Ronstan RF5010. Its cams can be swapped left to right to present fresh working surfaces once they become worn.

Ronstan RF5010

The "neck" in the line (an indentation at the point where the line was held stationary in the cam) was barely noticeable through 500 cycles, after which it was noticeable. A trace of fuzzing appeared at 500 cycles and was more pronounced at 1,000.

Bottom line: This is, overall, a gentle cam cleat. It's available with a range of different colored cores and with a raft of accessories: rope guides, fairleads, wedges, mounts, and bases.

HARKEN 150 CAM-MATIC

The Harken cam cleats are complemented with an array of extras to adapt them to any task on the boat. One of the selling points Harken touts with the 150 is that unlike most other cam cleats on the market, users can capture a line by simply dropping it down into the cams, rather than having to pull it through the cam.

The 150's hard-kote anodized aluminum cams make this the heavier of the Harken cam cleats tested. They feel very smooth and are indeed gentle on the line. The neck became definite at 500 cycles and the fuzz at 750 cycles.

Harken 365

Bottom line: This is a good choice when durability is a higher priority than saving weight.

HARKEN 365 CARBO-CAM

Interestingly, this lightweight cleat with carbon-fiber reinforced cams made a definite neck at 100 cycles, but it never became noticeably more pronounced even at 1,000 cycles. Fuzz wasn't noticeable until 500 cycles and was still barely noticeable at 1,000 cycles.

Bottom line: We recommended the 365 for racing boats where the goal is minimum weight. It doesn't look as though it would destroy expensive line, and at $23, it's not going to break the bank either.

Harken 150

SELDÉN 433-301-01

The 301 has cast-aluminum cams and base. The literature says it's hard anodized, but the finish on the pre-production sample appeared to be powder coated. The coating suffered no ill effects, and the cleat was kind on the test rope.

The neck became barely noticeable

Continued on page 20

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.

PS TEST RESULTS **CAM CLEATS FUZZ AND NECK TEST**

MAKER / MODEL	100 CYCLES		250 CYCLES		500 CYCLES		750 CYCLES		1,000 CYCLES	
	NECK	FUZZ	NECK	FUZZ	NECK	FUZZ	NECK	FUZZ	NECK	FUZZ
RONSTAN RF5010 C CLEAT	1	1	2	1	2	2	3	3	3	3
HARKEN 150 CAM-MATIC	2	1	2	1	3	2	3	3	4	3
HARKEN 365 CARBO-CAM	3	1	3	1	3	2	3	2	3	2
SELDÉN 433-301-01	1	1	2	1	3	2	3	2	3	2
SELDÉN 433-201-01	3	1	3	2	3	3	3	4	4	4
GARHAUER	2	2	2	2	3	3	3	4	4	4
SPINLOCK PXR 0810/T	2	1	2	1	2	1	2	1	2	1
SCHAEFER 70-27	3	1	4	1	4	1	4	1	4	1

Note: **1** = not noticeable; **2** = barely noticeable; **3** = definitely noticeable; **4** = pronounced.

at 250 cycles and remained only definite at 1,000 cycles. Fuzz, too, was inconsequential, being only barely noticeable at 50 cycles and remaining the same through 1,000 cycles. This kind demeanor was reflected in the pinkie test.

Seldén 301

Seldén sent a selection of accessories with its sample cleats, emphasizing the company's intent to join the fray with those already well entrenched.

Bottom line: It weighs a little more than the composite models but it's kind on line and inexpensive, so it's a good option for the boatowner looking for a general-purpose cam cleat.

SELDÉN 433-201-01

Seldén's 201 and 301 are identical—as far as we can see—in everything except construction material. The 201 is carbon-fiber-reinforced polyetherimide, which is supposed to be resistant to heat build-up, for example when a long line is pulled through it very quickly.

The 201's neck feature went from definite at 100 cycles to prominent at 1,000 cycles while the fuzz was barely noticeable at 250 cycles but was prominent at 750 cycles. Why the 201 was so much harsher than the aluminum 301 was a puzzle to testers. The pinkie test shed little light, but the surface of the composite used in the 201 does feel rougher and perhaps is significantly so at the fiber scale.

Interestingly, the relative harshness on the line between the aluminum and composite examples is opposite that found with the Harken products.

Bottom line: At half the weight and about $10 less than its aluminum brother, the 201 is worth considering.

Seldén 201

GARHAUER

Garhauer's products, big on stainless steel and light on composites, may look less fashionable than some others on the market, but the company's approach is a little different, too, in that it caters more to the cruising market. Garhauer offers an unconditional 10-year warranty on gear that certainly looks bulletproof.

Garhauer

For the cams, Garhauer went to a 60-61 T6 aluminum extrusion. This is the same grade of alloy used for spars, and it's free of the microscopic pores that result from casting. Its anodized surface should therefore last longer. The base is stainless steel.

Both neck and fuzz were barely noticeable until 500 cycles, when they were both definite. At 1,000 cycles, both were pronounced.

After we'd completed the testing, Bill Felgenhauer of Garhauer sent two more cam cleats for us to test. In his own testing, he'd observed that smaller lines tended to be gripped toward the points of the cams and figured that, to ensure the line would be held in the middle of the cams, he needed two models to handle line diameters from a quarter-inch to a half-inch. The cams are made from the same extrusion, and he adjusted them by drilling the pivot hole in a sightly different place (CNC machining is a wonderful tool.) These were the third generation he'd provided for this test, but the company continues to improve on its cam cleats and most recently reduced spring tension by 30 percent over the one we tested.

Bottom line: While the test data presented here may not accurately represent the Garhauer cleats on the market when this review is published, the indications are this is a worthy complement to the Garhauer line, and its price and warranty deserve a look from the serious sailor. It gets the *PS* Budget Buy.

SPINLOCK PXR0810/T

The Spinlock PXR is a rather different animal. The line feeds through a fixed-entry lead and an exit lead that pivots vertically. Between them, the cams are one above the other: a fixed cam on the bottom and a pivoting cam on the top. The top cam releases completely when the tail of the line is lifted to pivot the exit lead upward and re-engages when the tail is pulled downward to flip the exit lead down. You can also operate the release by stepping on the top of the body, which is very handy in some scenarios but not so helpful when caused by inattentive crew scrambling to get to the new high side of the boat.

All these lockings and unlockings

PS TEST RESULTS **CAM CLEATS LOAD TEST**

MAKER / MODEL	RESISTANCE FELT IN CLEAT		ADDITIONAL LOAD NEEDED TO PULL LOAD THROUGH CLEAT			
	NO LOAD	BUNGEE LOAD	15 pounds	20 pounds	25 pounds	30 pounds
RONSTAN RF5010 C CLEAT	.5 pounds	6 pounds	.5 pounds	0 pounds	0 pounds	0 pounds
HARKEN 150 CAM-MATIC	.75 pounds	9 pounds	.5 pounds	0 pounds	0 pounds	0 pounds
HARKEN 365 CARBO-CAM	.75 pounds	9 pounds	1 pounds	.5 pounds	.5 pounds	0 pounds
SELDÉN 433-301-01	.5 pounds	8 pounds	.5 pounds	0 pounds	0 pounds	0 pounds
SELDÉN 433-201-01	1 pounds	9 pounds	.5 pounds	.5 pounds	.5 pounds	0 pounds
GARHAUER	1 pounds	9 pounds	1 pounds	0 pounds	0 pounds	0 pounds
SPINLOCK PXR 0810/T	1 pounds	10 pounds	3 pounds	3 pounds	3 pounds	3 pounds
SCHAEFER 70-27 FAST ENTRY CAM	1.5 pounds	10 pounds	2 pounds	1 pounds	1 pounds	.5 pounds

Note: Weight measurements made with a spring scale graduated to .5 pounds.

are accompanied by satisfying clicks from the spring-loaded mechanism, but for many simple applications, the device seems to have a lot of moving parts. However, by itself, it accomplishes several auxiliary tasks that would require add-ons with the other cam cleats tested.

Spinlock developed the first PX about 10 years ago as a device that would work like a cam cleat in many respects but that could be released under load. The T-shaped base has the same mounting hole geometry adopted by Harken, Ronstan, and the others. Full-diameter 3/8-inch line (a little larger than 10 millimeters) is a tight fit, and a sloppily hot-knifed end will not pass through the fairleads.

From an observer's standpoint, the PXR's performance on *Doomsday* was boring. A barely noticeable neck and no fuzz were observed at 100 cycles and at 1,000 cycles.

Bottom line: The PXR was the kindest cleat of all those tested and, while it's not an exact replacement for a "standard" cam cleat, the fact it can be released under load is a big bonus. Although it's the most expensive in the test group, we recommend it for specialized uses.

SCHAEFER 70-27 FAST ENTRY

This is a relatively new product for Schaefer, and it tops out a hardware line with two smaller models, which likely would have been a better comparison for this head-to-head test. The 70-27 is a big cam cleat with a SWL of 500 pounds. On a racing boat where self-tailing winches are eschewed because of their weight, a robust cam cleat like this one might be found holding the tail of a control line whose load is held by a winch.

Spinlock PXR0810/T

In the test, the 70-27 had formed a definite neck in the line at 100 cycles and a pronounced one at 250 cycles. However, no sign of fuzz appeared at any time. This could be due to the sheer size of the device, though the tops of the cams do have an exaggerated and very smooth entry lip.

Schaefer 70-27

Bottom line: The Schaefer lives up to its "fast entry" description and doesn't scuff up the line, so it's a definite contender and an appropriate complement to the Schaefer line.

CONCLUSIONS

The models tested are just a sampling of the range of cam cleats offered in various sizes and materials. Most makers offer accessories—mountings, wedges, swivel bases, and fairleads—for adapting the products to deck and rig arrangements.

Price isn't much of an issue here. Most of the devices are in the $20 to $30 range. For pure squeeze for the buck and a 10-year warranty, it's hard to look past the $18 Garhauer, the *PS* Budget Buy.

A racing sailor, who probably uses cam cleats more frequently than a cruiser and who is keen to keep weight down, should consider a composite model. Of the tested cam cleats, the one that appears least likely to gnaw through expensive line is the Harken 365. At $23, it's not going to break the bank, either, so we recommend it for the weekend warrior. The aluminum Seldén 301 was also very gentle and only a few grams heavier. It's the *PS* Recommended cam cleat for general use.

At the other end of the spectrum, a cruiser who is more concerned about durability should consider the Garhauer. On the basis that bulk is everything, the Schaefer 70-27 could fulfill the same role, but we'd likely opt for one of the company's smaller models.

The Spinlock is in a class of its own in that the line is always in control. This could well give it an advantage in applications such as in a mainsheet setup, when a line sometimes has to be released in a hurry. It's comparatively pricey, but it gets our pick for specialized applications.

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