

Clarity in Cleats



Midship cleats are often mounted on the toerail where they are backed and reinforced by the thick solid fiberglass at the hull-to-deck joint. Although only two bolts secure the cleat, the usual loads on a spring line will align with the bolt pattern. A breast-line would not. Note that using an eyesplice here defeats a key advantage of a cleat: allowing a line to be cast off under load.

Are boatbuilders taking this essential piece of deck hardware for granted?

On average, a sailboat that's used 60 times a year actually spends only about 6 percent of its annual cycle underway. During the rest of the time, it's either tied up, moored, anchored, or hauled out for maintenance, and when tallied up, this time can total as much as 94 percent of the year. That means that cleats (and docklines), rather than the person at the helm, will likely be in control of your sailboat's destiny when the worst squall lines and cold fronts batter the fleet.

From this data, we can draw two important conclusions. The first is that we all need to spend more time underway, and the second underscores the importance of the cleat as an elegantly simple,

yet most essential piece of hardware.

For centuries, timber-built craft relied upon one or two parallel vertical posts, often call "bitts," that passed through the deck after being fastened to the keelson, floor frames, and deck beams. Lines were secured to these "Samson posts," a nickname that alluded to pillars that only Samson was able to tear down. The trend to secure these line-handling bitts to major structural components of the vessel was based upon function rather than fashion, and it stemmed from the huge tension loads that could be imparted by docklines, tow warps, and anchor rodes. Bitts, along with the spoon-bow sloops and schooners that sported them, have all but disappeared from the waterfront, but the need for secure points to attach the cleats that usurped the role of the Samson post are as important as ever.



This heavy-duty bitt on the Coast Guard Rescue 47 cutter is also found on many oceangoing yachts. The bitts can accommodate multiple turns and thick-diameter lines.

The concept of a cleat as a securing mechanism goes back to the 1400s, when antecedents to modern horn-type belaying cleats began to arrive on the scene. Eventually iron and bronze cast renditions were bolted to timber deck planking that incorporated additional under-deck reinforcement and load-spreading backing blocks. Today, in an era of stiff, light, foam-core decks, there's a need to carefully consider how energy is dissipated around cleat attachment points. For one thing, higher-density "infills" are necessary in regions where bolts secure a cleat to a cored deck. Some builders avoid this extra effort by placing cleats near the toerail, where the core is eliminated and the two fiber re-inforced plastic (FRP) skins of the deck have been brought together. This can be an adequate approach as long the laminate is thick enough or backed with a reinforcing (load-spreading) plate or extra units of FRP, and shoulder washers are used.

In addition to the structural issues involved, there are concerns over line leads and the need to make cleat use as safe and efficient as possible. It's easy to lose sight of how much energy a cleat must handle. In addition to steady-state line loads (normally in shear), there are a variety of angle and load oscillations associated with surging line loads. Fluctuations in the intensity can be linked to tidal rise and fall, along with force multipliers such as gusts and boat wakes.

Seiching, for example, is a low-frequency sloshing akin to what happens in a bowl of soup that's held in shaky hands. The net effect of such outside forces is to accelerate a tied-up vessel, adding a tension oscillation to the docklines or anchor rode. In many West Coast harbors, submarine canyons enhance this large-scale undulation, and

Photos by Ralph Naranjo

Race-boat Alternatives

The object of a racing boat is to keep moving, not sit still, so it's no real surprise that cleats aren't a high-priority item. Aside from adding weight, cleats are notoriously effective at snagging sheets and guys, pushing them further down the list of "must haves" on a good racing boat. In fact, some racing boats we looked at for this article did not even have cleats on the foredeck to take an anchor or bowline. The weld on this eyelet (right) is not designed to take the loads in the direction of pull of a dockline. Also, releasing the line under load will require a knife. Other makers, however, found folding designs and pop-up cleats (far right) to be a fair compromise. But corrosion and grit soon take the "pop" out of pop-up cleats. For cruising boats, *PS* still recommends the no-nonsense fixed cleats, always at the ready when you need them.



seiching can greatly increase the wear and tear on both lines and cleats.

Cleats are the lynchpin in keeping a vessel where it belongs when conditions deteriorate. Recognizing their importance, we sent *Practical Sailor* Technical Editor Ralph Naranjo to the recent Annapolis and Miami boat shows on a mission to scrutinize the amount of attention designers, builders, and brokers have been placing on these crucial components. On his checklist were bullet points such as hardware positioning, fastening means, and most importantly, how the cleat handled the job at hand. He also looked to see whether the cleats (and chocks when used) were large enough to accommodate appropriate sized lines and anti-chafe gear. And finally, if a storm was in the forecast, how would the "doubling up" of docklines be handled?

These cleat-focused show visits revealed more than we initially anticipated: They highlighted that in many cases, a seafaring tradition lives on,

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The Sparkman & Stephens-designed yawl Manitou, the "floating White House" sailed by John F. Kennedy while he was president, sports a traditional Samson post. Passing through the deck and tying into the stem below, the Samson post is engineered to withstand heavy anchoring and mooring loads.

and hardware and securing methodology were sound enough to do the job. In a few cases, such as with the "flip-up" horn cleats found on the luxury line of Oyster Yachts, there were true design innovations. But we also noted that some of the other hide-away cleat designs had to cope with water drainage and less-than-robust support structure, compromises that may not pay off in the long run. Even worse, some designers and builders seem to have dubbed cleats passé, substituting hard points such as rings and eyes as alternatives for line attachment. A few builders seemed to be placing cleats wherever they could find room to stick them. And in some cases,

this meant on the transom rather than the deck itself. The result was a new set of point loads on the hull skin, plus a very awkward perch for line-handlers. This lackadaisical approach to cleat placement and the growing trend in the race-boat fraternity toward eliminating "cleat clutter" altogether, occasionally resulted in docklines being tied to pulpit stanchions, chainplates, and even stays and shrouds!

It seemed that less and less concern was given to the ergonomics of handling a line on a cleat. It's understandable that a foredeck crew in the midst of a spinnaker peel doesn't want obstructions in the middle of their "court," especially





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Picks and Pans

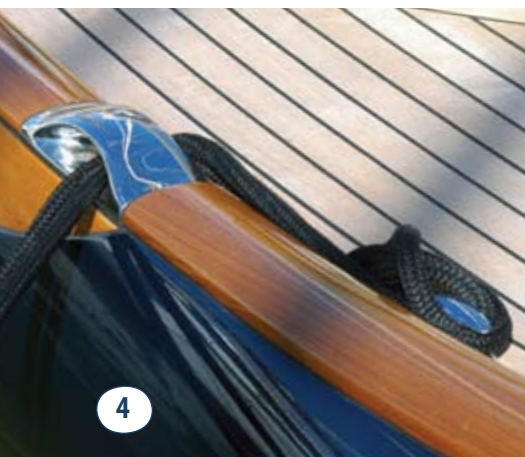
1. *The four-bolt cleat on the custom S&S Palawan VI takes snubbing loads from the anchor in a location that is easy to work.*

2. *A pop-up cleat and an open chock keep the decks clear. But sharp bends at the chocks invite chafe, and tight cleats impede doubling of lines for a storm.*

3. *Big bits and a hefty winch cleat stand ready to accept multiple lines or rodes.*

4. *The Friendship 53's chocks and cleats are elegant, but leave little room for fingers or chafing gear.*

5. *The hawsehole on the Cabo Rico 56 allows room for big lines and chafe gear, but leading sternlines to a winch can bend the winch's spindle, or worse.*



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ones with lethal horns eager to snag a lazy guy or sheet. But from the opposite point of view, a crew adjusting docklines in a rough, gale-swept harbor needs easy access to securely mounted hardware.

A growing concern is that many manufacturers seem more concerned with how cleats and chocks look, rather than how they work. The most important consideration is whether or not a deck cleat carrying a full load can be handled without potentially sacrificing fingers.

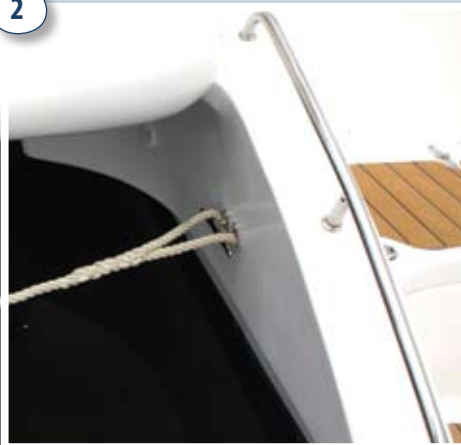
Sheet-handling cleats in the cockpit belay lines that have been load dampened via turns around a winch drum. Just the opposite is true with a deck cleat. The energy contained in a stretching bow or spring line goes directly to a cleat. The load in the line is only slightly abated by a partial or full turn around the cleat, and when a crew member has a line in "hand," good cleat placement allows a quick wrap to be taken without any appendages having to be placed in harm's way.

Our boat-show foredeck roundup revealed a wide array of cleat/chock designs, and an even wider variation in how crews made up docklines and secured their prized possessions at center stage of these in-the-water events. Some boats, like the elegantly designed and artfully built mega-daysailer, the Friendship 53, featured cleats and chocks that kept with the theme of vessel—adding to the overall function and aesthetic appeal. The low-profile chocks and dropped-to-deck-level cleats han-

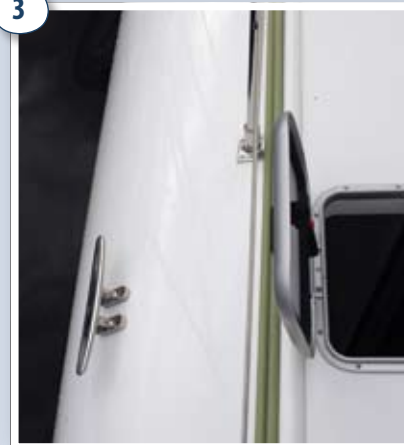
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The Catamaran Cleat Conundrum

1. Loads on this stern cleat probably won't align with the three-bolt pattern, potentially transferring a tremendous amount of load to the hull skin and backing below. Whether this backing and the bolts can withstand the load is worth considering.

2. Hmm... Without dwelling on the precarious security of this eyesplice, it's clear that this cleat presents several challenges. It is not oriented or placed where it can best distribute the load.

And then there's the bigger question: How is one to handle this line without going swimming?

3. Relying on the solid laminate at the hull-to-deck joint to beef up a cleat can raise other issues. Here, the line-handler must lean over or through the lifeline and, hopefully, will restrain the impulse to step on the slick curved deck that leads to the briny below.

dled braided docklines efficiently. The brokerage crew understood what they had in line-handling capability and displayed it well. With bow, stern, and double springs set, a crew could go home knowing that their sloop was securely tied to the dock. However, if storm warnings are posted, there's neither room for anti-chafe gear or room to double-up the lines.

Well over half of the boats tied up at the 2009 Annapolis and Miami boat shows displayed misled lines, foul leads, incomprehensible cleat hitches, and their brokers either ignored or were unaware of the glaring lapse in seamanship. One of the welcome exceptions to the rule belonged to Don Backe and members of Chesapeake Region Accessible Boating (CRAB), a sailing club for developmentally challenged individuals. The CRAB crew had several of their training boats on display (see photo on page 2), and despite the tight cramped confines, their lines ran fair, and anti-chafe gear had been used appropriately. Not one line was snaked back and forth like a cat's cradle. Cleat hitches were properly

made—in short, they displayed a fine example of good seamanship.

Line disarray was often more than just a hint about the priority given to cleats. In some cases, it was just the tip of a construction-shortfall iceberg. On several vessels festooned with floral arrangements, bowls of fruit, bottles of wine, and cute pillows, the cleats were jammed too close to the toerail, making line-handling difficult and

fair leads all but impossible to attain. In the anchor lockers, we discovered little or no sign of extra reinforcement where the nuts and washers associated with cleat attachment came through the under deck. A few builders even preferred to bury aluminum plates in the laminate in order to provide reinforcement, a bad practice that, among other things, invites poultice corrosion. ▲

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The investment-cast fold-up cleats found on new Oyster yachts (holding a fender here) present a good combination of beauty and functionality.

Look Beneath that Cleat

Installation calls for careful thought regarding placement and reinforcement.

Casting metal parts has been a technology in use for at least 6,000 years, and it remains the preferred approach when it comes to manufacturing sailboat cleats. Modern investment casting yields smooth symmetrical surfaces in need of less polishing. The approach can be used with zinc, aluminum, bronze, and stainless steel. Zinc, though often found chrome-plated on low-end powerboats, is too weak a metal to be used for cleats on a sailboat. Aluminum alloys are light and relatively strong as long as the casting process has kept void (air bubble) content to the barest minimum possible. One of the biggest challenges with aluminum alloy cleats is their galvanic interaction with the stainless-steel bolts that secure them to the deck. Bronze and 316 stainless steel castings are heavy, but they are also stronger and less prone to corrosion issues.

The shape of a cleat carries real significance in a variety of ways. The first and most important is how the configuration locks a line in place yet still allows a crew member to control the easing or snubbing process. Cleats with abnormally long horns and two bolt attachment points allow more line to be

wrapped around the appendage, but these “long-horn” cleats also present increased leverage on the base and more vulnerable end points. The four-bolt open pattern of Herreshoff-style cleats (see photo page 2) affords greater support, and their shorter horns are less vulnerable. Some cleats come with an in-line, three-bolt pattern that offers significant strength in one direction but very little on an angle

that’s perpendicular to the bolt alignment. All cleats rely on good engineering practices when it comes to how they are installed.

Those retrofitting or upgrading their boat’s deck cleats can greatly improve the installation with a little attention given to topping and backing plates. The former is a carefully cut and painted piece of G-10, or homemade FRP layup comprising three to five units of woven roving and mat laid up on a smooth waxed surface. The solid glass laminate ends up about a quarter-inch thick, and using a cardboard template, is cut to well exceed the cleat’s bolt pattern footprint. The exact shape of these topping and backing plates depends upon available space and deck shape, but the underlying principal is to provide a load-spreading capacity both above deck and below. The topping and backing plate are best bonded in place with a gap-filling epoxy putty prior to cleat attachment. When the epoxy putty has cured, the cleat can be fitted, holes drilled and a sealant used on the fasteners during the installation. If a raw balsa or low-density foam core is exposed in the newly drilled holes, the extra time spent “hooking out” a half-inch perimeter around the hole and filling it with epoxy putty will pay off in the long run. Be sure to plug or seal the bottom of the hole before filling the holes with epoxy putty. Once it cures, re-drill the holes and install the cleat.



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A Peek Down Under

1. *It isn't pretty, but this aluminum backing plate, drilled and tapped to accept bolts, can be inspected and easily replaced, unlike glassed-in aluminum plates that many makers use.*

2. *The bolts to the foredeck cleats on this Beneteau lack a backing plate, leaving it up to the DIYer.*

3. *Glassing in a backing block to accept cleats is an acceptable practice, but the resin-rich slurry used here shows a lack of workmanship that suggests other hidden surprises.*