

Hose Clamps

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Once while transiting the coast of the central Gulf of Alaska, my engine began running erratically. It would suddenly lose rpms and then speed up again. Over several hours, it gradually lost power to the point that I couldn't maintain the vessel's modest cruising speed. We put in at Seldovia and called a mechanic, who said it sounded like air in the fuel, and suggested I check the fuel line connections. Sure enough, in minutes I located a loose hose-to-copper-pipe joint; the hose clamp had loosened enough that the diesel could suck air past it. One minute to tighten the clamp, a few more to purge air from the injection system, and we were ready to go.

As with the little bands of gold on our wives' fingers, we put a lot of faith in the effectiveness of the little bands of stainless steel, only $\frac{1}{50}$ " thick, called hose clamps. That paper-thin piece of metal is all that keeps the sea from pouring into the boat via underwater through-hulls, and keeps fuel and oil going where they should and other substances from going where they shouldn't.

Stainless May Not Be

Not all hose clamps are created equal. Your common plumbing or automotive hose clamp has no place on a boat. The reason is corrosion. Stainless steel comes in many grades, determined by the alloys in the metal, and some are relatively useless when it comes to resisting the effects of damp air and saltwater. What's more, on clamps not made specifically for the marine environment, the screw that tightens the band may be 400-series or plated carbon steel, which can rust through and cause corrosion of the band in as little as a few months in the marine environment.

The test of the screw is a magnet. If it isn't attracted to a magnet, that doesn't prove it is of the highest quality marine-grade stainless, but if it is attracted you can be sure that it isn't.

Hose clamps may be made of any of various grades of stainless, but the one you want for boat use is 300-series, such as 304. The best is 316. The reputable marine clamp manufacturers, such as Ideal, Tridon, Breeze and AWAB, use 316 stainless in some or all of their lines, so if you don't know your clamp steels, know your steel clamp maker.

Hose Clamp Types

We're all familiar with the standard clamp, a band of metal $\frac{7}{16}$ " to $\frac{9}{16}$ " wide, perforated most of its length with parallel slots that are gripped by the grooves of a hex-headed worm-drive screw in a housing near one end. Turn the screw to the right and the clamp tightens, turn it the other way and it loosens, turn it far enough and it opens. The purpose of the clamp is to exert radial pressure on the hose greater than the pressure of the fluid it is intended to contain. The radial pressure is exerted by applying torque to the screw. With the exception of some special high-torque clamps, most are made to seal adequately at about 100 pounds of clamping pressure, using 35 inch-pounds of torque, or about as much as the average adult man can apply by hand through the handle of a screwdriver.

But what if you need to seal a pressurized joint? Well, there is the **T-bolt clamp**, which is tightened by applying torque with a wrench to a hex-head mounted on a bolt built into the band. T-bolt clamps can produce over 200 lbs. of clamping force. Similar force can be obtained from some super heavy-duty worm gear clamps designed so that as many as eight screw threads are wound into the perforations at one time.

If you need quick and easy installation in confined area, try a **quick release clamp**, which has a spring-loaded mechanism between the band and the housing, or a clipped pre-positioned clamp, which allows hose pre-assembly and can be installed quickly and in hard-to-reach locations. Another al-

ternative is a Snaplock clamp, which has a swivel-action locking screw that facilitates both installation and removal.

Plastic "speed clamps," such as those used on some outboard motor fuel lines to connect the primer bulb, have tiny gripping teeth that allow quick adjusting. They are impervious to corrosion and chemicals, but because they are plastic they are not recommended for use below the waterline.

A Flex Seal or Constant-Torque clamp is used where expansion and contraction due to temperature changes make other clamps ineffective. A V-clamp is a specialized T-bolt clamp made for use on flanged joints such as turbochargers and exhausts. Constant-tension clamps are spring-tensioned to allow pre-placement on hose and to distribute load evenly.

Lined clamps, like those made by Ideal, have an inner ring of smooth metal to protect soft plastic and silicone hoses from being cut by the slots in the tightening band. The best have rolled or rounded edges, also to prevent cutting. A variation on the lined clamp is the Euro-Seal by Breeze, with embossed band threads, or the Swedish-made AWAB, which has coined threads on the outside of the band. Both make for a smooth inside band surface that prevents soft-hose damage

The AWAB is sometimes cited by boating writers as the premium hose clamp for the reason listed above, and because it is all 316 stainless and because it requires use of its own flexible torque driver. This \$20 driver is handy for installation in awkward locations and is designed to prevent over-tightening. Company literature claims that the clamp actually seals better at lower torque due to a design that applies clamping force more uniformly around the hose. Naturally, it is more expensive than other brands, costing about two and a half times as much as its competitors.

An alternative to hose clamps in certain applications is a tool called Clamptite, which

is used to wrap stainless steel wire tightly around fixed objects. In most cases, several wraps with Clamptite will hold a hose in place, but the process takes several minutes and requires nearly a foot of clearance around the hose end to work the tool. While not likely to displace conventional hose clamps, the Clamptite kit could be a handy item for making emergency repairs and is advertised to “stop leaky hoses on the spot.”

Installation and Maintenance Tips

In his excellent volume *Boatowner's Mechanical and Electrical Manual*, Nigel Calder offers these tips on connecting hoses: If the hose diameter is a little too large and fits loosely, apply some marine sealant such as 3M 5200 to the hose barb before inserting it into the hose. Don't apply it to the inside of the hose, or the barb will push it in and form an obstruction. If the fit is too tight, a little liquid dish detergent will lubricate the inside of the hose enough that in most cases it can be slipped over the barb. If that doesn't do it, try softening the end of the hose a few seconds in boiling water, and then apply the detergent.

Boat maintenance writers invariably recommend that all hose connections be double-clamped. This sometimes poses a problem because the outermost clamp is supposed to be at least a quarter-inch from the end of the hose and not all fittings have enough space for two clamps, but it's a good general guideline, and especially important for connections located below the waterline.

When fitting two clamps, it is a good idea to position the heads 180 degrees apart on the hose to give better sealing due the possibility of discontinuities of the inner surfaces of the band. If leakage is to occur, it is most likely to be under the head or housing.

Remember that hose is measured by inside diameter (ID) and hose clamps are measure by minimum and maximum diameter, so when ordering be sure to get clamps with a maximum diameter at least a quarter-inch greater than hose size. There is no harm in using clamps bigger than necessary for the job, as long as there is room for the tail that protrudes from the housing. Cutting the tail leaves a sharp edge that is a safety hazard.

Unless you are using a special tightening device such as a flexible clamp driver or torque wrench, tighten only with a nutrunner, which is like a small socket

mounted on a screwdriver handle. A slotted screwdriver will work, but you risk damaging the head of the screw, and may not be able to apply the correct amount of torque. Tighten only to the limit of what you can do with a twist of a wrist. Do not use a ratchet wrench; you can apply too much torque and weaken or damage the clamp. Avoid tightening to the point that band perforations or edges cut into the hose.

It's not necessary to lubricate screws; 300-series stainless is “gummy” and the manufacturer waxes them so they tighten smoothly. The bands don't need maintenance, but if a band is found to have a kink or sharp bend, it may be impossible to straighten it enough to eliminate a discontinuity. Throw it out.

Periodically re-torque clamps in use, and any new clamp in a critical application should be re-torqued after its first few hours in use. Compressed rubber experiences “cold flow” and actually flows out from under the clamp, reducing residual torque. This creates the impression that the clamp has backed off, which is not true, but the effect is that it has to be re-tightened to maintain its radial pressure.

Once a year, or any time you remove a hose end, completely open the clamp and inspect the point where the band threads were inside the housing for metal fatigue, rust, and crevice corrosion. Don't try to clean up or repair any damaged hose clamps—chuck them. Better yet, make a habit of replacing hose clamps on a regular basis to forestall any problems. Some vessel operators simply replace all hose clamps once a year. ♦