Gearhead

BY STEVE D'ANTONIO

Motor Mount Wisdom

Simple components bear a heavy burden, so treat them right.

Take a moment to think about what connects the thrust created by your vessel's propeller to the vessel itself. Its very driving force. The propeller shaft, transmission and engine are all isolated from the hull by four small components. Motor mounts are the sole means of interface between the power created by the engine and the vessel, enabling it to move. If they are improperly installed or ill-maintained, you may not be able to rely on them to do their job.

The motor mount's saving grace is its simplicity; it typically has only two moving parts, the adjustment and locking nuts that enable it to be used as a fine tuner (coarse adjustment is carried out during initial engine installation and with shims where necessary) of engine alignment.

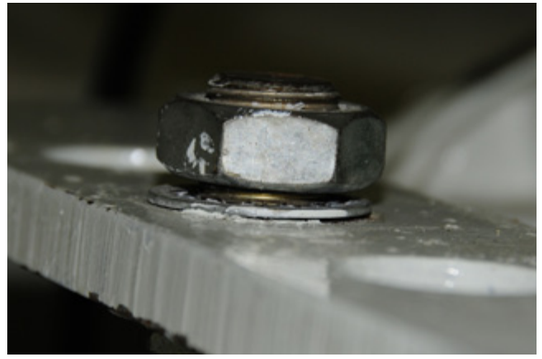
A typical motor mount consists of a cast or forged aluminum or steel foot, which is affixed to the vessel's hull or stringers. Within this base or foot is a rubber-like, vibration-absorbing pad or ring, some of which are considerably more sophisticated than others. The threaded stud rests on top of or within the rubber, offering it a degree of isolation from the metal base and the stringer.

HOW THEY WORK

Motor mounts have two vital missions. First, they should be designed to absorb some of the vibration created by the engine and running gear. Second, with the exception of vessels that are equipped with a thrust bearing system, motor mounts must also absorb the aforementioned thrust created by the propeller. Carrying out both of these tasks well is a tall order. Absorbing vibration requires suppleness in a motor mount's flexible component, however, absorbing thrust invariably compresses a portion of that flexible material, thereby enabling the transmission of vibration.

Additionally, resistance from the propeller under load causes an engine to attempt to rotate in the opposite direction, thereby compressing the mounts on one side of the engine more than the other. In some cases, for smaller engines, the mounts on the non-compressed side may actually go into tension. That is, they are being lifted by the engine. For this reason, some engine manufacturers specify mounts of differing durometer for the right versus left sides of the engine, a detail that is critical for those carrying out mount replacement.

Motor mounts are available in a wide range of sizes and durometer, and with varying mechanisms, improving their ability to absorb both vibration and thrust. Most are exceedingly simple, relying on a cast-in-place hunk of rubber to fulfill these roles. Others are more complex, and more costly, with designs that allow progressive absorption of movement and compression that's based on thrust load.



Loose motor mount locking nuts are especially common. Avoid using star (shown above), or split lock washers, instead rely on self-locking nuts or cam-style washers.

More sophisticated mounts also typically require specialized knowledge where installation and adjustment are concerned. One brand, Barry Controls, includes a two-page installation "manual." Reading it is a must for every installation and subsequent adjustment. In the vast majority of cases when I encounter these mounts, I'm able to determine with a quick visual inspection that their installation instructions have not been followed, or they have not been adjusted properly. I happen to like these mounts, I believe they are very effective, however, if they are not installed properly then you've paid for performance you aren't getting.

ADJUSTABLE

In addition to ensuring that the engine remains firmly attached to the vessel in which it's installed, the motor mounts perform another vital function; that of engine alignment or adjustment. Rotating the adjustment nut on the mount stud enables a mechanic or savvy do-it-yourselfer to move any one of the engine's four corners up or down as necessary in order to properly align the shaft coupling with the transmission output coupling.

Once the alignment is set, it rarely has to be adjusted, and herein lies the problem. With disuse, any mechanical component can become balky and motor mounts are no exception. You may find, when the day comes where the engine alignment must be adjusted, the mounts are frozen solid with years of accumulated corrosion. Inspect your mounts for rust, make sure they are free of rust and corrosion, and then spray them liberally with a non-petroleum-based corrosion inhibitor to keep rust at bay. Petroleum-based

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lubricants and rust preventatives may attack the mount's rubber shock absorber, so avoid them or use with caution, avoiding application onto the flexible component.

More sophisticated mounts include two stages of adjustment. One involves alignment, the other has an effect on the amount of load carried by the mount. Unevenly loaded mounts can actually induce rather than mitigate vibration. Where conventional mounts are concerned load is difficult to determine. For "designer" mounts, on the other hand, a load indicator is incorporated into the mount's design, enabling an installer to, in addition to carrying out alignment, properly balance load across all four mounts, a desirable feature to be sure.

INSPECTION

Check all mount fasteners–those used for adjustment as well as those that attach the mount base to the vessel's stringers, and the mount bracket to the engine or transmission. For casual inspection simply run your fingers over all of these and feel for any movement. Mount fasteners are notorious for loosening, deforming, rusting and stripped threads.

Inspect the visible portions of rubber shock-absorbing material on your mounts. If they show any signs of cracking, crumbling or separating from the metal, it's time (probably well past time) for their replacement. Some higher quality mounts utilize a color indicator to draw attention to failing flexible material, the outside portion is black while the core is red. If you see the latter then the mount has effectively failed, frequently because of improper installation.

Engine brackets should interface with motor mount studs at the midway point or lower, however room should remain to adjust downward if necessary. All engine brackets should be at roughly the same mount stud position, shims installed under mount bases should be used if necessary, to close an excessive gap. Self-locking or double adjustment nuts should be used, along with hardened, "thick" washers (thicker than typical fender washers), both above and below the engine bracket. Unlike conventional thin washers these are able to resist deformation under the very heavy loads to which motor mount hardware is subject.

Washers used with all motor mount hardware must be resistant to distortion.

Because many mounts include an athwartship adjustment slot, fasteners that secure mounts to stringers should also be equipped with heavy duty, deformation-resistant washers. Any deformation in motor mount washers is too much. Look carefully at yours and upgrade them if necessary.

Make sure all fasteners associated with motor mounts are installed over surfaces that are free of paint. Under heavy compression paint can crack or be squeezed out from under fasteners over time, leading to loss of tension. Finally, use a torque wrench to tension all motor mount fasteners, including and especially the upper adjustment locking nut.

Steve owns and operates Steve D'Antonio Marine Consulting, Inc. (www.stevedmarineconsulting.com), providing consulting services to boat buyers, owners and the marine industry. He's also PassageMaker*'s technical editor.*

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Ask Steve

SYNTHETIC DIET

Steve, what is your view on changing an engine's oil diet from mineral-based oil to synthetic or vice versa?

Richard Brewer
Southampton, Bermuda

Richard, synthetic oil offers a host of advantages over mineral-based oil. Among other things, it's extremely resistant to viscosity breakdown, or shearing. Its most valuable asset is resistance to thermal degradation and oxidation. Synthetics were originally designed for aviation jet engines, to resist the effects of extreme heat and the harmful by-products it caused. These by-products reduced engine life. Synthetic oil also performs much better when cold, making life easier on an engine's starter and starting batteries, as well as flowing more easily at start-up, which reduces wear. Because of these properties, synthetic oil lasts longer than mineral oil, which can equate to less frequent oil changes—at a price.

Synthetic oil is considerably more expensive than mineral oil, so the upcharge is tough to justify unless you intend to extend your oil drain intervals. If you run your vessel's engine hard in extreme temperatures, if it is turbocharged, or if you wish to extend your oil drain intervals, then synthetic oil may be right for you. If you change your engine oil once a season, with relatively low engine hours, using synthetic oil will still offer advantages, however, it will be more costly for less return.

When synthetic oil first became available for use by the general public, there were issues involving compatibility with conventional mineral oils. Today, that's no longer the case. Barring specific manufacturer warnings to the contrary, synthetic and conventional oils (of the same weight and grade) are fully compatible and adverse reactions between the two will not occur. Going from conventional to synthetic, or back, should not present any issues. While proprietary synthetic/conventional blends are available, it's probably not a good idea to intentionally mix them.—Steve D'Antonio

FUEL SYSTEM PRIMING

Steve, thank you for your classes and great articles, I've enjoyed all that I've participated in. I just re-read your articles on filtering and polishing. My current issue is that I'm trying to recover from fuel contamination in the port tank. I thought I had plenty of fuel in the tank since the gauge said "quarter full" (two tanks, each 149 gallons in a Bayliner), but it turns out that I was down to about 5 gallons of very grody fuel. I have run about 15 gallons of fuel through the port tank a couple of times, pumping it out and filtering it to try to remove as much "stuff" as possible. I am now trying to restart the 2001 Cummins 330 after changing primary and engine filters. The good tank and

starboard side engine started fine. The contaminated port side won't start. I've tried multiple times turning the key on-off-on to start, but to no avail. The filter doesn't have a manual prime system. Prior to "fuel starvation," both engines were running fine. Any suggestions on getting a better prime?

Skip Fisher
Bayliner
Washington, D.C.

Skip, the contaminated fuel and tank aside, it sounds as if the engine's fuel injection system may simply be air bound. In March, 2013 I wrote an online Channels newsletter column on the subject (see "Can You Bleed?"); reviewing it may be helpful. Did you bleed the air out of the secondary fuel filter after it was replaced? If not, fuel will not be able to get to the injection system. If you did, at each injector, loosen the high-pressure fuel injector pipe nuts half a turn and crank the engine briefly, fuel should dribble out of the parted union (wear safety glasses during this process and cover the opened fitting with a rag during the cranking). If you see no fuel here then it's likely that air resides somewhere in the fuel injection system after the lift pump, either in the secondary filter or in the lift or injection pumps. The fuel needs to be bled out of the system. If the engine isn't equipped with a manual lever on the lift pump (most are) then you can bleed the system by opening the bleed valve at the filter housing and cranking the engine for 10 seconds or so at a time until air-free fuel exits this fitting. Once bled, close that fitting and try to start the engine. If it still won't start repeat this process with injection fittings loosened as described previously. Once air-free fuel shows up there, tighten those fittings. The engine should then start. One note of caution, if the exhaust system is not self-draining, make sure the raw intake valve is closed during the bleeding process. Doing so will prevent water from filling the exhaust system and backing up into the engine. As soon as the engine starts, be sure to re-open this valve immediately.

If the debris in the tank was severe it's possible that it's blocking the pickup or supply fitting, however, if you are able to manually pump the lift pump and get fuel, then this isn't likely to be the immediate issue. If your primary filter is equipped with a vacuum gauge, and it should be, then it will alert you to a blockage at the pickup or in the fuel supply plumbing between the filter and the tank.—Steve D'Antonio