September 2019 Newsletter

Photo Essay: Hydraulic Steering Relief Valve

Hydraulic steering systems are ubiquitous, they are found on everything from wheel-steered tenders to large motor yachts, and even a few sailing vessels have them. Dodge Morgan's well-known American Promise, aboard which he circumnavigated solo, non-stop, the first American to do so, and which I sailed aboard many times as a US Naval Academy navigation and systems instructor, relied on hydraulic steering (and hydraulic propulsion).

Hydraulics offer many advantages for steering systems; plumbing, unlike cables, can be routed almost anywhere, regardless of the number of turns or indirectness of run, and pumps can be designed to provide significant mechanical advantage, albeit at the expense of additional wheel revolutions. They can also be easily paralleled with autopilot pumps.

One area where they can present a challenge, however, is if it becomes necessary to revert to manual steering, using a manual tiller. If the hydraulic cylinder remains charged with fluid, it is impossible to move the piston using a manual tiller (it is for this reason they hydraulic steering systems have no 'feed back' or pressure on the wheel transmitted from the rudder). Without proper planning the alternatives are not very attractive, and neither are they quick. You could remove the hydraulic lines from the cylinder, which would spill hydraulic fluid. Or, you could separate the piston from the rudder tiller arm, a process that is time consuming, and could be dangerous in a seaway; and, if the piston is also the rudder stop, as many are, the rudder could swing wildly into the prop or jam against the hull.

The preferred alternative involves the installation of a relief valve. This could be thought of as a bypass for the steering system's check valves. When it's opened the piston can be pushed by the emergency tiller, making it possible to steer manually, along with retaining the cylinder's attributes as a damper and rudder stop. The valve shown here will allow the user to do just that, however, it has two flaws. One, it's not labeled, and two, its nickel-plated brass body is rated for just 600 psi, most manual steering systems have a relief pressure of 1,000 psi and some 1,500 psi. Make sure your hydraulic steering system has a relief valve, one that's clearly marked and rated for the application pressure.

Ask Steve

Hello Steve,

Background: I live in Vancouver BC, my boat is 64' Ocean Alexander pilot house, 2005. Engines are DD/MTU Series 60, 825 Hp, 1400 hours. By the undisturbed nature of the paint it appears nothing significant has ever been done to them. I am a slow boater (formerly had and loved a Hatteras 58 LRC) and run almost all of the time at 1100 rpm, 10 knots. I do an occasional burnout for a few minutes. I do not run, like so many do, at slightly above hull speed because the OA makes a huge wake at anything over 10 knots. Besides, it's a real waste of fuel. The boat will do 23 knots at rated rpm.

During my routine maintenance, I decided I'd better get acquainted with my intercoolers. Since the cost of gaskets is about $300 per engine just to open up the housing, I decided to first have a look through the air inlet to see what I might find. What I did find was some oil at the turbo and some oily film on the intercooler. Given that I run under-loaded so much this did not surprise me. What did surprise me was all the rust inside the air pipe that interconnects the turbo and the intercooler housing. I should note that I thought these pipes were stainless steel, but I guess they are chromed mild steel. They look very pretty on the outside!

So my question for you is, why the rust in an apparently oily environment? The engines do not ?use? any oil, nor coolant. Both engines have the identical conditions.

I presume I should be removing and cleaning the intercooler matrices, and I'd better check the crankcase breathers (the engines do have the Airsep system). I wonder what the lifetime of these matrices should be. I certainly don't want them to leak into the engines, but the cost is about $6000 each, so not something I want to do unnecessarily. Can one really predict how much life is left by inspection?

Any words of wisdom you may have will be gratefully received!

Thanks, and keep up your wonderful work for our boating community,

Bob Thomson

Bob:

Depending on the engine model, the charge air cooler, sometimes called the after-cooler or inter-cooler, service interval can be as short as every two years, particularly if it's seawater cooled. For the benefit of other readers, this requires disassembly, cleaning and replacement of gaskets and/or O rings. Don't ignore that requirement, as a leak in a seawater cooled charge air cooler, which allows water to be ingested by the engine, nearly always leads to severe engine damage which is often irreparable.

The air that a diesel engine breaths is often laden with moisture, so it's not surprising that the inside of the mild steel pipe, through which this air travels, is rusting. While they are also exposed to some oil vapor, the pipes are cooler than the air /water vapor traveling through them, which will cause the water vapor to condense inside this pipe. Over time this water will displace the oil, thereby exposing the steel beneath, which in turn will lead to rust. I've seen the same phenomenon on cast iron valve rocker arms, on chronically under-loaded engines, where condensing water causes them to rust. In that case the water vapor comes from exhaust gas blow by, past piston rings, which to some degree is normal.

The inter-coolers should be disassembled in accordance with DD/MTU guidelines (this is such a common procedure, and one that is so frequently overlooked, that it is well documented in Detroit service literature). Cleaned and carefully inspected, using a remote viewing device if necessary (these are available as a smart phone attachment for less than $50). If you are concerned about the condition of the water passages, you could pressure test them, a procedure that is also well-documented.

Servicing your crankcase ventilation system is also a good idea, these live a hard life and are prone to fouling if not serviced regularly.

Steve,

I have read with great interest your articles on the QSB5.9 Cummins engines, and would like your advice/opinion on the following.

When I checked the heat exchanger zinc on my QSB5.9, it was almost like new. Is it likely that I used too much Teflon pipe thread sealant on the plug, and the zinc was not grounded to the exchanger? I re-installed it, but am wondering if I should check continuity between plug and exchanger. The lower zinc in the after cooler was at about 65% (I replaced that) and the upper zinc was at about 80% and I re-installed that one.

Cordially,

Paul E. Herbold

Paul:

The maximum allowable resistance between an anode and the metal it's protecting is one ohm, so very little leeway. Under no circumstances should Teflon pipe tape be used on anodes, it's a very good insulator and will very likely upset continuity between the anode and heat exchanger or after cooler.

In practice soft NPT threads like those found on these brass plugs are nearly self-sealing, so very little sealant is needed. My recommendation is to use just a small amount of Leak Lock (made by Highside Chemical) paste. After the plug is installed, at least the first time you do this, go ahead and test continuity between the plug and the body of the heat exchanger (you'll have to find or make a paint-free clean spot for this). Again, it should be no more than one ohm. Thereafter, I'd monitor anode consumption every 60-90 days. Don't skimp, if the anode breaks off and falls into the heat exchanger cavity it's stuck there until you disassemble it; if you accumulate enough of them they will impede water flow.

Steve,

What brand and type of spray lube do you recommend for lubing thru valves?

Thanks.

Eric Bescoby

Eric:

There's not much you can do on a modern ball valve, however, if the ball is crusty, spraying it from the outside with the valve CLOSED will wet that surface, then working it a few times may help. I use PB Blaster, and Kroil as a close second. These are penetrating oils which will soften hard accumulations of marine growth and generally free things up. Available at auto parts stores.

Doing this from the inside is also helpful, but that requires hose removal.

Nothing you apply will stay on once the vessel is launched and used, the Teflon seals pretty much wipe everything off. These valves really can't be lubricated per se. Having said that, you can pump grease into the cavity around the ball, by temporarily replacing one of the drain plugs with a zerk fitting. This is done with the valve OPEN. This will displace water and debris that can accumulate here. Groco offers a purpose made grease for this. Alternatively you can use Lubrimatic Marine Wheel Bearing Grease,

available at many auto parts stores and marine chandleries.

While it isn't for your valve specifically, this specification and maintenance sheet describes the lubrication process. Click on the BV Series Service Sheet icon.

Aloha Steve,

I just finished reading your excellent article on fuel-tanks and would like your advice.

I have a nice old Ericson 38 here in Honolulu that is leaking diesel into the bilge. I plan to empty the tank, then cut an inspection/access hole, then try to clean the bottom/foremost welded seams, then attempt to seal the welds with epoxy or fiberglass resin. Do you think this could work? If so, what epoxy or chemical should I use?

I'll say Mahalo up front for your help.

Mike Griffin

Mike:

When it comes to repairing aluminum fuel tanks using epoxy, or any sealant for that matter, I'm afraid all bets are off. While there are those who have done it successfully, using both West System and JB Weld (hint), it's not something you should bank on. The most difficult aspect of accomplishing this is ensuring the aluminum is squeaky clean, literally. All vestiges of petroleum residue must be eradicated using an emulsifying agent and an abrasive, such as mineral spirits and a ScotchBrite pad, and compressed sir if you have it. This is very difficult to accomplish, and is often the reason such patches fail to work. If you attempt it, preparation is everything.