Muffler and Engine Manifold Exhaust Riser Replacement

On A 1995 Catalina 36 MKII (#1458) with M35 Universal Engine Using Catalina Replacement Parts

Project as documented by Mark P. Gadson, West Chester, PA sailing out of St. Michaels, MD

Initial comments:

1. I discovered the leaks due to water flowing under the bulkhead between the aft cabin and galley which resulted in the wood getting totally soaked and rotted. Apparently this leak had been going on for a while and the wood was soaking up the water/antifreeze. This scenario has been noted in several other previous posts.
2. In order to make this job easier, I would highly recommend that you remove the aft bulkhead in order to have total access to the muffler and exhaust riser from both sides of the engine. In order to do so, simply remove the screws on the galley side of the bulkhead, including two that are in the small piece of molding at the left end of the galley counter. You will need to drill out the wood putty covering the galley counter screws in order to remove them.

3. While one can use non-Catalina parts to safely and successfully complete this project, I chose to purchase the muffler, exhaust riser and other needed parts from Catalina Direct because I did not have the time to spend searching and purchasing the parts elsewhere and customizing them to fit correctly. I do recognize that by choosing direct Catalina parts it was the more expensive route. But, time saved, ease of installation, peace of mind and great help from the Catalina Direct staff more than made up for the greater expense.

4. All the pictures included that I did not take of my particular project were from previous contributor's posts which I would like to recognize and thank.

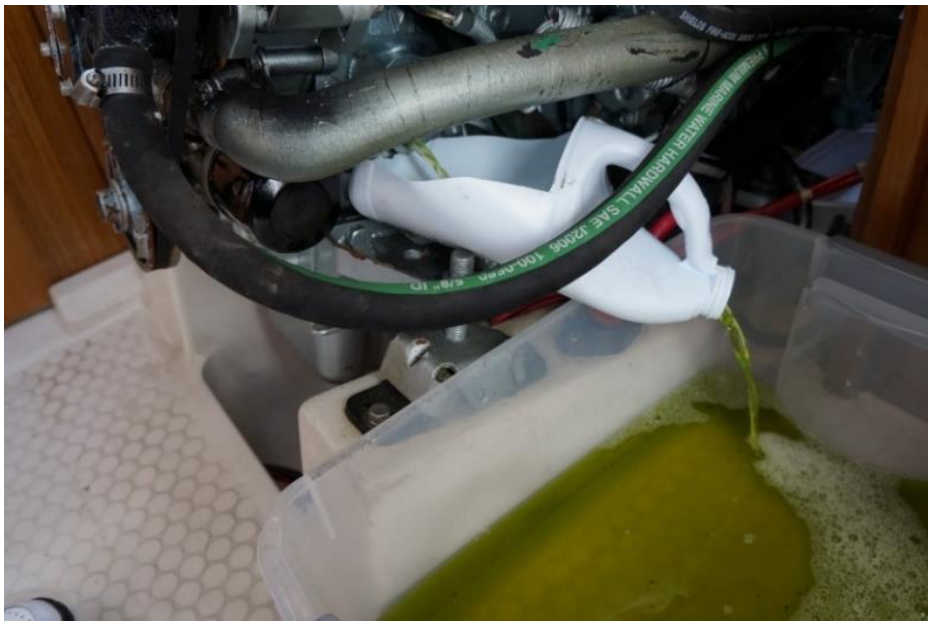
Part 1 – Picture of the Damaged Goods!

Original muffler and manifold exhaust riser after removing the thermal wrap

Part 2 – Draining the Fresh Water Cooling System

Note: The pictures in this section are all from previous posts on the web site and show different engines.

1. Remove the manifold filler cap and drain plug on the port side of the engine. Hold a plastic one-gallon bottle cut in half under the drain plug in order to direct the antifreeze into a plastic tub which is placed under the plastic bottle.



Picture from Previous Catalina Web Site Post

2. Flush the entire contents of the hot water coil by disconnecting both hoses near the thermostat and use a dinghy foot pump to force air into the hot water heater hose which will then drain antifreeze from the other hose.

Picture from Previous Catalina Web Site Post

3. Place a container under the front of the engine.
4. Place a funnel under the big black hose underneath the freshwater pump.
5. Loosen the screw on the hose clamp of the big black hose underneath the freshwater pump and use a thin screwdriver to open up the space between the hose and the elbow.
6. Antifreeze will then drain into the container through the funnel.

Picture from Previous Catalina Web Site Post

Part 3 – Removing the Old Muffler and Exhaust Riser

1. Remove the hose clamps from the hoses connected to the muffler, exhaust riser and exhaust hose. You may have to cut the old hose between the muffler and riser in order to remove it.

2. Spray the three nuts holding the exhaust riser flange to the engine exhaust manifold with an anti-corrosion product like Blaster Petroleum-Based Penetrate in order to have a better chance of being able to easily remove the nuts without also removing the studs attached to the engine or worse, breaking them off. This will totally depend on the condition of those bolts. Mine came off very easily after spraying them with Blaster.

Engine Manifold Riser Connection Flange

3. Remove the exhaust riser and gasket from the engine. If the flange is in good shape and the riser can be successfully unscrewed from it, you may be able to re-use it.

   Question from previous post: When I disconnect the old riser from the aqua lift muffler, would I expect sea water to come out of the muffler? No. You will, however, end up releasing antifreeze when you disconnect the exhaust flange from the manifold. (Hint: make sure you purchase a replacement gasket for the flange-to-manifold connection).

4. Remove the muffler from the boat by removing the screws securing it in place.

Part 4 – Installing the New Muffler

1. Clean up the area where the new muffler will be installed using a de-greasing cleaner.
2. Since the new muffler's mounting tabs and screws will not match the old mufflers screw locations because of the new muffler design, use either an epoxy or Marine-Tex like product to fill in the old screw mounting holes.

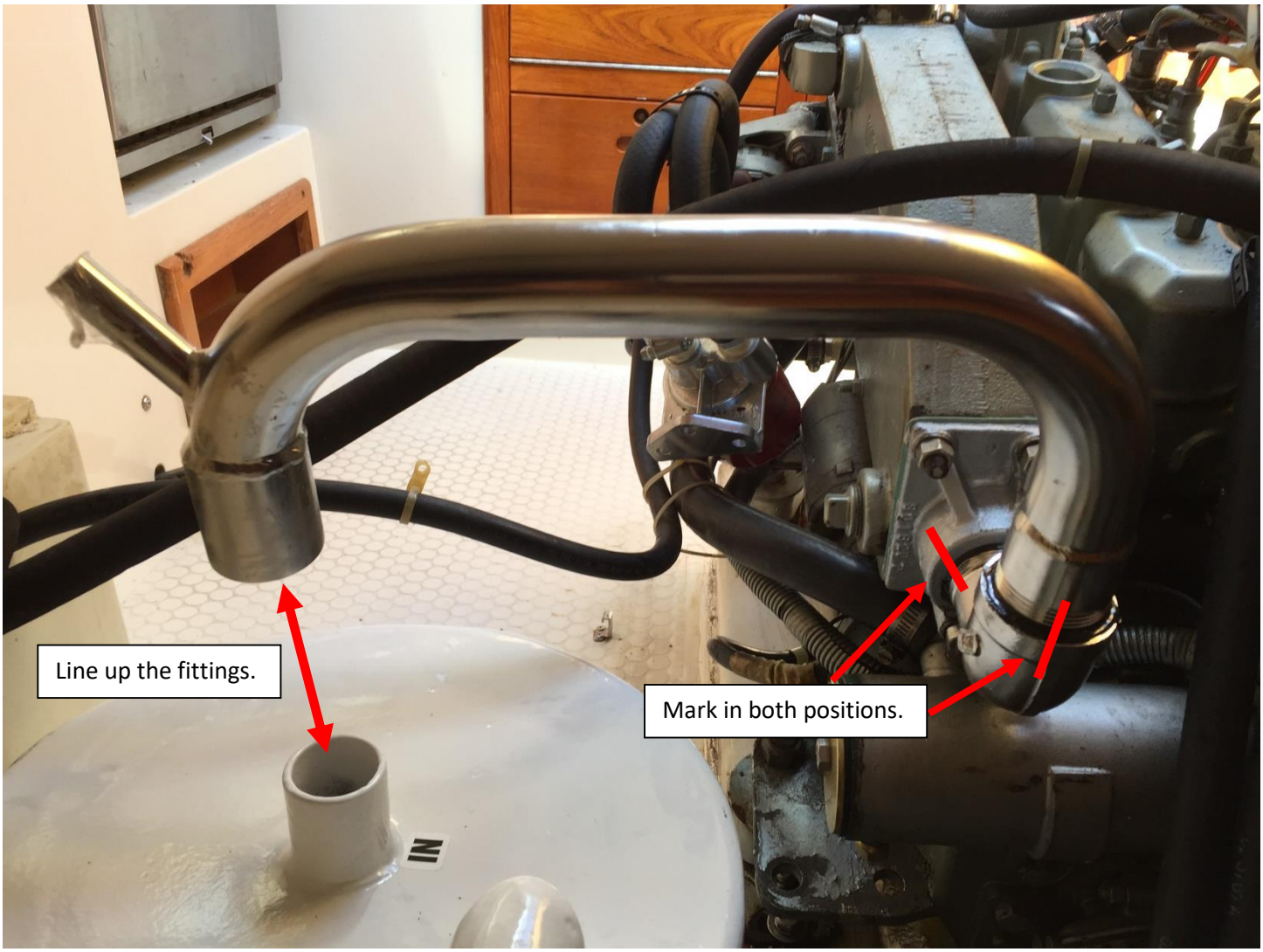
3. After setting the new muffler in place, I marked and drilled the new mounting holes in the muffler tabs and boat mounting location. I used four #10, 1 ½" stainless steel machine screws and washers.

Comment: Before I installed the muffler and exhaust riser, and while the fresh water system was drained, I took the opportunity to clean and replace both end caps on the heat exchanger and replace the zinc anode. I used a soft bristled plastic brush to accomplish the cleaning task. The heat exchanger itself was clean and did not need to be boiled out.

4. Since the bottom of the new muffler is not perfectly flat, I added some 1/8" gasket material to each of the muffler's mounting tabs to allow for a secure and level footing when screwed into place. I used heat-proof gasket cement to adhere the gasket pieces to the muffler.

Part 5 – Installing the New Engine Manifold Exhaust Riser

1. Dry fit the exhaust riser to the engine manifold flange and loosely mount it and the flange gasket to the engine. Then use a Sharpie marker to indicate the exact position on the flange and riser pipe that lines up the end of the riser over the muffler input tube. It will not be exact, but very close.



2. Remove the riser and flange. Apply the heat-proof paste included with the riser to all threads on the flange and riser. Then firmly tighten the flange in a workbench vice using a soft rag to keep it from getting scratched. Then carefully and slowly tighten the joints together lining up your Sharpie marks. You will need to use quite a lot of torque to completely tighten the fittings into position. Since the flange is a cast metal component, you do not want to break it. You want to be absolutely sure that these connections are secure so that no carbon monoxide is released. I tried using two pipe wrenches, but could not hold the pipe and flange in position with the amount of torque needed to adequately tighten the fittings.

3. If you are able to re-use the old flange, thoroughly clean it and facing on the engine where it is mounted. Do not use any tool that would scar either surface since the gasket will need to tightly seal this connection.

4. Attach the hump hose to the riser pipe using double hose clamps.

5. Coat the threads of the three engine bolt studs with Tef Gel. This is to prevent corrosion and allow the nuts to be easily removed in the future.

6. Place the gasket dry – no gasket cement – onto the engine manifold studs.

7. Position the flange on the engine and attach the muffler side of the hump hose in place using double hose clamps. Be careful not to overtighten the hose clamps which could crack the fiberglass muffler input tube.

8. Tighten the three nuts to secure the flange/riser to the engine. Make sure it is very secure, but do not overtighten.

9. Connect the exhaust hose to the muffler output tube using double hose clamps. Be careful not to overtighten the hose clamps which could crack the fiberglass muffler output tube.

10. Connect the anti-siphon hose to the manifold riser using double hose clamps.

Completed Installation from the back and front

11. Attach the thermal jacket cover as per the manufacturer's instructions using the included stainless steel bands.

Thermal jacket cover installation from the front

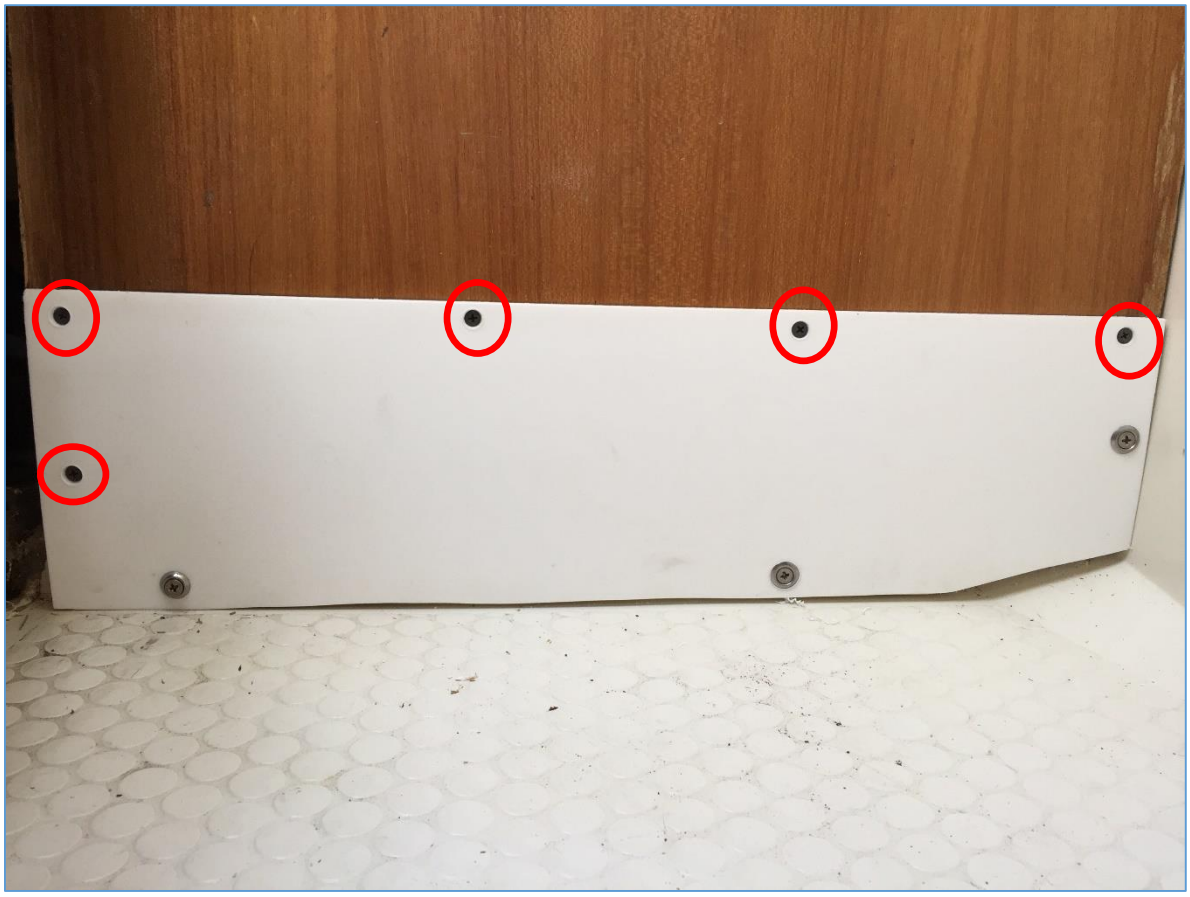
Thermal jacket cover installation from the back

Part 6 – Repairing the Rotted Wood on the Bottom of the Bulkhead

Initial Comment: I'm not an engineer or boat designer, but I truly believe that after completing this project, there is an inherent design flaw in protecting the bulkhead from water intrusion and drainage of the muffler using the drain plug. If you look at the picture below, you will readily see that if there is a leak in the muffler, riser or you simply open the muffler drain plug, the water will head to the base of the back wall of the bulkhead and into the galley area. With that said, I have suggested to the very helpful folks at Catalina Direct, that they suggest to the manufacturer of the new mufflers that the drain be repositioned to the back inboard corner of the muffler rather than the front inboard corner so the if you do need to drain the muffler, the water could be diverted to the small bilge area under the engine rather than run along the engine mount pad and into the galley.

Knowing that my current installation could still promote water intrusion in the wooden bulkhead, I decided to cut off about 2 ½" of the rotted wood at the base and replace that section with King Starboard which would not be affected by water intrusion or leaks. I first cut two pieces of 1/4" Starboard to exactly match the portion of the wooden bulkhead that I cut off and drilled 3 holes that matched the locations of the original 3 holes for securing the bulkhead to the muffler mounting platform. The original bulkhead is 1/2" wide so I used two 1/4" pieces sandwiched together to match the original width.

Once I completed adding the footer to the muffler mounting platform, I traced the outline of bottom of the rotted portion of the wooden bulkhead onto a piece of the ¼" Starboard up to a height of about 5" and cut it to match the bottom of the original bulkhead. I then cut off about 2 ½" of the bottom of the rotted wooden bulkhead. I then matched up the three existing screw holes in the muffler mounting platform and drilled holes in the new Starboard bottom to the bulkhead. Finally, I attached the new Starboard section to the wooden bulkhead with 5 stainless steel screws and re-installed the entire bulkhead. No more rotted wood to deal with if the muffler or riser fail and leak, or you have to drain the muffler which will definitely cause water to flow under the bulkhead into the galley based on the poorly chosen designed location of the drain plug.




WARNING

Part 7 – Refilling and "Burping" the Freshwater Cooling System

Note: The first two methods listed below are continuations of the draining instructions listed in Part 2 above - Draining the Fresh Water Cooling System

Adding New Antifreeze and "Burping" the Engine Fresh Water System – Method 1

1. I used a funnel to fill the hot water coil and sucked the air out using the pump until antifreeze came out from the other hose - then I reconnected to the thermostat housing. Then I filled the engine with antifreeze until it displaced the distilled water and antifreeze came out of the engine block. I placed pipe paste on the threading of the engine plug and reinstall plug. Then I filled more through the engine manifold filler cap until it could not be filled any longer. Then I replaced the filler cap.

2. At this point there is plenty of air trapped inside the engine block that must be burped. Turn on the engine and watch the water temperature. Turn off the engine quickly as the temperature goes above 160F. Loosen the water temp sending unit until you see bubbles coming out followed by liquid. Be sure that you have plenty of antifreeze in the reservoir above. Tighten the sending unit until there is no more leaking of liquid.

3. There always will be some air trapped making the liquid in the reservoir go up and down as the engine cools and heats up. On mine the rise and fall is about 1/2" on the reservoir.

4. The next day after the engine has cooled and most of the antifreeze has been sucked into the engine - add more in the reservoir and repeat the engine temperature test. Do not assume anything - run the engine at 2000 RPM to make sure it is burped well.

5. Here is what I did to avoid overheating and requiring burping the fresh water system after it is flushed and new antifreeze is added.

6. After as much fluid has been added through the filler cap that is possible, install the filler cap and add about 16 oz. of fluid in the reservoir then remove the water temperature sending unit at the top of the engine and use a syringe with a flexible hose to fill about 12 oz. of fluid through this opening until fluid starts to come back out. Then reinstall the sending unit.

7. The reason for overheating is that after the coolant is added the thermostat prevents fluid from filling the fresh water pump chamber. When engine runs no fluid is circulated so the water temperature continues to rise. By filling the top of the engine through the water temperature sending unit opening, the fresh water pump fills with fluid and is able to circulate the water.

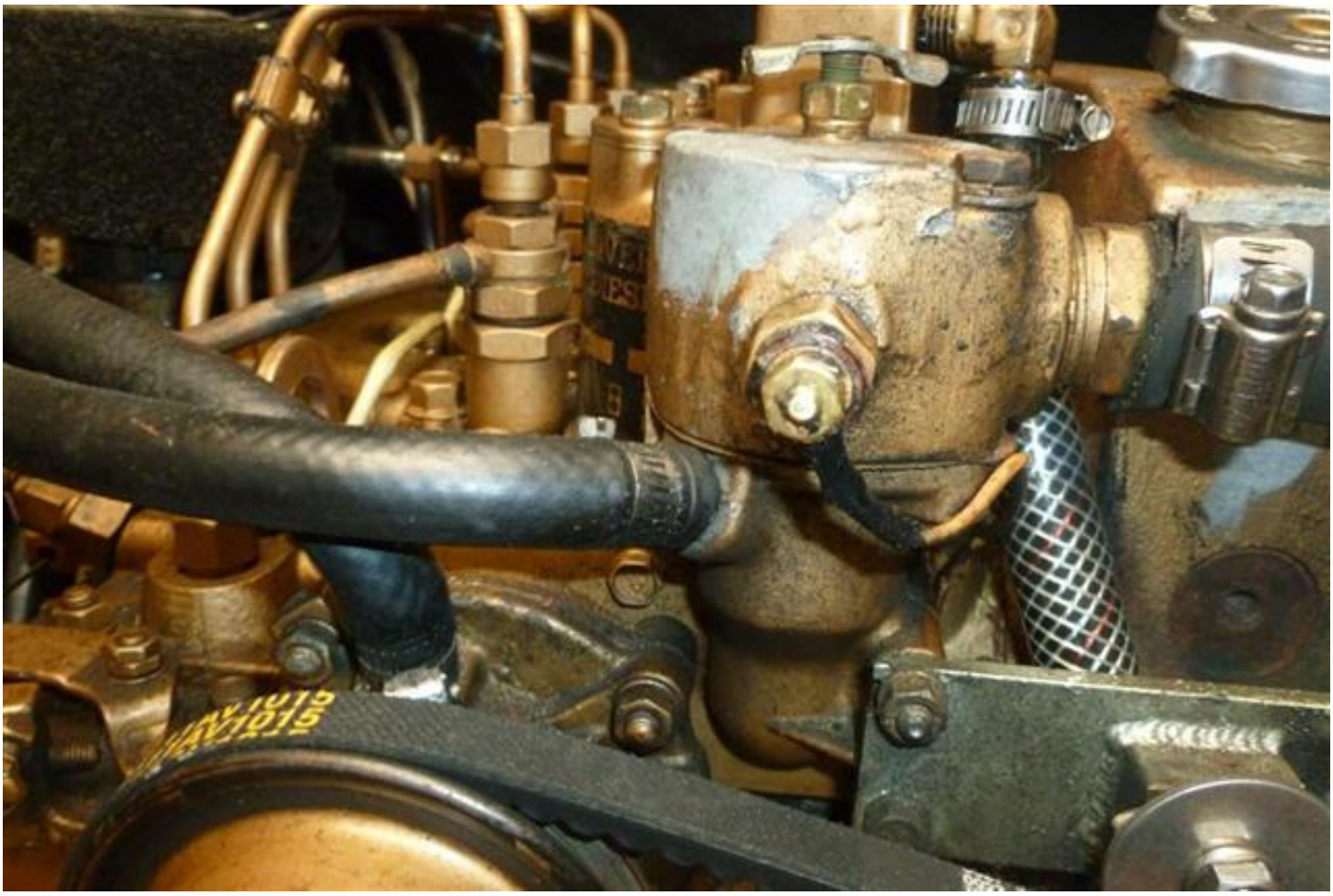
Adding New Antifreeze and "Burping" the Engine Fresh Water System – Method 2

1. To burp the system, simply remove the 3/8 inch hose from the bottom of the thermostat.
2. Hold that hose up above the thermostat and pour distilled water or antifreeze or the 50/50 mix into that hose with a funnel until water comes out of the nipple on the bottom of the thermostat from where you just removed the hose.
3. Once that happens, reattach the hose back to the nipple under the thermostat housing and tighten up the hose clamp. Put some Lanocote on the nipple to make it easier to remove the hose the next time.

   This method expels the air from the loop of hoses that go to the hot water heater and avoids engine overheating at startup. It also avoids revving the engine while the thermostat petcock is open. There is no need to open the thermostat petcock using this method for burping.

   One hose goes to the BOTTOM of the thermostat housing, the other hose goes to the freshwater coolant pump.

   Like this:



Picture from previous Catalina Web Site Post

From Maine Sail
This is the easiest way to bleed the system:

I designed this a number of years ago and have installed one on every engine since. The M-25 has a spot for a real ball valve on top of the t-stat housing.

1- Fill the engine as much as you can with antifreeze via the manifold.

2- Do yourself a favor and lose the sub par, burn your fingers, twist and open "pet cock" and replace it with a real ball valve. This one is male X female to reduce the number of fittings. Then connect a hose barb and a three to four foot piece of clear PVC hose. This hose now becomes your engines new "high spot" for both venting and purging air AND topping up with antifreeze..

3- Open the pet cock/ball valve and fire up the engine with the hose held high above it and let her run.

4- As the engine warms and the t-stat opens fluid may rise in the hose. As it drops, when the stat opens, use a transmission fluid funnel connected to the hose to fill it with antifreeze. Eventually the fluid will never dip back into the t-stat cap as the t-stat opens and closes. At that point the system is full and all the air has been purged.

5- Close the valve.

6- To drain any remaining antifreeze in the hose simply dip the hose end into an empty soda bottle to capture what is stuck in the hose after you closed the valve and you're good to go. Air and antifreeze DON'T mix well, especially if you are using Death Cool (AKA DexCool)...;)