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Don't Be Taken For A Ride!

Everyone knows the 'out-of-sight-out-of-mind' phenomenon! Oh yes! Avoidance and denial, how warm and fuzzy can that make us feel... One of the prime examples in this category is our diesel engine. Honestly, how many times did you check the oil, the coolant or belt tension on the last trip? What is learned in the Basic Coastal and Bareboat Courses is quickly shoved aside as the engine keeps starting reasonably well and then just ticks away for days on end.

But wait! This is not always the case as we all know, and a few suggestions can help avoid an unpleasant weekend or a costly lay-up in port. These subjects are typically covered with demonstrations during the Bareboat Class and we hope they'll come in handy for you one day.

Don't forget the basic five-point check!

- 1) Check the **oil level**, and make sure it is not too low. Oil provides vital coolant in addition to the lubrication. Overfilling should also be avoided as it can lead to other problems such as excessive oil vapors from the crank case or even the famed run-away engine. Problems with the **transmission fluid** are very rare, unless you cannot even remember when you last checked it! On charters it is always good to check at least at the beginning and then monitor for any drips.
- 2) Check the **coolant level** in the reservoir or the header tank (if not raw-water cooled).
- 3) Check the **belt tension** to make sure it has no more than about 1cm (~1/2 inch) deflection (but not less) on its longest run when depressed with moderate finger pressure. Make sure there is no excessive belt dust and the edges of the belt aren't frayed.
- 4) Check the **wiring** for any looseness or discoloration. Make sure all connections are tight, clean and well-secured.
- 5) Check all **hoses** and be aware of unusual softness, drips or smells.

In essence: *Be* the engine! With the right amount of Zen can *feel* trouble...at least sometimes.

Alright, you did this diligently but one day your engine doesn't start. Here's the simple checklist that might help in those situations:

- 1) **Engine doesn't even turn over.** Nothing! (Conclusion: No or insufficient power reaching the solenoid switch on the starter motor)
 - a. Check the battery switch for the starting battery (if fitted) or the central 1-2-ALL switch to make sure it is on. Check for loose wiring on the solenoid.
 - b. With batteries on, if all you hear is faint clicking sound but no cranking noises, chances are your batteries are low. The solenoid, which is what you hear, will usually engage if there is minimal voltage available. Dim cabin lights and low voltage on the panel meter would confirm such a theory. Keep reading but your options are slim.
- 2) **Engine turns over slowly and unwillingly but does not start.** (Conclusion: We have sufficient power to engage the solenoid but the starter does not turn over the engine fast enough to start.) Now it gets interesting as a number of scenarios can cause this situation.

- a. Check your system voltage or at least the cabin lights while you start the engine. If your voltage drops well below 10 V and/or lights dim significantly, the most likely situation is that batteries are low for the whole system. Stop cranking, please!
- b. If cabin lights and system voltage are still high (over ~11V) while cranking is lack-luster, the conclusion above is still correct. In this case, however, it is possible that the starter just doesn't 'see' the full system voltage because, along the way from the battery, there is a bad connection somewhere. When the starter begins pulling its substantial current, voltage will drop across the bad connection thus reducing the cranking voltage. Stop cranking, please! You should be able to find the bad connection by carefully touching each one of the connections between the starter solenoid and the battery. Careful! Cranking at perhaps 50Amperes can drop 2.5kiloWatts into a 1 Ohm resistance! The junction will be HOT and the skipper will be audibly delighted to find the culprit! Clean the junction and try cranking again!

Remember we said '*stop cranking*'? Whenever there is a starting problem, don't try to make up in quantity what your attempts lack in quality. The problems you can cause are an overheated starter or, worse yet, backing up the raw water into the exhaust lines. Remember, the raw water pump always turns along with the engine and deposits water into the muffler. The only way place to go without exhaust pressure is to slowly rise back into the exhaust line...not good!

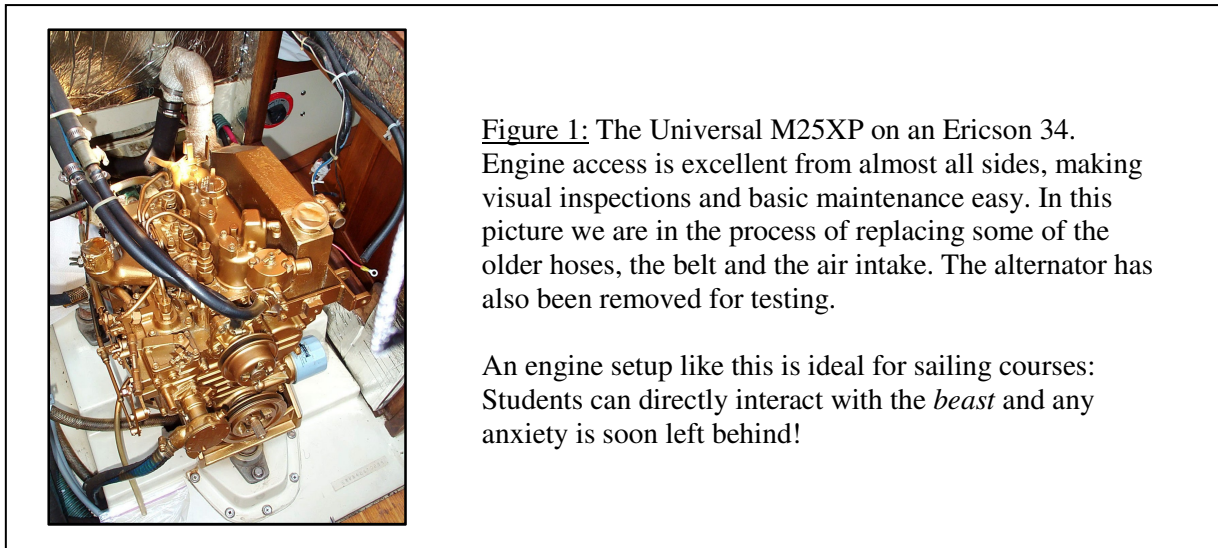


Figure 1: The Universal M25XP on an Ericson 34. Engine access is excellent from almost all sides, making visual inspections and basic maintenance easy. In this picture we are in the process of replacing some of the older hoses, the belt and the air intake. The alternator has also been removed for testing.

An engine setup like this is ideal for sailing courses: Students can directly interact with the *beast* and any anxiety is soon left behind!

Ok, Back to (1a.) and (2a.) above. Let's assume you have concluded that there is just not enough juice left in the batteries, and after switching to the other battery or even combining the two of them you are still left without the necessary *mojo* to crank successfully. You should attempt one more procedure between now and calling your favorite on-the-water helper: *Decompression*! You may remember that, when the engine is cranking normally, the pistons actually perform their compression strokes just as if the engine was running. After all, this is part of the four-stroke Diesel cycle. Opening the exhaust valves with the decompression levers (one for all cylinders or individually) will allow the engine to be cranked without the significant work of compressing the gas in the cylinders! Using a LINK10 we measured the cranking current to the starter motor of the Universal M25XP (3 cylinders). The difference is dramatic: It takes 50+ Amperes during normal starting but only around 4 Amperes with exhaust valves open and the cylinders 'breathing'. While cranking with open decompression lever(s), let the flywheel of the engine

gather momentum (less than 3 seconds) with an audible whine, then release the decompression lever(s) while continuing to crank. Oh...don't forget to keep the fingers of the other hand firmly crossed. We have found that an almost dead battery can still start a 'willing' engine and reinstate the skipper as the hero onboard!

Needless to say, if this doesn't work, you are probably best advised to check your list of friends with boats or your towing insurance and proceed along that route. Much has been written about the importance of maintaining your batteries; you are now able to add your own chapter!

- 3) What is left? The **engine cranks willingly and eagerly but still doesn't start**. (Conclusion: The starter is working fine, i.e., no electrical problems, but something else is missing. Perhaps the fuel?)
- a. My favorite in Bareboat classes is the stop lever. Make sure it is pushed in all the way!
 - b. If the condition persists, try not to assume the most unlikely scenarios first. These could include running out of fuel, a clog in the line, gremlins... Why would any of these reasons suddenly conspire to hit? A more likely scenario is that the engine has not run for a while or ran well just yesterday only to cool overnight. In the meantime, a culprit snuck into the system: AIR. In the fuel line, small amounts of air can lead to airlock and to failure to deliver fuel at the appropriate pressure to the injectors. Depending on your engine, you will have bleed points to remove the air from the fuel lines. Individual procedures will vary as will tricks and shortcuts. Engines with electric fuel lift pump are generally easier to bleed than those with manual ones. The time to study this procedure is before you need to know!
Airlock is also the culprit if the engine starts fine but stops shortly thereafter. A small bubble has traveled down the fuel line to the injection pump. One more reason to not cast off the lines right after starting!

Does all of this sound complicated? Perhaps a little, but consider that we rarely choose the problems we are faced with while onboard. They somehow find us, and it is up to us to find the answer. I typically recommend a diesel course with a local distributor or trade school for students that want to dig deeper into the subject. Since the engine is so critical for our confined harbors or when the wind dies, this is time and money well spent. A single event that you can deal with yourself may pay for itself!

Like everything else onboard, be knowledgeable and challenge yourself to learn more...and don't forget to have an enjoyable time on the water!



Capt. Christoph A. Winter has been an ASA Sailing Instructor for over 13 years, teaching more than 1000 students mostly in advanced courses and navigation. He is a USCG-licensed Captain's and received the ASA Outstanding Instructor award three times. He also holds a doctorate in nuclear physics from the University of Goettingen, Germany. Some of his students will confirm that he occasionally talks to his Diesel engine. Despite some relationship problems in the past, they remain good friends.