

Repowering an I-36

13 August 2006 - 26 October 2006



1978 Westerbeke L25



2006 Yanmar 3JH4E

Repowering an Islander 36 sailboat

by John Hamlet

Captain - S/V Charisma

The thought of repowering our 36 foot Islander sailboat had occurred to me many years ago. We bought the sailboat in June 1993. We were the fourth owners. The 1978 four cylinder Westerbeke L25 diesel was in good condition, but the number of running hours could only be estimated. At 100 hours a year, for 28 years, the running hours came to 2800 in 2006.

Over the years I'd repaired a leaky heat exchanger, replaced water pump seals, installed two alternators, replaced numerous seawater impellers, upgraded the primary fuel filter, and epoxied the fresh water coolant fill tube back into place. All in all ... not too bad for marine diesel maintenance.

But on 13 August 2006, enroute from the Magothy River above Annapolis to Swan Creek on the Eastern Shore, the boat simply stopped moving forward. It was as if we had hung one of the Chesapeake Bay's rogue crabpots. My wife, who has unusual low frequency acoustic acuity, thought she heard some noises just before we loss motive power. When we placed Charisma in reverse, she behaved normally; however, we were about 4 miles from our slip. To back the boat that far seemed risky. Fortunately, the wind soon shifted and we were able to sail back to our slip at Swan Creek Marina. It was only the second time I'd done this.



Figure 1 - Shaft coupling missing key

I examined the engine compartment and found that the prop shaft coupling key was missing. Elated that this was the cause for our loss of motive power, although puzzled by the presence of speed in reverse, I installed a new shaft key. The coupling had some play around the shaft and I could feel the remains of the old key as I turned it. I then observed the shaft rotate at various speed while moored in our slip. It seemed that reverse turned the shaft faster than forward, but both moved Charisma in the slip. We tested my shaft key fix the next weekend.

Later, I would learned that both the shaft and stuffing box needed replacement due to keyway wear and tube age.

At first I obtained an estimate to replace Charisma's Hurth HBW 10-2R transmission with a new one just in case the missing shaft key was not the cause. The estimated cost for a new HBW 10-2R, including installation, was \$4500. The local marina was amenable to performing the work, but could not start until late September.

The culmination of the repower decision occurred on 4 September 2006. After replacing the prop shaft key, we went out for a weekend at a nearby anchorage. We could tell the forward clutch was

not up to par. We only made about two knots to the anchorage. That afternoon I went over the side to look at the prop. It was clean - no crab pot lines or other restraints on the shaft or rudder. The next morning, not knowing if we were soon going to haul the boat for the winter, we decided to pump out. We were returning from pump out at a nearby marina and noticed people walking along the dock faster than we were moving. The forward clutch was ineffectual. We decided to back Charisma to our slip about a mile away. We got lots of quizzical looks. That afternoon I asked the local repowering experts to give me an estimate. Two weeks later I got their estimate.

Table 1 - Repower Costs

Item	Description	Estimate (\$)	Actual (\$)
1	Tow from Swan Creek to Haven Harbour	68.00	68.00
2	Remove existing Westerbeke L25 & replace with Yanmar 3JH4E with marine gear:	3936.00	3735.00
	a. Removal of existing engine		
	b. Thoroughly clean engine space and paint eith AwlGrip or Gelcoat		
	c. Change shaft coupling to couple new transmission		
	d. Adapt engine stingersto accept new engine		
	e. Replace exhaust hose and muffler as necessary		
	f. Remove and replace engine panel with Yanmar C-panel		
	g. Replace as needed shift and throttle cables		
	h. Use existing Racor dual filter system		
	i. Sea trial vessel to complete engine performance plan		
3	Yanmar 3JH4E with KM35P transmission	8605.00	} 10049.18
4	Upgrade to C-Panel (oil pressure & coolant temperature)	547.00	
5	Miscellaneous materials to install engine	1375.00	
6	Engine shipping & handling	200.00	291.15
7	Crane to lift engine	210.00	} 793.50
8	Haul, powerwash, block, inspect, relaunch, tow back	252.00	
9	Enviromental Compliance Charge	238.27	
10	Remove and install fixed prop	246.00	246.00
11	15" fixed 3-bladed prop	445.00	445.00
12	Replace cutlass bearing, supply & install Dripless stuffing box, replace 1" diameter x 3' length stainless steel shaft	1114.00	754.96
13	MD Sales Tax	558.60	539.91
14	Consummable shop supplies	79.43	0
	TOTAL	17874.30	16922.70

The yard foreman recommended either of two 3 cylinder Yanmar diesels: 3YM30 (27.3 HP, 271 lbs) or 3JH4E (36.3 HP, 408 lbs). Since the L25 weighed 372 lbs with transmission, and I had been in several squalls where I believed Charisma was underpowered, I opted for the larger diesel. The yard was the local Yanmar distributor and could start the repower job in September. The foreman told me it would take about two weeks. I checked the initial estimates with another repower specialist nearby. This second boat yard also had a good engine repower reputation, but could not start until the winter. They recommended a 3 cylinder Westerbeke 35B (32 HP, 368 lbs). I chose the Yanmar yard to repower Charisma based on several sailboat-related conversations I had over the past years

Table 2 - SOG with 3-bladed 14"x14" prop

RPM	Speed (kts)	Comment
1800	5	Slight wake
2000	5.4	
2200	5.7	No cavitation
2400	6	
2600	6.5	
2800	6.7	Perhaps 15" pitch would improve
3000	6.9	Max speed (Hull speed=7)

The old two-bladed, 14 inch prop was deemed insufficient for 40 HP. A fixed, 3-bladed, 14 inch prop, was ordered due to the limited shaft-rudder clearance. Calculations indicated a 3-bladed, 18 inch diameter prop with 11.8 inches of pitch was ideal, but we did not want to replace the shaft strut. Moreover, the yard foreman told me it was important to keep the shaft depression angle shallow for the sake of the engine orientation. A local prop shop adjusted the 14 inch prop's pitch to 14 inches.



Figure 3 - Before prop

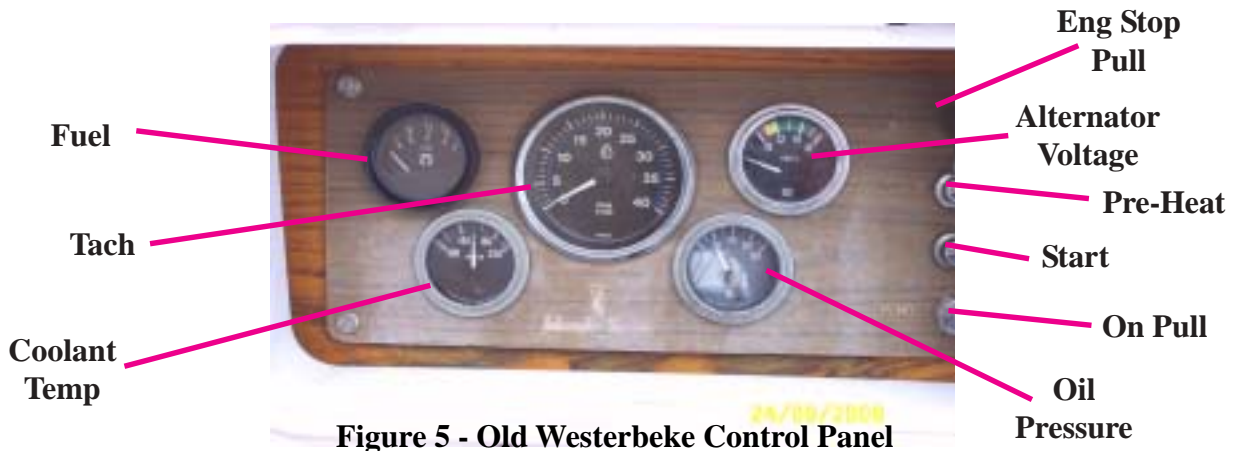


Figure 4 - After prop

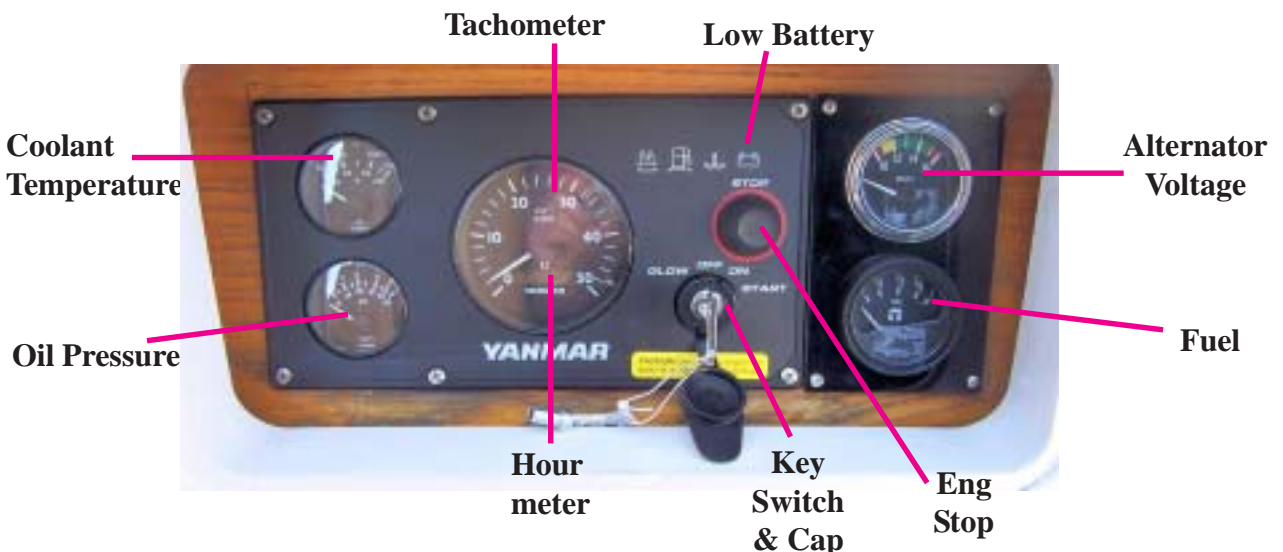
I was quite pleased with the installation. In addition to the new shaft, packless seal, cutlass bearing, and prop, the exhaust system was completely replaced with new hose, AquaLift muffler, and bronze exhaust fitting. The shield over the engine's V-belt was unusual. The engine's performance and the new instrument panel made me feel like I had a new boat.

I had previously adapted the original Westerbeke instrument panel by replacing the DC ammeter with a DC voltmeter after my first alternator had burned up. The tachometer was driven off the alternator; so this was a sure fired way to tell when the alternator was acting up. RPMs would go to zero upon

the first sign of trouble. Voltage would then hover below 12 VDC. Eventually, I changed over from flooded, wet cell, batteries to Absorbent Glass Mat (AGM) batteries. I had installed a Balmar 90A alternator, with ARS-5 external voltage regulator, to charge the two Group 24 AGM batteries. Fortunately, the Balmar dual-footed alternator fit the new Yanmar engine.



The Yanmar is metric. The new temperature and oil pressure gauges were difficult to read because each has both Metric and English units. I opted for these gauges (C-type panel) which do not come standard (B-type panel). I also had recently replaced our original fuel gauge. Note that the new Yanmar panel has no fuel gauge! The yard mounted both our old DC voltmeter and fuel gauges beside the standard Yanmar panel in the original panel enclosure. This Yanmar diesel used no glow plug. The key switch uses two positions - ON and OFF. No preheating is necessary. The ignition position “GLOW” was a “leftover” caused by reuse of an engine panel from another Yanmar model. The key switch has a plastic cap to keep out water. To stop the engine, one presses the STOP button. Only the Low Battery “icon” light at the top of the panel is functional. The other icon lights for seawater flow, water in fuel filter, and water in sail drive are non-functional on the 3JH4E model.



There is no air filter on the Yanmar. There is a large baffle at the rear of the engine, beside the exhaust manifold, where the air intake is located.

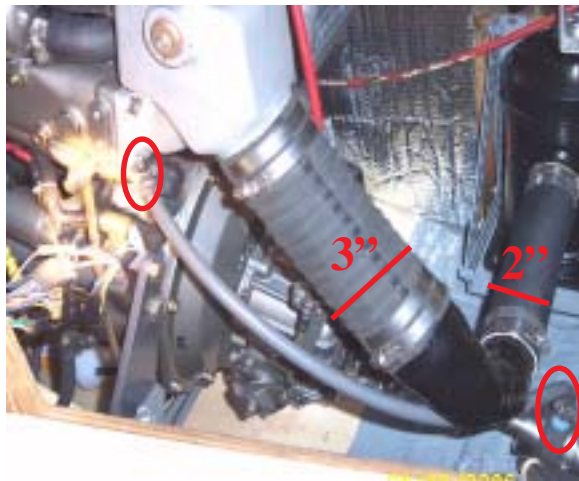


Figure 7 - Dripless shaft seal

There are no zinc anodes in the seawater coolant flow. The engine exhaust is 3 inches in diameter and is reduced to 2 inches at a 90 degree elbow before the AquaLift muffler. The closed water coolant has three petcocks to enable drainage. The coolant fill is above the heat exchanger.

I opted for a Packless Sealing System to replace the original threaded stuffing box which had given me no trouble. It had truly been maintenance-free for the 13 years since I bought Charisma. The new shaft seal has a hose connected to a seawater water fitting below the exhaust manifold. This provide cooling water to a carbon flange around the shaft. The flange

presses against a stainless steel rotor cuff attached to the shaft. Bellows keep the flange tight against the rotor. Heat is generated by the friction between the carbon and stainless. The seawater provides a coolant.

The transmission is a Kansaki KM35P made in Japan for Yanmar. It has 2.36 reduction ratio in forward and 3.16 reduction ratio in reverse. A mechanical cone clutch is used. Its lubrication system is a splash type with air cooling. The gear oil capacity is 1 pint. It uses SAE 30, single-grade, non-detergent motor oil. I expected ATF as the gear lubricant, but the Yanmar operation manual and dealer specified motor oil.



Figure 8 - Kansaki transmission

The original dual Racor fuel filter assembly (Racor 75/500 FGX/MAX) with 2 micron filter elements was retained. The original fuel tank, fuel hoses, and electric fuel pump were retained. The engine control levers on the cockpit pedestal, the engine gearshift cable, and throttle cable were also retained. The gearshift lever operated effortlessly; however, the throttle direction was reversed from the Westerbeke. A small human factor adjustment took care of this.

The original Westerbeke L25 diesel turned out to be an Americanized version of the British Watermota Sea Panther diesel. The British still support the design, but Westerbeke has reduced its technical support to microfilm retrieval. I could no longer procure a L25 service manual. The first maintenance action I performed on the Yanmar was the acquisition of a service manual.

It was time to replace the diesel engine in Charisma after 28 years of use. I'm pleased with the decision to go with a Yanmar 3JH4E diesel. The meticulous engine installation performed by the local boat yard (Haven Harbour Marina in Rock Hall, MD) was very gratifying. I'm a contented I-36 sailor again.