

VOLVO 2002 DIESEL

[This document was developed from notes taken during two Volvo 2002 workshops conducted at the CS factory, and other experience. It has not been reviewed or approved by CS or Volvo]

1. GENERAL OPERATING PROCEDURES

1.1. Cold Start and Stop Procedure

- 1.1.1. Turn "Instruments" and other electronics off before starting engine (or they may fault)
- 1.1.2. Turn battery selector switch to the starting battery, usually #1. The engine can be started with battery selector switch in "BOTH" or #2 if needed.
- 1.1.3. NOTE: SEQUENCE IS IMPORTANT: Advance throttle 75% with red button engaged (throttle only, no transmission engagement). Then pull stop handle out and push back in to set governor in extra fuel position. Extra fuel is not needed if engine is warm.
 - 1.1.3.1. Insert key and turn ignition on (fan will start). Start engine and maintain speed at 1,500 RPM. Let the engine warm for 5-10 minutes before attempting to move boat.
 - 1.1.3.2. When the engine is running, both batteries are charged regardless of the position of the selector switch.
 - 1.1.3.3. Switch to #2 (deep-cycle) after engine is started so that if battery accidentally discharged, the engine can still be started.

NOTES: *Leave key on after starting engine.*

Turn key off after stopping engine with stop handle. Do not turn key off without first stopping engine or the alternator fuse may blow.

Do not turn key off and then on or the alternator fuse will definitely blow. Always stop engine in neutral with pull stop handle and then turn off ignition.

The ignition key in the "on" position provides power to the instrument panel (e.g. alarms) but has no effect on the running of the engine which is controlled by the governor.

- 1.2. Don't "baby" the engine, continuous operation at 3,000 RPM is fine although typical operation is 2,300-2,700 RPM. Back-off the RPM if it begins to smoke.
- 1.3. If engine has been worked hard for more than an hour, let the engine idle for a few minutes to eliminate any differential cooling after stopping.

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Always stop engine with stop handle (cable to governor) and not with ignition switch. In an emergency, the decompression lever (top of the engine) can be moved to the vertical position but it is hard on the valves.

- 1.4. Re-start procedure after running completely out of fuel
 - 1.4.1. Re-fill fuel tank.
 - 1.4.2. Decompress engine by placing lever in vertical position.
 - 1.4.3. Bleed low-pressure fuel side. Loosen fuel filter and catch fuel in a jar. Use priming pump on side of engine and pump until fuel is clean. Close off and continue pumping 10-15 seconds.
 - 1.4.4. Advance throttle 75%. Pull stop handle out and push back in to set governor fuel supply.
 - 1.4.5. Loosen screws at injectors (where fuel lines enter engine) 2-3 turns.
 - 1.4.6. Hand crank or engage starter until fuel spurts.
 - 1.4.7. Tighten injector screws and re-set decompression lever down. Engine is ready to start.

2. ENGINE & TRANSMISSION SPECIFICATIONS

- 2.1. HP (13 kW) @ 3,200 RPM: 3,400-3,600 RPM Maximum.
- 2.2. Four cycle, direct injected (2,500 PSI fuel onto top of pistons). Cycles: intake, compression, fuel injection/combustion (400-500 PSI, 750 degrees C), and exhaust. More economical than indirect injection which requires glow plugs.
- 2.3. Power take-off (extra pulley and mounting bracket required) available for extra equipment such as 12 VDC refrigeration compressor.
- 2.4. Seawater circulation pump (lower port front side of engine) for cooling. Spare impeller, gasket and fan belt carried on-board under Navigator's Station.
- 2.5. Engine mounts are adjustable for shaft alignment. Alignment should be checked every year. Measure the gap between the mating surfaces on the output shaft, total difference should be .002 or less.
- 2.6. MS2 Transmission: Mechanical with slip clutch (no dog gears). Generally will not be damaged with prop shock such as running aground. The transmission has a 2.1:1 drive ratio, is water cooled, uses the same type oil as engine, and has 100% power in forward or reverse. It is mounted such that the prop shaft is at a 7° angle with level engine.
- 2.7. Heavy-duty alternator rated at 50 Amp @ 14.2 volts. Fuse block on top of engine. Don't use for extra power, get from power distribution panel. 3 spare fuses are provided, pull and reconnect wires. Yellow sensing wire

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can be connected to the starter battery to average out charge to multiple batteries.

- 2.8. Shore power AC Battery Charger rated at 10 Amp. Battery to be charged must be selected (B1 or B2) with switch above main Battery selector switch.
- 2.9. Heavy-duty starter activated by ignition key in earlier CS30's (push button in later models). Hand crank provided for service and not for hand starting, although theoretically possible with extreme effort.

3. DIESEL FUEL & OIL

- 3.1. Fuel is commercial grade diesel. Also a lubricant for internal engine parts especially the injectors which are manufactured to very fine tolerances. Clean fuel is a key factor to trouble free operation.
- 3.2. No direct link to fuel. Governor (controlled by cable adjusting tension on spring) controls air flow and maintains speed. Don't change factory set painted screw settings on governor (also voids warranty). If engine runs away, cut off air vs. fuel.
 - 3.2.1. Fuel tank capacity 21.6 Gal. (US), 18 Gal. (Imp.)
 - 3.2.2. Consumption Rate about 1 GPH, 7 NM per gallon
 - 3.2.3. Effective Range about 18 Hours, 100 NM
- 3.3. To re-prime, loosen fuel filter screw, prime with finger pump until fuel is flowing, tighten screw to close off, and pump 20 more times.
- 3.4. Oil for engine and transmission is SAE 30 API-CD. Do not use any multi-viscosity, synthetic, or multi-grade oils. Oil temperature gets very hot, 80-90° C.

4. INSTRUMENTATION AND ALARMS

- 4.1. Cockpit instrument panel with tachometer, stop handle, ignition switch, alarm lights, alarm speaker, panel and compass light rheostat, and alarm test button. Avoid water in the unit, cut drain holes if needed.
- 4.2. High Water Temperature light and alarm are activated by temperatures greater than 95° C. Check impeller in engine water pump.
- 4.3. Low Oil Pressure light and alarm are activated with oil pressure less than 10 PSI.
- 4.4. Alternator Discharge and High Water Temperature lights and alarm mean a bad alternator and do not indicate overheating. The Alternator Discharge light should not come on by itself.
- 4.5. Continuous low alarm noise may indicate a ground fault. Check for water in the instrument panel or a bad ground wire.

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- 4.6. The test switch may be used to test all three lights and the alarm. All three lights will briefly light when the engine is being started.
5. PERIODIC INSPECTIONS AND MAINTENANCE
 - 5.1. Check engine crankcase oil with dipstick on port side. Should be mid-way on the flat portion of the dipstick.
 - 5.1.1. Change oil filter (front of engine) each year or every 50 hours of operation. Do not leave dirty oil in the engine over the winter.
 - 5.1.2. Capacities: Engine, 2.75 L; Transmission, .8 L.
 - 5.1.3. Very difficult to remove all of the oil, so creep up to full (middle of marked range on dip stick, usually around 2L) when refilling.
 - 5.1.4. Volvo Part Number **834337-8**.
 - 5.2. Change fuel filter on engine after the first year and every 2 years thereafter assuming about 50 hours/year operating time. Bosch Part Number is **829913-3**.
 - 5.3. Remove and inspect water pump impeller every spring. Volvo kit Part Number **875583-7**. Use older impeller for winter storage and replace with newer impeller in spring.
 - 5.4. Racor 220R fuel/water separator near tank in cockpit locker should be drained every 4-6 weeks and changed every year, especially before winter storage because the water could freeze, burst the bowl and flood the boat with diesel. Use flat vise-grips with rag to pinch off flow from diesel fuel tank. Filter part number is **R24**.
 - 5.5. Check engine mounts and shaft alignment periodically. Gap between mating surfaces of the output shaft should be even.
 - 5.6. Maintain full fuel tank (especially in winter) to avoid water vapor moisture build-up and biological growth in tank. Water in the fuel is a real danger. Maintain clean air, fuel, and oil for minimal problems. Not necessary to use fuel additives. The engine should not smoke if maintained well.
 - 5.7. The air cleaner is washable in diesel fuel (kerosene). Drip-dry before reinstalling.
 - 5.8. Use graphite lubricant for moving engine parts such as the governor linkage.
 - 5.9. Test injectors every 4-6 years or 200-400 hours of operation. Pull injectors and have a machine shop do it.
 - 5.10. Check valve clearances (hot/cold) after first year and thereafter every 150-200 hours of operation. See manual or have a machine shop do it.
 - 5.11. Do not re-torque head bolts, they are pre-set.
- 6.

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WINTER STORAGE PROCEDURE: BEFORE HAULOUT

- 6.1. Change engine oil, transmission oil, and oil filter; preferably before haul-out. Don't leave dirty oil in engine over the winter.
 - 6.1.1. If storage is longer than 1 year, use inhibiting fuel first. Top-off fuel tank.
 - 6.1.2. Pump warm engine oil through dipstick hole to remove and re-fill through the front cap. Engine capacity is 2.75 Liters SAE 30 CD. Creep up on full (middle of marked range on dip-stick) because it is difficult to remove all of the oil from the engine.
 - 6.1.3. Transmission drain plug available but hard to get to; pump out and re-fill through transmission dipstick hole instead of cap. Loosen cap to help bleed air. Transmission capacity is .8 Litter SAE 30 CD (do not overfill or it will leak out through the center of the notch and continue leaking thereafter)
- 6.2. Pump-out holding tank and flush with fresh water before haul-out. Pour 2-3 L of non-toxic antifreeze into toilet and pump into holding tank.

7. WINTER STORAGE PROCEDURE: AFTER HAULOUT

- 7.1. Drain seawater from engine.
 - 7.1.1. Drain out of block using starboard drain plug under alternator and another further aft under starter. Re-install drain plugs.
 - 7.1.2. Loosen impeller and drain seawater and re-install with coating of Vaseline, soap or silicone grease. Or use old impeller and replace with new impeller in spring. Volvo kit part number **875583-7**.
 - 7.1.2.1. Don't use impeller for more than 3 seasons.
 - 7.1.2.2. Impeller is reversible. Turn tips in direction of rotation (CW).
- 7.2. Flush engine with mixture of antifreeze.
 - 7.2.1. Remove thermostat housing cover (2 bolts) and clamping bolt of discharge tube, remove thermostat, and reinstall cover.
 - 7.2.2. Drain transmission by disconnecting hose at seacock on starboard side and draining. Close and label the seacock.
 - 7.2.3. Then put hose, with extension, in pail of 2 gallons of 50:50 water and antifreeze and run engine until drained, about 1-2 minutes.
 - 7.2.4. Leave antifreeze in engine and reconnect hose to closed seacock.
 - 7.2.5. Re-install thermostat, new gasket generally not needed. Make sure drain cock is closed and labeled.
 - 7.2.6. Drain water from Pot Muffler
- 7.3. Drain water from Racor diesel fuel/water separator. Very important because water can freeze, burst the bowl and flood the boat with diesel

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fuel. Use flat vise-grips with rags to pinch-off diesel fuel flow from tank if you do not have a shut-off valve (recommended).

- 7.4. Drain water from Cold & Hot Water Tanks
 - 7.4.1. Open Cold Water Tank and run hot & cold faucets until tank empties.
 - 7.4.2. Put 2-3 4L containers of non-toxic antifreeze in Cold Water Tank and run faucets until color shows.
 - 7.5. Drain water from Bilge
 - 7.5.1. Siphon or sponge-out all bilge water.
 - 7.5.2. Pour about 1-2 L of non-toxic antifreeze into bilge at lowest point and at bilge pump pick-up.
 - 7.5.3. Manually pump bilge until some color shows.
 - 7.6. Install an "oily" rag in the engine exhaust pipe to prevent condensation.
 - 7.7. Remove Batteries and store in a cool, dry place for the winter. As soon as possible, fill cells with distilled water and charge batteries to 100%. Keep charged throughout the winter if possible.
8. SPRING ENGINE START-UP PROCEDURE
- 8.1. Before Launch, Check batteries and charge to 100% before re-installation.
 - 8.2. Check oil levels, fuel levels, and all connections.
 - 8.3. Replace impeller if old one was used for winter storage. Install new filters if not done for winterizing.
 - 8.4. Open engine intake seacock and remove "oily" rag from exhaust.
 - 8.5. Change engine fuel filter (every 2 years) and Racor water/fuel separator. Keep air out of system when changing filters. Use flat vise-grip and rag to pinch-off input to Racor filter if no shut-off valve. Loosen fuel filter and use jar to catch fuel. Replace with new filter. Use priming pump on side of engine to pump fuel through until clean. Close off and continue pumping 10-15 seconds.
 - 8.6. The air cleaner should be washed in diesel fuel (kerosene). Drip dry before reinstalling.
 - 8.7. Re-prime engine fuel system. To re-prime, loosen fuel filter screw, prime with finger pump until fuel is flowing, tighten screw to close off, and pump 20 more times.
 - 8.8. Run engine with water from pail using winter storage procedure.