

Chapter Four

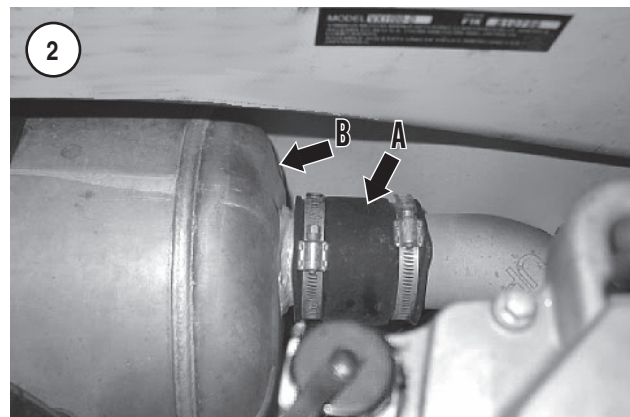
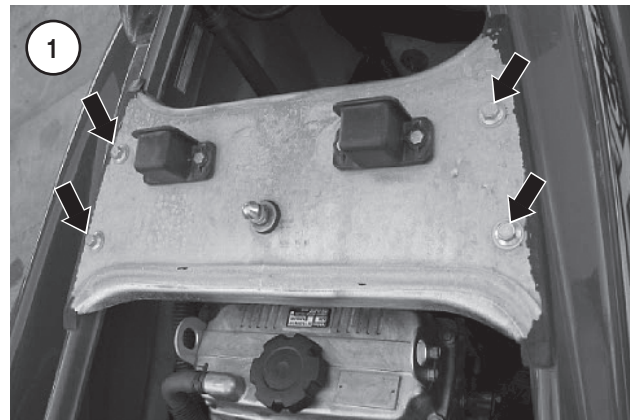
Engine

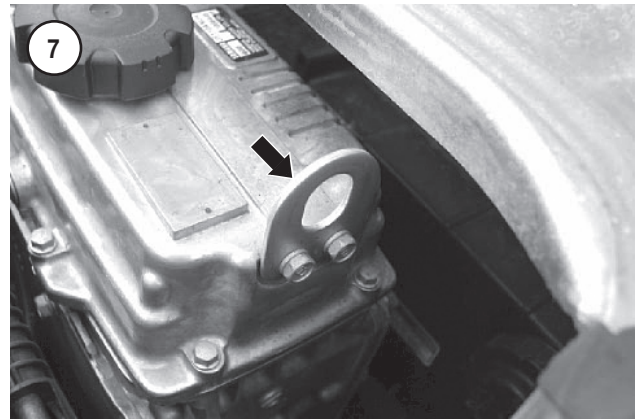
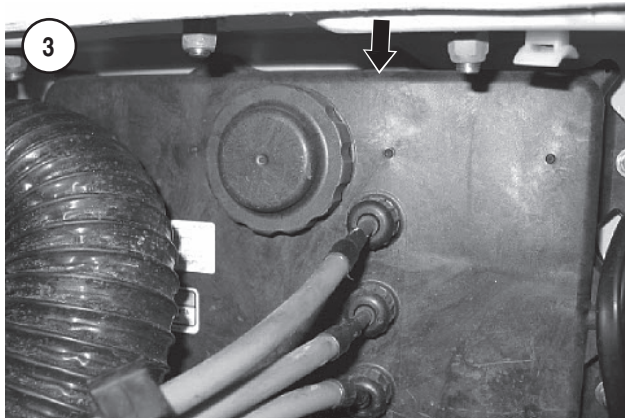
This chapter covers engine repair. **Table 1** includes torque specifications. **Tables 1-8** are located at the end of this chapter.

ENGINE

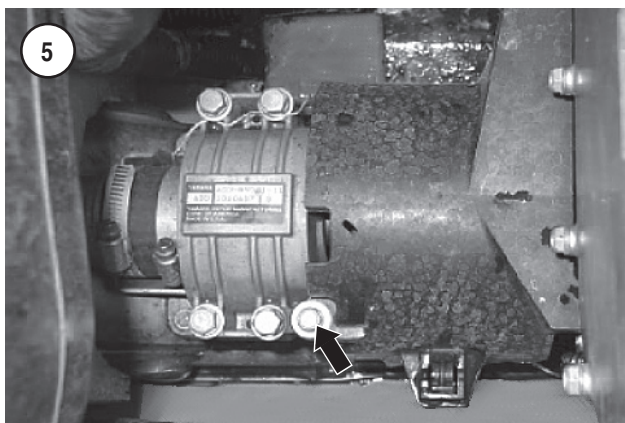
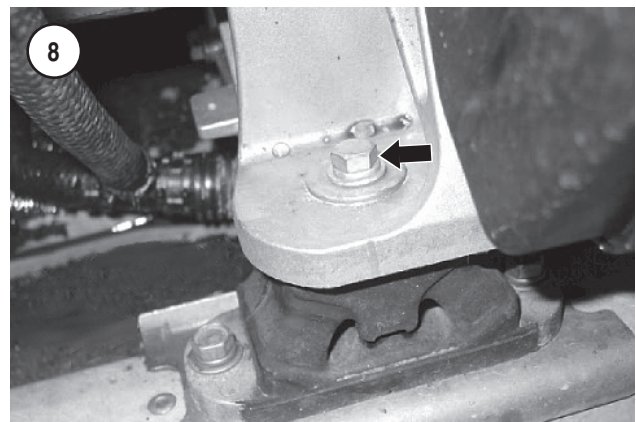
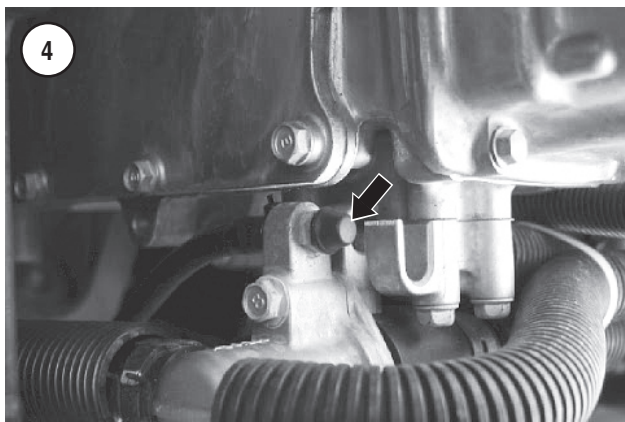
Removal/Installation

1. Drain the oil from the oil tank as described in *Engine Oil Change* in Chapter Three.
2. Remove the four bolts and nuts (**Figure 1**), then lift the seat support bracket off the hull.
3. Disconnect the positive and negative cables from the battery as described in Chapter Eight.
- 4A. On FX models, disconnect the throttle cable from the throttle body as described in Chapter Six.
- 4B. On VX models, disconnect the engine wire harness connector from the throttle position sensor as described in Chapter Six.
5. Disconnect the fuel hose and wire harness connector from the fuel pump module as described in Chapter Six.
6. Remove the exhaust tube (A, **Figure 2**) and water lock (B) as described in Chapter Seven.
7. Remove the mounting bolts or nuts and washers, then separate the electrical box (**Figure 3**) from the hull.
8. On VX models, remove the air filter housing as described in Chapter Six.





4



9. On FX models, remove the oil filter as described in *Periodic Maintenance* in Chapter Three.

10. On VX models, locate the engine control module (ECM) and rectifier/regulator on the port side of the engine. Remove the mounting bolt, and then separate the ECM and rectifier/regulator from the engine. Unplug the wire harness connectors from the components. Removal of these components is required to provide hull clearance during engine removal. Refer to Chapter Eight.

11. Disconnect the cooling water inlet and outlet hoses from the engine. Refer to Chapter Seven to identify the hoses.

12. Note the wire routing and connection points, then disconnect any hull mounted wire harness from the engine wire harness.

13. Disconnect the grease hose fitting (**Figure 4**) from the engine. Route the hose to an area that will prevent interference during engine removal.

14. Remove the bolt and sleeve (**Figure 5**), and then lift the coupler cover off the engine (**Figure 6**).

15. Attach a suitable overhead lift onto all three engine-lifting hooks (**Figure 7**, typical). Apply just enough lifting force to remove slack at this time.

16. Locate the four mounting bolts and washers (**Figure 8**) at each corner of the crankcase. Loosen, but do not remove, the four mounting bolts and washers. Check each mount for shims between the crankcase and the engine mount. The shims are slotted and can be removed without remov-

ing the bolt. Note the location of each shim. Remove the shims then mark them to ensure that each is installed into the original location during engine installation.

17. Remove the four mounting bolts and washers. Lift the engine enough to relieve all pressure on the mounts. Move the engine forward enough to disengage the engine coupler from the jet pump coupler.

18. With the help of an assistant, lift the engine out of the hull. Rotate the engine clockwise during removal to allow clearance for the exhaust system. Work carefully to avoid damaging wiring, hoses or other engine components. Place the engine on a suitable work surface.

19. Inspect the engine mounts for cracks in the rubber, deterioration of the rubber or separation of the rubber from the mount. Replace any damaged mounts as described in this section.

20. Clean all loose debris, oil, grease or other contaminants from the hull.

21. With the help of an assistant, lower the engine into the hull. Work carefully to avoid damaging wiring, hoses or other engine components. After the engine is within the engine bay, move the engine to align the engine coupler with the jet pump coupler. Make sure the coupler fingers properly engage the rubber dampener. Then, move the engine to align the four mounting bolt openings. Hand-thread the four bolts (**Figure 8**) and washers into the crankcase and engine mount openings. Do not tighten the bolts at this time. To allow mount compression, relieve the overhead hoist pressure and allow the engine to rest on the mounts for a few hours.

22. Lift upon the engine enough to relieve any pressure on the mounts, then install the shims into their original location between the crankcase and engine mount. Remove the mounting bolts, one at a time, and apply threadlocking compound (Loctite 271 or equivalent) onto the threads. Tighten the four mounting bolts to 17 N•m (15 in.-lb.).

23. Check and correct the engine coupler alignment as described in this section.

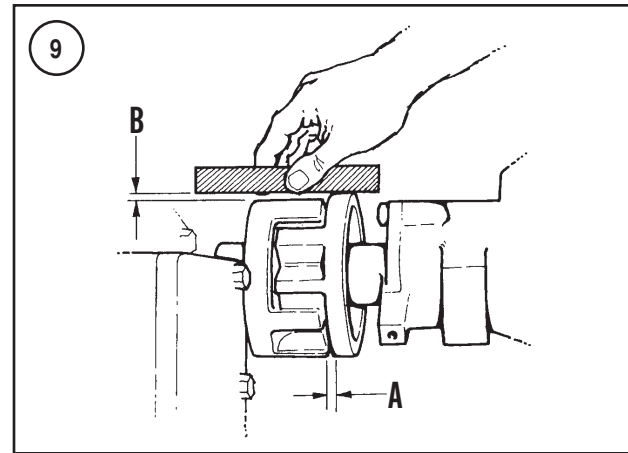
24. Install the coupler cover onto the engine. Move the cover to align the bolt openings. Apply threadlocking compound (Loctite 572 or equivalent) onto the threads, and then thread the bolt with sleeve into the cover and engine. Tighten the bolt to 7.8 N•m (69 in.-lb.).

25. Fit the grease hose fitting into the engine-mounted retainer. Route the hose to prevent interference with moving components.

26. Connect any disconnected hull wire harness connector onto the corresponding engine wire harness connector.

27. Connect the cooling water inlet and outlet hoses onto the engine. Refer to Chapter Seven to identify the hoses.

28. On VX models, plug the engine wire harness connectors onto the engine control module (ECM) and rectifier/regulator. Tug lightly on the harnesses to verify a secure connection. Then install the components onto the mounting bracket. Apply threadlocking compound (Loctite 242 or equivalent) onto the threads, and then thread the single bolt into the ECM and mounting bracket opening. Initially



tighten the bolt to 8.8 N•m (78 in.-lb.). Tighten the bolt a final time to 18 N•m (159 in.-lb.).

29. On FX models, install the oil filter as described in Chapter Three.

30. On VX models, install the air filter housing as described in Chapter Six.

31. Mount the electrical box onto the hull. Tighten the mounting nuts and washers or mounting bolts to 17 N•m (150 in.-lb.).

32. Install the exhaust tube and water lock (**Figure 2**) as described in Chapter Seven.

33. Connect the fuel hose and wire harness connector onto the fuel pump module as described in Chapter Six.

34A. On FX models, connect the throttle cable onto the throttle body as described in Chapter Six.

34B. On VX models, connect the engine wire harness connector onto the throttle position sensor as described in Chapter Six.

35. Fill the engine with oil as described in Chapter Three.

36. Connect the positive and negative battery cables as described in Chapter Eight.

37. Install the seat support bracket onto the hull. Install the four bolts and nuts (**Figure 1**) into the support bracket and hull openings. Tighten the bolts and nut in a crisscross pattern to 5.2 N•m (46 in.-lb.).

38. Prepare the watercraft for operation under actual conditions. Start the engine and immediately check the engine bay and entire fuel system for fuel, water or exhaust leaks. Correct any leaks before operating the watercraft.

Engine Coupler Alignment

1. Remove the bolt and sleeve (**Figure 5**), and then lift the coupler cover off the engine (**Figure 6**).

2. Use a feeler gauge to measure the clearance between the engine coupler and the jet pump coupler at the point shown in A, **Figure 9**. The clearance must be 2.0-4.0 mm (0.079-0.157 in.). Refer to the following:

- a. If the clearance exceeds 4.0 mm (0.157 in.), loosen the four engine mounts and move the engine slightly rearward to achieve the required clearance. After correcting the alignment, apply threadlocking com-

- pond (Loctite 271 or equivalent) to the threads and tighten the engine mounts as described in this section.
- b. If the clearance is less than 2.0 mm (0.079 in.), loosen the four engine mounts and move the engine slightly forward to achieve the required clearance. After correcting the alignment, apply threadlocking compound (Loctite 271 or equivalent) to the threads and tighten the engine mounts as described in this section.
3. Use a straightedge to check the alignment of the engine and jet pump coupler surfaces as shown in B, **Figure 9**. The flat surfaces of the engine and jet pump couplers must align within 0.5 mm (0.020 in.) at the points shown in B, **Figure 9**. If the misalignment exceeds the specification, loosen the engine mounts and install more or remove the necessary shims. After correcting the alignment, apply threadlocking compound (Loctite 271 or equivalent) to the threads and tighten the engine mounts as described in this section.
 4. Install the coupler cover onto the engine. Move the cover to align the bolt openings. Apply threadlocking compound (Loctite 572 or equivalent) onto the threads, and tighten the bolt to 7.8 N•m (69 in.-lb.).

Engine Mounts

1. Remove the engine from the hull as described in this section.
2. Remove the two bolts that secure the suspect mount and liner onto the hull. Remove the mount and liner.
3. Clean any debris from the mount bolt openings and mating surfaces to the hull.
4. Fit the liner onto the hull with the curved sides facing the hull. Then fit the mount onto the liner.
5. Apply threadlocking compound (Loctite 572 or equivalent) onto the threads, and then thread the two bolts into the mount, liner and hull openings. Tighten the bolts to 17 N•m (150 in.-lb.).
6. Install the engine as described in this section.

Oil Tank

The oil tank serves as a reservoir and the cooling system for the engine oil. The tank mounts onto the rear of the engine. Although similar in design, the tanks used on FX and VX models are not interchangeable. The oil tank can be serviced without disassembly of the engine. However, if there is an internal engine failure, the oil tank must be removed, disassembled and cleaned to remove debris from the oil system.

Removal/installation

Refer to **Figure 10** or **Figure 11**.

1. Remove the engine as described in this section.
2. On FX models, remove the air filter cover and housing as described in Chapter Six.
3. Note the hose routing and connection points, then disconnect all water and breather hoses from the oil tank assembly. Make a diagram and mark each hose connection point prior to removal to ensure correct connections upon installation.
 - 4A. On FX models, remove the three bolts (21, **Figure 10**) then remove the oil/air separator (18) from the oil tank. Remove the grommet (19, **Figure 10**) and collars (20) from the separator. Direct solvent into the passages to remove all of the oil residue from the separator. Use compressed air to remove the solvent. Cover the fittings to prevent contamination.
 - 4B. On FX High Output and VX models, remove the two bolts (16 and 22, **Figure 11**) then remove the oil/air separator (19) from the oil tank. Remove the grommet (18 and 20, **Figure 11**) and collars (17 and 21) from the separator. Direct solvent into the passages to remove all of the oil residue from the separator. Use compressed air to remove the solvent. Cover the fittings to prevent contamination.
5. On FX models, disconnect the ground wires from the lower port side of the oil tank.
 - 6A. On FX, remove the four bolts (31, **Figure 10**) that secure the oil tank onto the crankcase. Then remove the two nuts (35, **Figure 10**) that secure the support bracket (23) onto the tank. Remove the two bolts (22, **Figure 10**) that secure the support bracket onto the crankcase.
 - 6B. On FX High Output and VX models, remove the two bolts (27, **Figure 11**) that secure the support bracket (28) onto the crankcase. Remove the two nuts (44, **Figure 11**) that secure the support bracket onto the oil tank. Then, remove the five bolts (39, **Figure 11**) that secure the oil tank onto the crankcase.
7. Pull the oil tank assembly off the crankcase. Remove the two joint/tubes (29, **Figure 10** or 30, **Figure 11**) from the openings at the lower end of the oil tank or crankcase. Remove the O-rings from the joint/tubes. Discard the O-rings. Remove the two alignment pins (27, **Figure 10** or 29, **Figure 11**) from the openings in the oil tank or crankcase.
8. Disassemble, clean, inspect and reassemble the oil tank as described in this section.
9. Apply a water resistant grease onto the surfaces, then install a *new* O-ring into the groove at each end of the two joint/tubes (29, **Figure 10** or 30, **Figure 11**). Guide the joint/tubes into the corresponding openings in the oil tank. Apply a light coating of engine oil onto the surfaces, and then insert the two alignment pins (27, **Figure 10** or 29, **Figure 11**) into the corresponding openings in the oil tank.
10. Align the two joint/tubes and alignment pins with the corresponding openings in the crankcase, and then guide the oil tank onto the engine. Verify alignment of the pin and joint/tube openings, and then seat the tank against the crankcase.
11. Guide the two studs of the support bracket (23, **Figure 10** or 28, **Figure 11**) into the corresponding openings in the oil tank. Apply threadlocking compound (Loctite 572 or equivalent) onto the stud threads, then hand-thread the

Copyright of Yamaha Four-Stroke PWC Shop Manual, 2002-2009 is the property of Penton Media, Inc. ("Clymer") and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.