

# Engine Removal / Installation

Sea-Doo 580 / 650 / 720

## Step 1

### Battery Removal

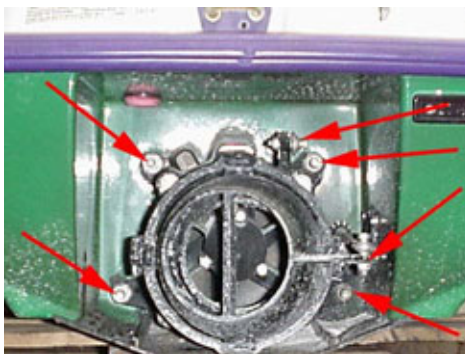
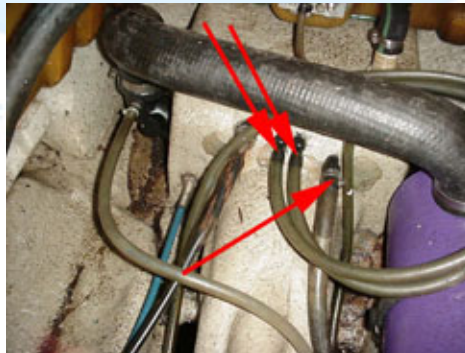


1.1 ( Above) Remove the two retaining straps, disconnect the battery and remove it from the hull. Disconnect the negative (black) cable first, then the positive (red).

## Step 2

### Pump Removal

2.1 (Right) Inside the hull, remove the bilge siphon hoses and the water intake hose from the pump fittings. On the back of the hull, remove the four nuts & washers from the studs fastening the pump to the hull with a 17mm socket. Disconnect the steering and trim cables, if equipped. Rock the pump assembly side to side & up and down to break the seal, then pull it straight back and out of the hull. Also remove the driveshaft. NOTE: There are two rubber bumpers on either end of the driveshaft. Make sure you don't lose them, and make sure to replace them, if removed. If possible, have someone hold the driveshaft while you slide the engine to prevent the impeller side bumper from disengaging.



## Step 3

### Intake Removal

3.1 (Right) Slide the six air intake cover latches back and remove the top cover. Remove the spark plug wires, plugs & heat sensor from the head.



3.2 (Right) Remove the six allen bolts securing the air silencer brace to the base and remove the brace, then lift the base off the carb(s).



3.3 (Below) Your craft may have an additional brace installed between the head and the carb stack. If so, remove the 4 allen bolts securing it and remove the brace.

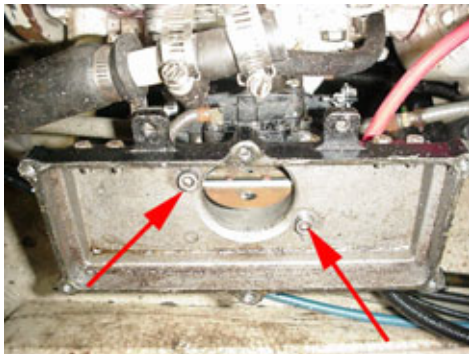




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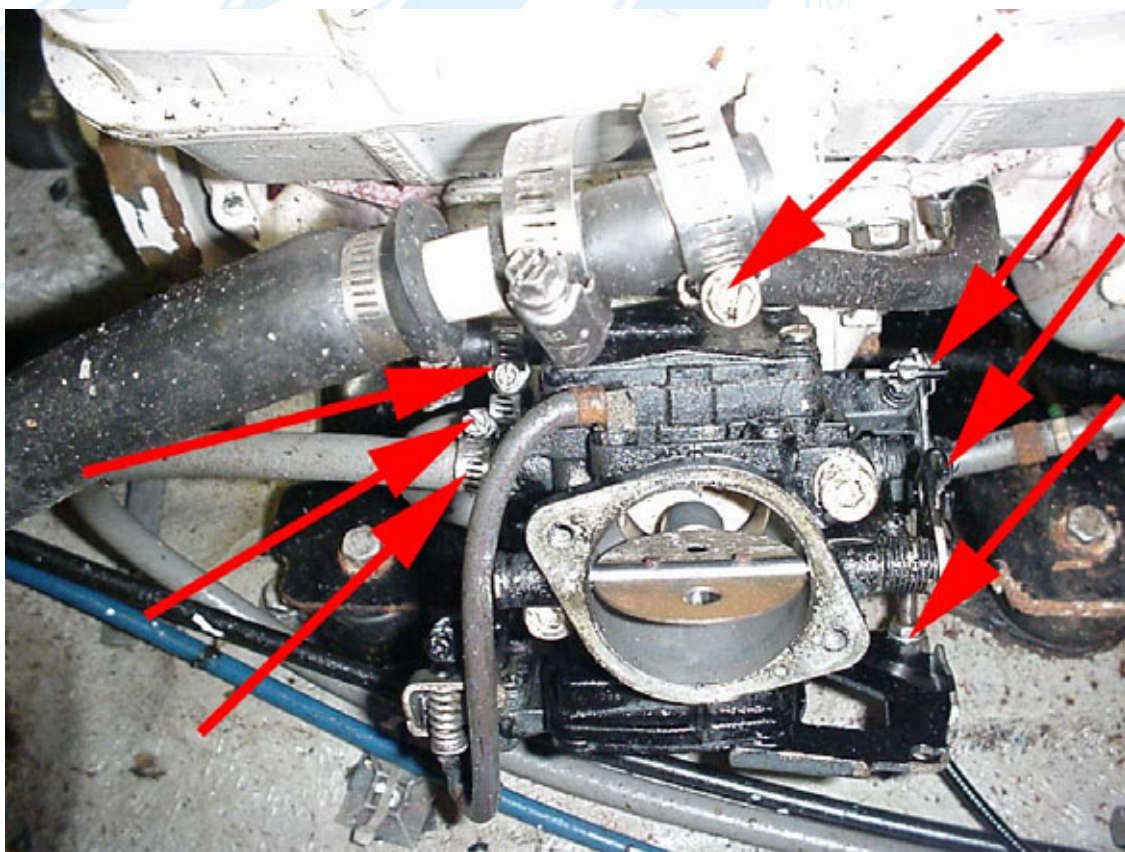
3.4 (Below) Pull the flame arrestor out of the bracket and remove the two allen bolts securing the bracket to the carb(s). Pull off the bracket.



3.6 (Right) Four 13mm bolts hold the rotary valve cover to the block. Remove them and cover/carb assembly from the hull. Your craft may have oil injection, using an oil pump. If so, disconnect the oil feed line going to the pump, and either clamp the line, or screw a bolt into the end of the line to plug it.



3.5 (Right) Loosen the gas tank cap to relieve pressure. Unscrew the hose clamps and remove the pulse line, fuel in and fuel return lines. Be sure the fuel switch is turned to the "OFF" position, and be aware of any fuel that may spill from the hoses. Make sure the Hull is clear of any gasoline fumes before continuing work, especially with power tools. Undo the nuts securing the throttle and choke cables to the carb(s) with a 10mm wrench and detach them from the carb(s). Loosen and remove the water inlet hose(s) from the head. **Note: 580, 650 and 720 head cooling line routings differ.** Mark each hose for easy re-installation.



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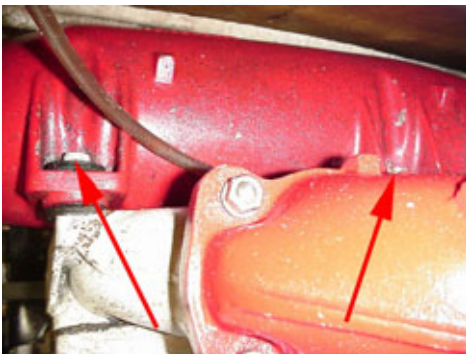
## Step 4

### Exhaust Removal

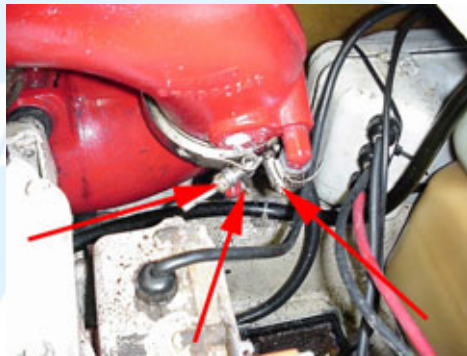
4.1 (Below) Loosen the clamp and detach the waterbox from the stinger pipe.



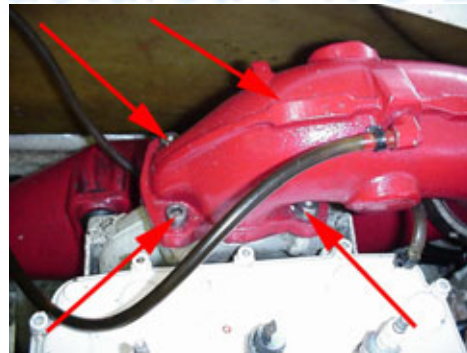
4.2 (Below) Remove the two 12mm bolts securing the lower pipe section to the exhaust manifold.



4.3 (Below) Remove the 11mm nut on the pipe clamp and remove the clamp from the pipe. Disconnect the two water lines from the pipe. This will allow you to remove the lower pipe section from the hull. Slide it back, tilting the forward section down to clear the exhaust manifold.



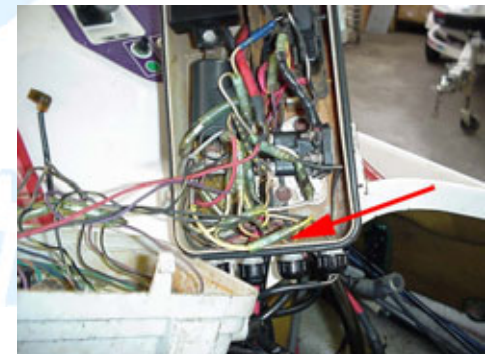
4.4 (Below) Remove the four 13mm nuts securing the top pipe section to the exhaust manifold, with a socket and wrench. Removal of the front spark plug is often required.



## Step 5

### Engine Removal

5.1 (Below) Unlatch the electrical box by pushing on the release tab. Pull the box forward so you have access to open it.



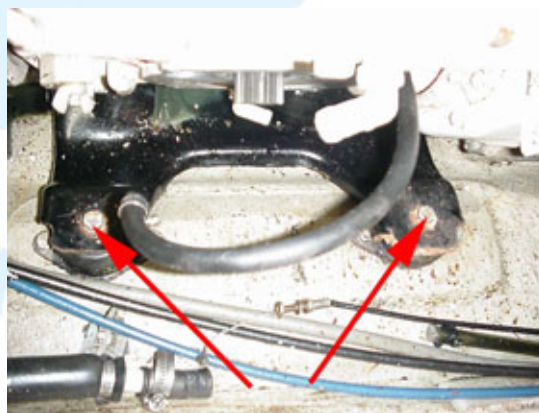
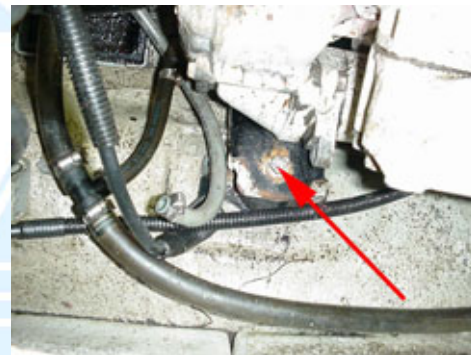
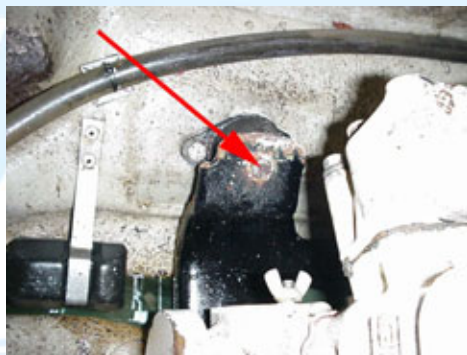
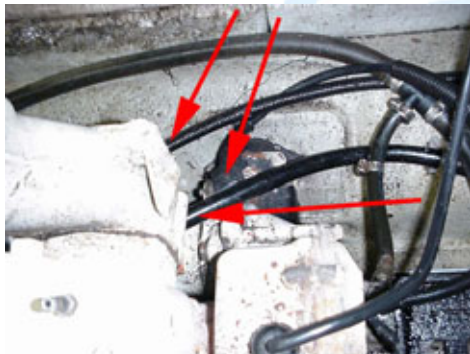
5.2 (Above) With the electrical box open, disconnect all the wires coming in from the flywheel assembly, and pull the wires out of the box. **NOTE: DO NOT CUT THE WIRES!**



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5.3 (Below) Remove the engine ground bolt with a 13 mm socket. Remove the starter wire nut & washer with a 10mm socket. There are two oil lines running from the oil tank to the case. These provide oil to the oil bath inside the case. Loosen the clamps and pull both lines from the case. Don't worry about spilled oil, you will inevitably lose the oil in the case. Zip-tie the two lines anywhere above the tank level so the oil will not drain out.



5.4 (Below) Next, remove the four 13mm bolts from the motor mounts with a socket. If any of the mounts are loose, or spin, they will need to be replaced. Making sure every hose and cable have been removed, lift the engine out of the hull.

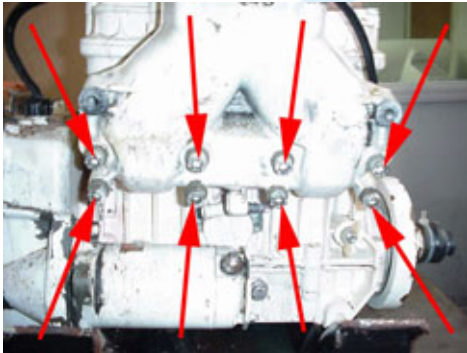
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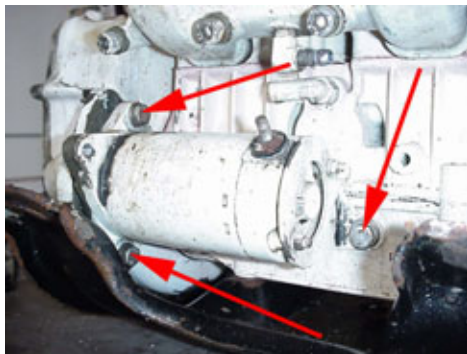
## Step 6

### Accessory Removal

6.1 (Below) With the engine on the ground, workbench or some other solid surface, begin removing the external accessories that will NOT be shipped with the core. Remove the exhaust manifold by unfastening its 8 allen bolts.



6.2 (Below) Remove the three 13mm bolts securing the starter and remove it by pulling straight back from the flywheel cover.



6.3 (Above) Remove the 10mm and 8mm bolts securing the flywheel cover and remove it.

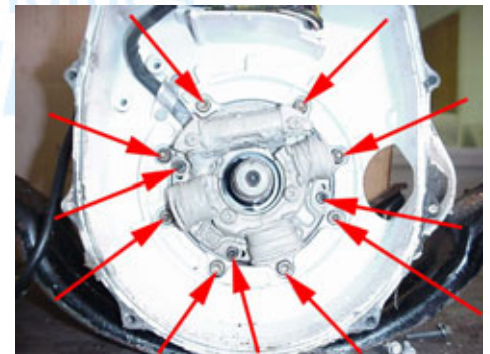


6.4 (Above) Stuff a rag into one of the exhaust ports. Make sure the rag penetrates through the port, into the combustion chamber on top of the piston. This will prevent the engine from turning over while you remove the flywheel nut & PTO coupler. Remove the flywheel nut with a 14" pi pe wrench. A cheater bar may be necessary.

6.5 (Below) Use a universal flywheel puller to remove the flywheel. **CAUTION:** Do not screw the puller screws into the flywheel more than 5 complete turns or damage to the stator may occur. After tightening the center bolt of the puller, if it does not pop off, hit the end of the center bolt with a heavy hammer.



6.6 (Below) Remove the seven allen bolts fastening the flywheel cover to the block, and the three 4mm inner allen bolts securing the stator assembly. Remove them both.

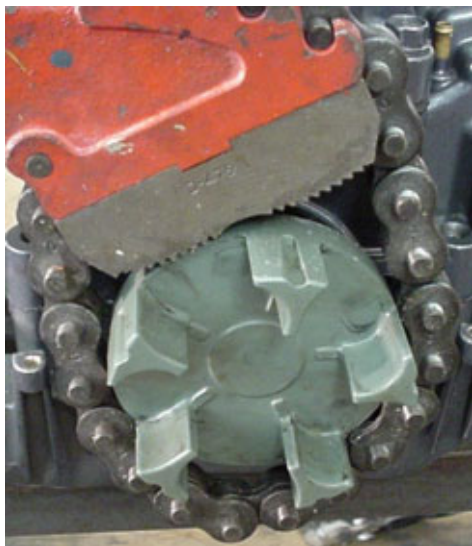




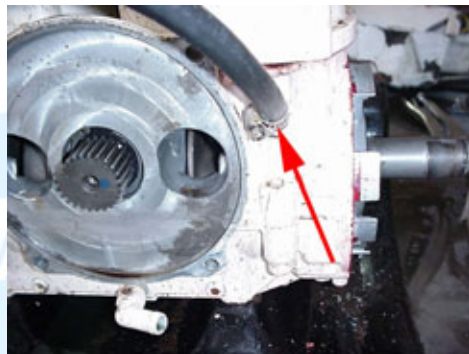
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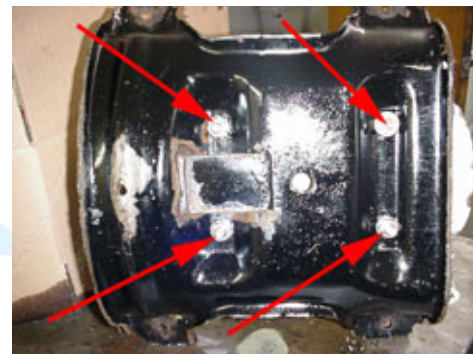
6.7 (Below) Remove the PTO coupler from the shaft using a chain wrench. Do not damage the grease fitting. Remove it if you wish. As with the flywheel nut, a cheater bar may be necessary. (Yamaha coupler pictured)



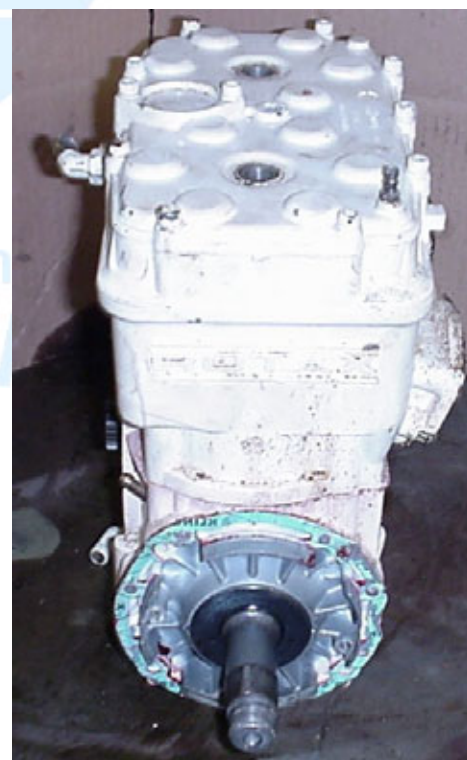
6.8 (Below) Loosen the clamp with a screwdriver and remove the pulse line from the block. Remove the remaining spark plug and heat sensor from the head.



6.9 (Below) Remove the four 17mm nuts from the mounting plate and remove the plate.



6.10 (Below) And with all of the external accessories removed, the engine is now ready to be packaged and shipped to SBT!



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## Insert

### Rotary Assembly

Before re-assembly of your new SBT engine, your rotary valve and cover must be inspected and re-timed.

(Below) Examine the surface of the valve cover. It is imperative that there not be any grooves, holes, cuts, etc. in the cover, especially any that connect between the two ports. If there is anything but minor surface scratching, the surface must be machined, or the cover replaced. For minor scratches, 400 grit wet sand paper can be used to flatten the surface.



Examine the rotary valve itself. It must also be free of any imperfections. It must not have any pitting, holes, scratches, dings, dents, bends, etc. If any of these are present you MUST replace the valve.

### Timing

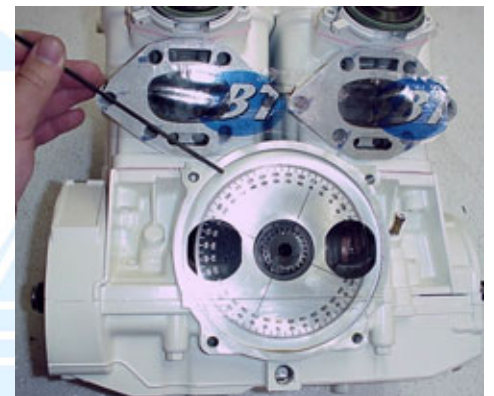
Before re-assembly, your valve must be re-timed. To do so requires a degree wheel, and the specifications for your particular engine.

Year, Model	Opening BTDC $\pm$ 5°
'90-'93 SP, '91 GT, '91 XP, '92-'93 GTS, '93 SPi	115
'92 GTX, '92 XP	129
'88, '89, '94+ SP, '90 GT, '93 SPX, '93-94GTX, '93 XP	130
'94+ SPX, '94+ XP, '95+ GTX	147

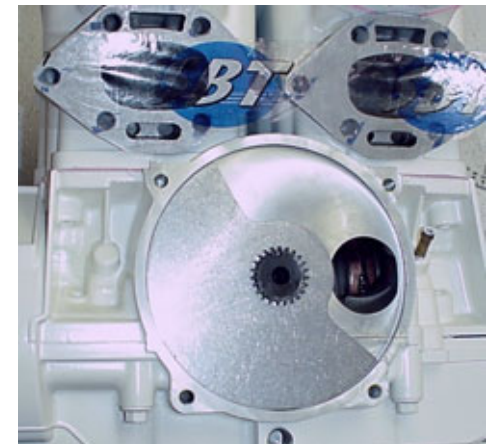
(Below) Place a screwdriver, or use a TDC gauge in the front (MAG) cylinder through the spark plug hole. Turn the crankshaft to find Top Dead Center of this piston.



(Below) Place a degree wheel over the rotary valve gear, aligning the 0°/360° mark at the bottom of the front (MAG) port. Using the timing spec guide, mark the opening degree on the case according to the timing wheel. NOTE: do not automatically use the notch on the case to time by.



(Below) Align the rotary valve as shown, so that the port is open, and the edge of the valve matches as precisely as possible with the mark. NOTE: the valve is asymmetrical. Flip it around to find the closest match.



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## **Engine Installation**

### **Oil Injection**

It is SBT's recommendation that the oil injection pump be disabled, and block-off plate(s) be installed prior to use of the new engine in your ski. This is only recommended to insure reliable lubrication and extended engine life for all of your customer's PWCs. Re-use of your functioning oil injection pump, if so equipped, does not void your warranty.

### **Paper Gaskets**

It is SBT's recommendation that all paper gaskets be treated with Loctite® High-Tack Gasket Sealer prior to installation. Read and follow all instructions on the product canister to insure good gasket sealing on your new engine.

### **Special Gaskets**

It is SBT's recommendation that all exhaust gaskets be sealed with Loctite® Copper Gasket Adhesive prior to installation. Read and follow all instructions on the product canister to insure good gasket sealing on your new engine.

### **Bolts**

It is SBT's recommendation that all bolts be treated with Loctite® Medium Strength Threadlocker Blue (242) during assembly.

### **Break-In Oil**

It is SBT's requirement that the new engine be broken-in with additional oil in the fuel supply for the first tank. Follow the mixing chart on the back of the bottle to determine quantity needed.

### **Electrical Connections**

It is SBT's recommendation that all electrical connections be sanded, cleaned and secured during the assembly process. It is a common problem to not have solid connections due to corrosion, paint, poor wire condition, etc.

### **Disclaimer**

While every precaution has been taken in the preparation of these guides, SBT assumes no responsibility for errors or omissions. Neither is any Liability assumed for damages resulting from use of the information contained herein. Publication of the procedures in these guides does not imply approval of the manufacturers of the products covered. Persons engaging in the procedures herein do so at their own risk.



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Follow the removal steps in reverse order to install your new SBT short block assembly:

## 6.9 Install the engine mount plate.

- Torque to 26 ft. lbs.

## 6.8 Install the head heat sensor and block pulse line.

## 6.7 Install the PTO coupler.

- Torque to 81 ft. lbs.

## 6.6 Install the stator plate and flywheel housing.

- Torque to 44 in. lbs.

## 6.5 Install the flywheel, key and nut.

- Torque to 107 ft. lbs.

## 6.3 Using a new o-ring, install the flywheel cover.

- Torque to 44 in. lbs.

## 6.2 Install the starter.

- Torque to 16 ft. lbs.

## 6.1 Using a new gasket, install the exhaust manifold.

- Torque to 17 ft. lbs.

**5.4** Install a bolt into each motor mount. Using your hand, forcefully rock it in all directions, trying to break each mount. If any fail, they must be replaced. Place the engine into the hull and install the mounting bolts. Be sure to replace any shims present from the old engine.

- Torque to 18 ft. lbs.

## 5.3 Install the block ground wire.

- Torque to 16 ft. lbs.

Install the starter wire.

- Torque to 62 in. lbs.

Install the upper and lower oil bath lines.

**5.2** Reconnect all the electrical wires inside the electrical box, and seal the box.

## 5.1 Install the electrical box.

**4.4** Using a new gasket, install the top exhaust pipe.

- Torque to 18 ft. lbs.

**4.3** Install the exhaust stinger pipe. Use a thin bead of Copper Silicone gasket maker on each side of the copper exhaust gasket. Tighten the clamp and re-attach the three pipe water lines.

## 4.2 Secure the top pipe bolts and nut.

Torque to 18 ft. lbs.

**4.1** Re-attach the waterbox and tighten the clamp.

**3.6** Install the oil feed line to the rotary valve cover. Using a new o-ring, install the rotary valve cover. Open the bleed screw and allow the line to bleed for at least one minute to remove air pockets.

**3.5** Re-attach the head cooling line(s), carb fuel & pulse lines.

**3.4** Using a new gasket, install the flame arrestor base.

- Torque to 88 in. lbs.

**3.3** Install the flame arrestor and brace if present.

**3.2** Install the air silencer base and brace.

**3.1** Install the air silencer cover, heat sensor, plugs and plug wires.

**2.1** Install the pump, using 100% silicone to seal the pump to the hull. Make sure all old sealer is removed and both surfaces are perfectly clean.

- Torque to 26 ft. lbs.

Re-attach the control cables, siphon lines and water inlet hose.

**1.1** Re-install the battery, connecting the positive lead first.

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## Tools Needed:

### Sockets

- 8mm
- 10mm
- 11mm
- 12mm
- 13mm
- 17mm

### Sealers / Lubricants

- Loctite® Copper Gasket Adhesive
- Loctite® Copper Silicone Gasket Maker
- Loctite® 2 Gasket Sealer
- Loctite® Medium Threadlocker (Blue) 242
- Loctite® High-Tach
- SBT Break-In Oil

### Misc.

- Ratchet
- Long socket extension
- Short socket extension
- Screwdrivers
- Universal flywheel puller  
(Available at most major auto parts stores for rent/lend/purchase)

### Parts

- External Gasket Kit
- Zip-Ties
- \* Degree Wheel

### Wrenches

- 10mm
- 12mm
- 13mm
- Torque wrench
- Pipe wrench
- Allen wrenches