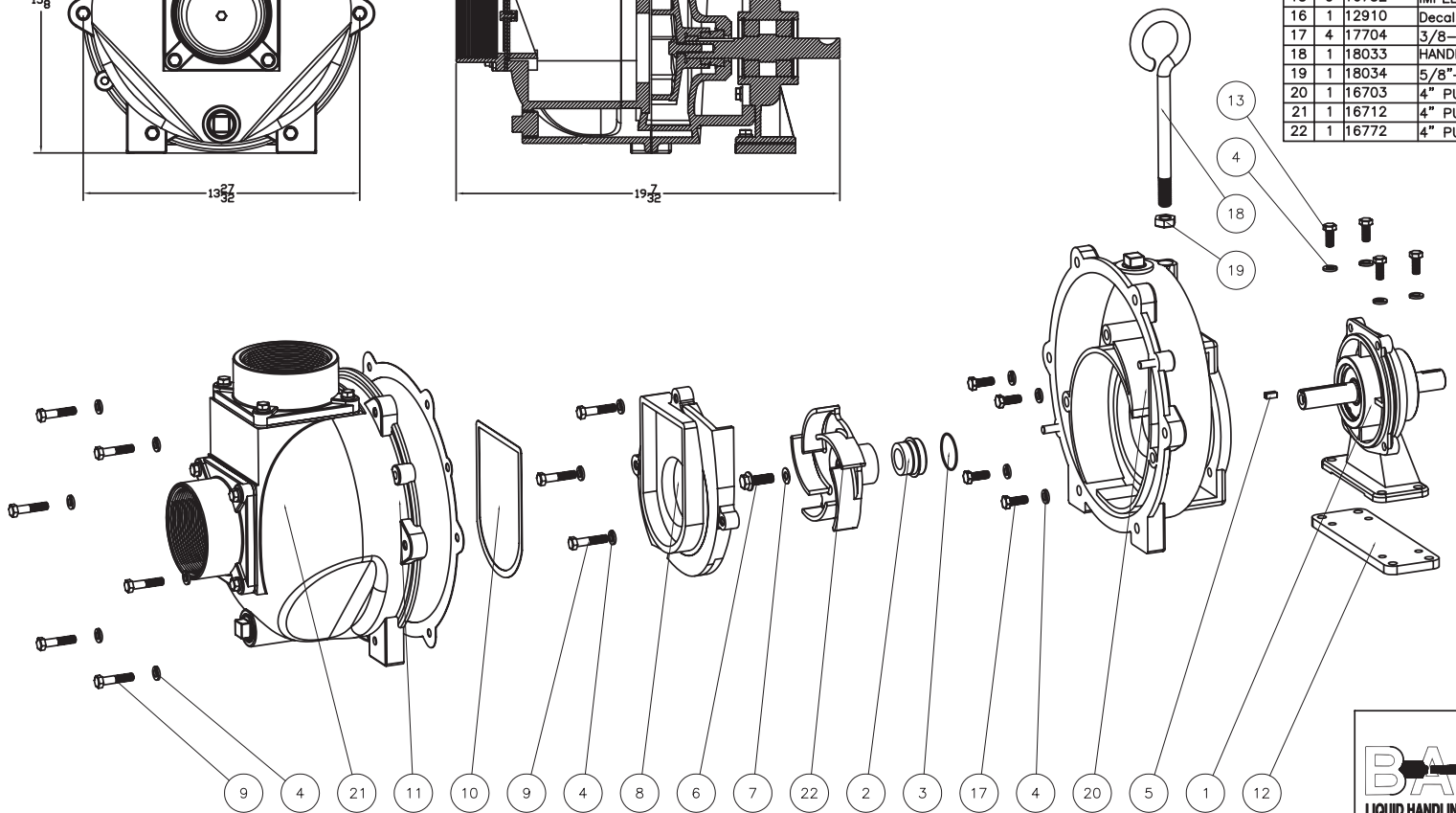


Parts List			
ITEM	QTY	PART NO.	DESCRIPTION
1	1	18500	Bearing Pedestal Assembly
2	1	16713	Mechanical Seal
3	1	16710	O-ring
4	17	V20018	3/8" Split Lock Washer
5	1	16901	1/4" x 3/4" Shaft Key
6	1	16765	Impeller Bolt
7	1	16019C	16019 Gasket Set (A,B,C)
8	1	16702	Volute
9	9	V20011SS	3/8"-16 x 1.75" HHCS
10	1	16019B	16019 Gasket Set (A,B,C)
11	1	16019A	16019 Gasket Set (A,B,C)
12	1	18511	Bearing Pedestal Adapter Plate
13	4	18512	3/8"-16 x 0.87" HHCS
14	0	16751	Rear Bracket Shim (AS REQ'D)
15	0	16752	IMPELLER SHIM (AS REQ'D)
16	1	12910	Decal for Pump (N/S)
17	4	17704	3/8"-16 X 1 1/4" HHCS
18	1	18033	HANDLE
19	1	18034	5/8"-11 Jam Nut
20	1	16703	4" PUMP REAR BRACKET
21	1	16712	4" PUMP BODY ASSEMBLY
22	1	16772	4" PUMP IMPELLER



BANJO CORPORATION
 150 BANJO DR. ■ CRAWFORDSVILLE, IN 47933

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PART NO.	444PBI
TITLE	4' Banjo Pump w/ Bearing Pedestal



3" & 4" Cast Iron Self-Priming Centrifugal Pump Instruction Manual

333 & 444 Series

Read these instructions and the instructions covering operation of the pump drive unit. Do not operate the gas engine (if so equipped) until you have put oil in the engine. Do not run the pump dry. Always fill the pump with water or the liquid being pumped before starting the drive unit to avoid premature pump seal failure.

The gas engine (if so equipped) is shipped with no oil. Consult your owners manual for specific oil recommendations, maintenance procedures, schedules, and troubleshooting. The maximum angle of operation for gas engine drive units is 25° in all directions. For engine warranty service contact your local engine dealer.

Do not use flammable liquids. This pump is not designed or produced to pump flammable liquids of any kind. Failure to follow this warning can result in explosion, serious bodily injury or death.

Do not run the pump dry. Serious damage to the mechanical seal or complete failure of the mechanical seal can result from running the pump dry. Always fill the pump with water or the liquid being pumped before starting the drive unit.

Make certain that all hose and pipe connections are airtight. An air leak in the suction line may prevent priming and will reduce the performance of the pump.

Do not restrict the pump inlet. High volume pumps such as the Banjo 444 Series pumps should not have the inlet port or line restricted. If the pump is equipped from the factory with a 4" inlet flange, the pump should be plumbed with a 4" inlet line. If the pump is equipped from the factory with a 3" inlet flange, the pump should be plumbed with a 3" inlet line. Failure to follow these instructions can result in pump cavitation and pump failure.

Always place the pump as close to the liquid to be pumped as possible. Keep the suction line short and with few bends. Keep the pump and engine on a level foundation. A poor foundation and a heavy suction hose (made heavier when "primed" full of liquid) could result in a pump "down the hole". It is not necessary to drain the pump body after use, unless there is a danger of freezing.

There are important instructions regarding the preparation of the engine for long periods without use. (Reference the engine owners manual). Before long periods of storage, the pump should be flushed with clean water and drained. Leave all plugs (fill and drain) out of the pump. Always store the pump in a heated and dry building.

There are no points on the pump that need lubrication. The pump seal is cooled and lubricated by the fluid being pumped. When pumping dirty water or liquids containing solids, always use a basket strainer on the end of the suction line.

Engine warranty service available at authorized Honda & Briggs and Stratton Dealers.

***Note: Do NOT operate pump without the supplied EPA approved fuel tank and lines.**

DISASSEMBLY INSTRUCTIONS:

Tools required:

9/16" Box End Wrench

9/16", 13/16" & 5/8" Socket

Ratchet with 3" Extension

Gasket Scraper or Wire Brush

Loctite 242 and Loctite Gasket Adhesive #2

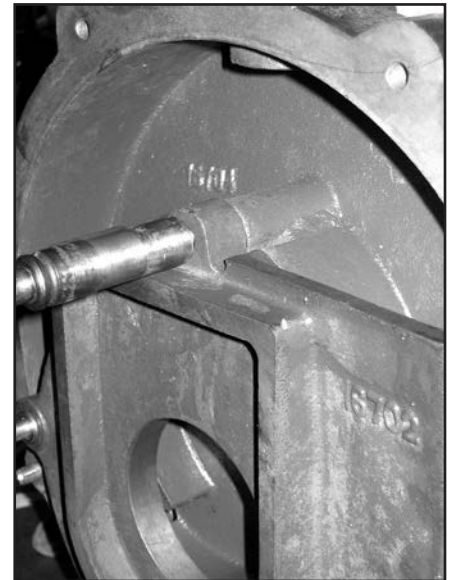
1. Remove the (6) bolts (V20011SS) and lock washers (V20018) that hold the pump body assembly onto the rear bracket. Remove the body from the remaining pump assembly.

1



2. Remove the (3) bolts (V20011SS) and lock washers (V20018) holding the volute to the rear bracket. Remove the volute (16702) from the remaining pump assembly.

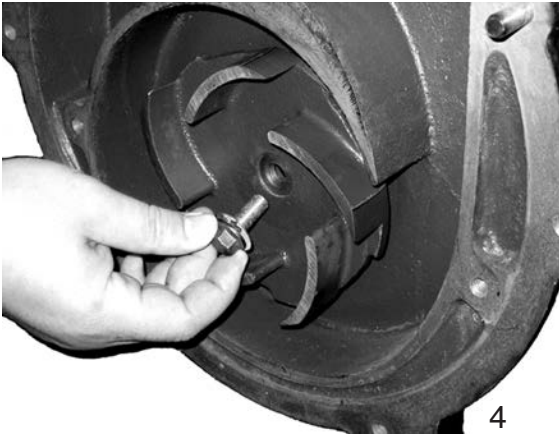
2



3. Remove the impeller bolt (16765) from the impeller (16772). Remove the impeller bolt gasket from the impeller using a gasket scraper or wire brush.

3





4

4. Screw the supplied 9/16" -12 hex head cap screw (16099) into the threaded hole in the impeller snout. As the bolt is tightened the impeller will be pulled off the shaft of the drive unit. Remove the 9/16"-12 hex head cap screw once the impeller has been removed from the drive unit.

If the pump impeller is going to be reused, the primary ring of the seal (16713) should be removed at this time. The impeller key (16901) located behind the primary ring of the seal should also be removed. If impeller shims (16752) have been installed from the factory, the same number of new shims will need to be reinstalled in the pump.



5

5. Remove the (4) bolts (18027) and lock washers (V20018) that hold the rear bracket to the drive unit. With the 4 bolts removed the rear bracket can be removed from the drive unit.

When removing the rear bracket from the drive unit, check if there are any bracket shims (16751) installed between the two parts. If bracket shims have been installed from the factory, the same number of shims will need to be reinstalled during the reassembly of the pump.

6. Remove the cup seal half from the rear bracket. This may be done by using a round object such as a socket and tapping it with a hammer as shown in the photo. If necessary, remove the inlet (16002) and outlet (16000) flanges, the flange gaskets (167006 and 16011) by removal of the flange screws (18027) and lock washers (V20018).



6

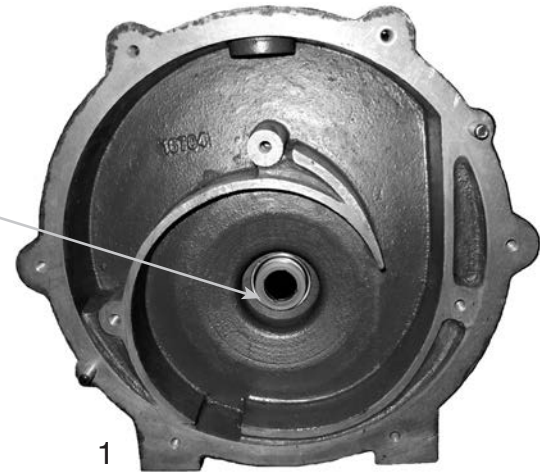
With the pump completely disassembled, clean all of the reusable parts thoroughly removing any traces of gasket material with a scraper or wire brush. Remove any corrosion on the sealing surfaces of the pump components. At this time it may be necessary to polish the drive shaft using emery cloth to remove any corrosion.

ASSEMBLY INSTRUCTIONS:

1. Place the seal O-ring (16710) behind the lip of the cup half of the seal. The cup half of the seal (16713) should now be installed into the rear bracket as shown at right.

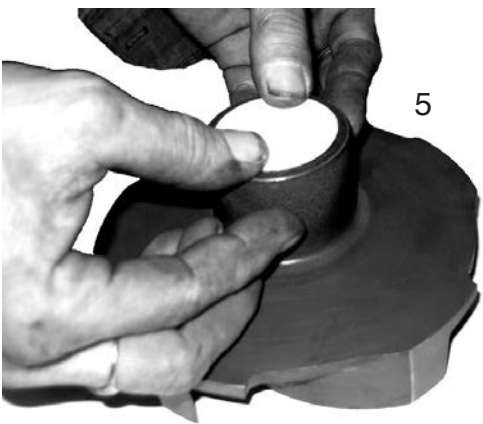
2. To install the cup half of the seal into the rear bracket, use a tool such as a 1 5/8"-12 point socket to give even pressure on the metal flange of the seal housing during installation. The seal should be pressed into its bore. Do not strike the seal with a sharp blow such as from a hammer. Do not press on the seal faces because they are brittle and will fracture from impact.

3. Install the rear bracket (16703) onto the drive unit using the (4) bolts (18027) and lock washers (V20018) originally used to attach the rear bracket to the drive unit. We strongly recommend the use of Loctite 242 (blue) on these bolts due to the heat and vibration caused by the engine. Be sure to install the correct number of bracket shims (16751) if the pump was assembled with shims from the factory. The handle of the rear bracket should be to the top of the drive unit. Tighten the rear bracket screws (18027) to 20 ft. lbs. of torque.





4. If the impeller originally had impeller shims (16752) in the impeller bore, install these shims now. Use the same number of shims that were originally in the pump from the factory. Place the impeller key (16901) in the slot located inside the impeller snout.



5. Install the primary ring seal half into the impeller. The seal half is pressed into the hub of the impeller by using both thumbs (shown in photo at left). The outside diameter of the primary ring may be sparingly coated with silicone to ease installation. The lapped or polished seal face must be installed face up.

Be absolutely sure that the primary ring seal half is bottomed out and installed squarely. If the installation is not square, seal wobble will occur leading to seal failure. Care must be used when handling the seal to not scratch or crack the seal surface. The seal surfaces must be kept oil and contaminant free.



6. The impeller (16772) is now ready to be slid onto the drive shaft unit. Be sure to align the impeller key with the keyway of the drive unit shaft. Secure the impeller to the drive unit shaft with the impeller bolt gasket (16019C) and impeller bolt (16765). Tighten the impeller bolt (16765) to 45 ft. lbs. of torque. We strongly recommend the use of Loctite 242 (blue) on these bolts due to the heat and vibration caused by the engine.

The impeller bolt will pull the impeller into its final position on the drive unit output shaft.

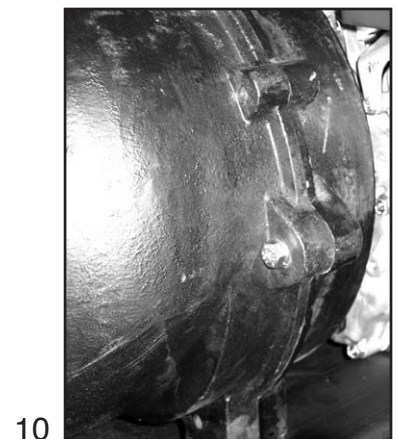
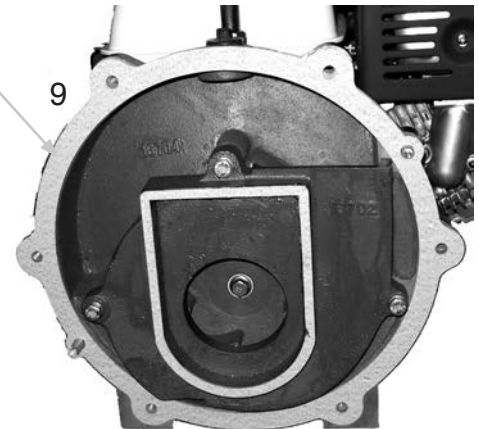
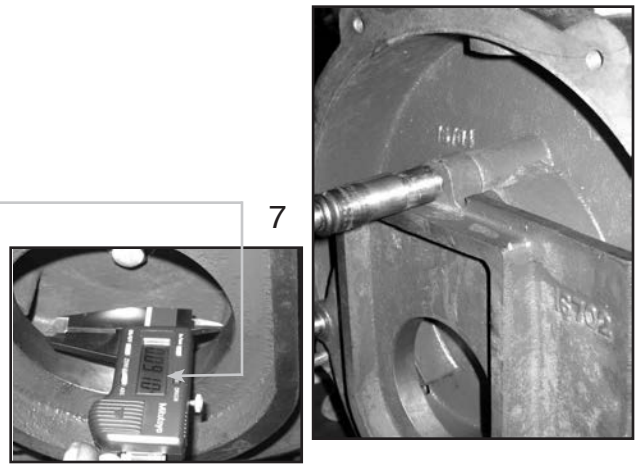
7. Install the volute (16772) onto the rear bracket using (3) bolts (V20011SS), and (3) lock washers (V20018). Tighten the (3) bolts (V20011SS) to 20 ft. lbs. of torque. We strongly recommend using Loctite 242 (blue) on these bolts due to the heat and vibration caused by the engine. There should be .080" to .100" clearance between the impeller face and the volute face. If the minimum clearance is not achieved a bracket shim (16752) will have to be installed in the impeller bore to achieve the proper clearance.

8. Install the volute gasket (16019B) as shown on the volute. We strongly recommend a light coating of gasket sealer, such as Loctite Gasket Sealer #2, be applied between the gasket and the volute. The gasket seal will ensure a good seal between the gasket and the mating cast iron parts. This seal is critical to having the pump prime well.

9. Place the main pump body gasket (16019A) on the outside flange of the rear bracket. The gasket should be aligned with and placed over the two dowell pins on the rear bracket. The gasket may be lubricated with chapstick or petroleum jelly. Lubricating the gasket in this manner will help the parts not to stick to the cast iron parts it is sealing against.

10. Install the pump body (16712) onto the rear bracket aligning the pump body with the dowell pins on the rear bracket. Secure the pump body to the rear with six bolts (V20011SS) and (6) lock washers (V20018). Tighten the (6) bolts (V20018SS) to 20 ft. lbs. of torque.

Pump is ready for operation.



TROUBLESHOOTING GUIDE:

1. GAS ENGINE WILL NOT START.

- a. Verify that there is no external damage to the engine.
- b. Verify that engine has the manufacturer's recommended amount and grade of oil in the engine.
- c. Verify that the engine gas tank has been filled with a minimum of 87 octane unleaded gasoline. Verify that the gasoline is fresh and clean.
- d. Verify that the spark plug wires are properly connected to the spark plugs.
- e. Verify that the battery cables are tight and properly connected to both the battery and engine.
- f. Verify that the battery is fully charged and in good condition.
- g. Review starting procedures and/or trouble-shooting guide in engine owners manual.
- h. Contact the engine manufacturer for warranty assistance and repair information.

Honda: 800-426-7701

www.honda.com

Briggs and Stratton: 414-259-5262 www.briggsandstratton.com

2. PUMP WILL NOT PRIME.

- a. Verify that the customer is filling the pump with fluid prior to start up via the fill hole located on the top of the pump.
- b. Verify that the customer is not trying to lift fluid more than 15 vertical feet.
- c. Verify that the customer does not have any kinks in the suction line.
- d. Verify that the pump inlet or suction line is not clogged.
- e. Verify that the suction line does not have any vacuum leaks at any of the connections.
- f. Verify that the pump is operating at a minimum of 3450 RPM for lifting and self-priming applications. Banjo pump will not prime while operating below 1750 RPM.
- g. Verify correct pump rotation if an electric motor or hydraulic motor is being used. A counter clockwise rotation (right hand rotation) is required from the motor.
- h. Verify that the impeller spacing is no more than .110".

3. PUMP LOOSES PRIME DURING OPERATION.

- a. Verify that the customer is not trying to lift fluid more than 15 vertical feet.
- b. Verify that the customer does not have any kinks in the suction line.
- c. Verify that the pump inlet or suction line is not clogged.
- d. Verify that the suction line does not have any vacuum leaks at any of the connections.
- e. Verify that the pump is operating at a minimum of 3450 RPM for lifting and self-priming applications. Banjo pump will not prime while operating below 1750 RPM.

4. ENGINE RUNS BUT PUMP DOES NOT TRANSFER LIQUID.

- a. Verify that the pump is operating at a minimum of 1750 RPM. Banjo pumps may not operate below this RPM.
- b. Verify correct pump rotation if an electric motor or hydraulic motor is being used. A counter clockwise rotation (right hand rotation) is required from the motor.
- c. Verify that the impeller spacing is no more than .110".
- d. Verify that the impeller is secured to the engine shaft with a shaft key. This verification can be done by turning the impeller (via the impeller bolt) on the pump by using a 5/8" socket attached to a 6" extension. If the impeller turns without spinning drive unit the impeller the shaft key is broken or missing. Replace shaft key.
- e. Verify that the customer does not have any kinks in the suction or discharge lines.
- f. Verify that the pump inlet, outlet, suction line or discharge line is not (partially) blocked.
- g. Verify all plumbing system valves are open.

5. MOTOR RUNS BUT PUMP DOES NOT PERFORM ADEQUATELY.

- a. Verify that the pump is operating at a minimum of 1750 RPM. Banjo pumps may not operate below this RPM.
- b. Verify correct pump rotation if an electric motor or hydraulic motor is being used. A counter clockwise rotation (right hand rotation) is required from the motor.
- c. Verify that the impeller spacing is no more than .110".
- d. Verify that the impeller is secured to the engine shaft with a shaft key. This verification can be done by turning the impeller (via the impeller bolt) on the pump by using a 5/8" socket attached to a 6" extension. If the impeller turns without spinning drive unit the impeller the shaft key is broken or missing. Replace shaft key.
- e. Verify that the customer does not have any kinks in the suction or discharge lines.
- f. Verify that the pump inlet, outlet, suction line or discharge line is not (partially) blocked.
- g. Verify all plumbing system valves are open.

6. ENGINE BOGS DOWN DURING PUMP OPERATION / ELECTRIC MOTOR TRIPS CIRCUIT BREAKER DURING START UP OR OPERATION.

- a. Verify that the customer does not have any kinks in the suction or discharge lines.
- b. Verify that the pump inlet, outlet, suction line or discharge line is not (partially) blocked.
- c. Verify that the impeller spacing is no less than .080". The impeller should not be touching the wear plate/volute.
- d. Verify the weight of fluid being transferred. Make sure that the drive unit is properly sized for the pump and its application. If you are unsure of the application consult with engineering.

7. GRINDING, TICKING OR WHIRRING SOUND DURING PUMP OPERATION THAT IS UNUSUAL.

- a. Verify that the impeller bolt has not loosened, letting the impeller pull itself into the volute. The impeller spacing should be no less than .080". The impeller should not be touching the wear plate/volute.
- b. Verify that outside diameter is not hitting on the pump housing or volute. Have the customers slowly rotate the pump several times by hand. If the customer can feel the pump dragging on the housing or volute, or hear a scraping sound, the impeller may be hitting on the pump body or volute. The impeller can be removed from the pump and either filed down or turned down slightly on a lathe.
- c. Remove the pump housing and inspect for internal debris such as rocks, sticks or other foreign material stuck inside of pump. With the pump housing and volute removed the customer can then inspect the impeller face and outside diameter for signs of contact between the impeller and other pump components.

8. PUMP/ENGINE RAN FOR A WHILE, THEN QUIT & THE PUMP/ENGINE WILL NOT RESTART.

- a. Verify that there is no external damage to the engine.
- b. Verify that engine has the manufacturers recommended amount and grade of oil in the engine.
- c. Verify that the engine gas tank has been filled with a minimum of 87 octane unleaded gasoline. Verify that the gasoline is fresh and clean.
- d. Verify that the spark plug wires are properly connected to the spark plugs.
- e. Verify that the impeller bolt has not loosened, letting the impeller pull itself into the volute. The impeller spacing should be no less than .080". The impeller should not be touching the wear plate/volute.

444PIH24 ONLY

Fuel Supply tank

Use only EPA approved Fuel containers for fuel supply tank.

Use only EPA approved low permeability fuel line.

Always consult State and local regulations regarding fuel supply systems before installation.

Fuel Pump

The standard fuel pump provides an operating pressure of 0.1 kgf/cm² (1.4 psi) and delivers 15 liters/hr (4.0 US gal/hr). The carburetor inlet float valve has a closing pressure of 0.2 kgf/cm² (2.8 psi). If a secondary fuel pump is used, to prevent carburetor flooding, its operating pressure must not exceed the standard fuel pump's operating pressure.

Fuel Tank Position

The fuel tank must be installed so that its maximum gasoline level is within 50 cm (20 in) above or below the carburetor gasoline level.

Use a fuel tube rated for use with gasoline. The fuel tube should have an inside dimension of 5.5 mm (0.22 in).

Keep the fuel tube as short as possible if the fuel tank is installed below the carburetor. Install the fuel tube so that it will not rest against any sharp objects or make sharp bends that can restrict the flow of fuel. If the fuel line passes through an enclosure wall, protect it with a rubber grommet.

Route the fuel tube away from hot engine and exhaust system components and away from electrical wiring. Secure the fuel tube with straps to prevent sagging and bending.

Fuel Valve Installation

A fuel valve should be installed so that it is easily accessible. Install the fuel valve at the outlet of the fuel tank and indicate by an easily read label its location and operation. If under the fuel tank is not the ideal location, securely install the fuel valve in-line with the fuel tube in a cool spot, so that engine heat cannot cause vapor lock.

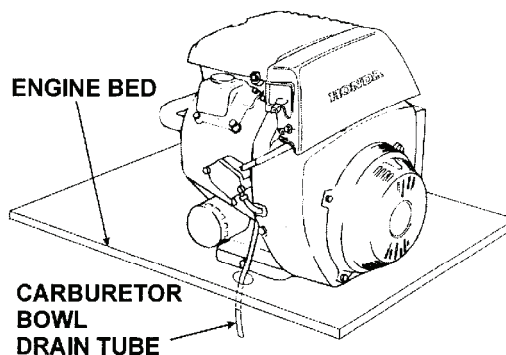
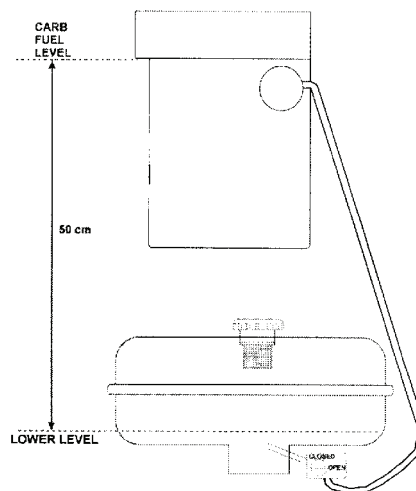
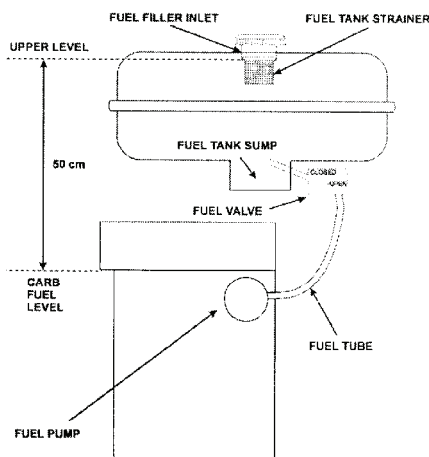
Fuel Tank Filter Installation

An in-line fuel filter is provided with the engine and is located under the carburetor cover.

It is recommended that a fuel tank strainer with a mesh rating of #80 be installed at the fuel tank inlet to catch debris when refueling. It is also recommended that a fuel tank sump be provided at the fuel tank outlet to reduce the chance of contaminants entering the fuel system.

Carburetor Bowl Drain Tube Position

Set the carburetor bowl drain tube so that the fuel from the carburetor bowl does not accumulate in the engine bed.



444PIH24 ONLY

Battery installation: *IMPORTANT NOTE*

When installing a battery be sure to use proper battery cable size according to length required. See requirements below.

Battery

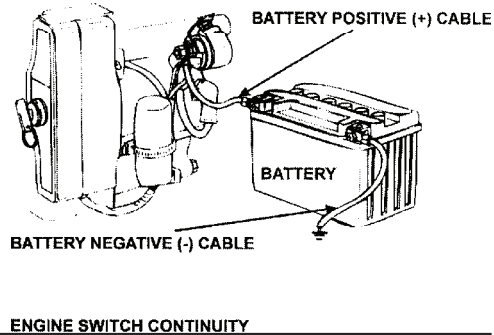
Use a 12V battery with a minimum capacity of 400CCA.

Battery Cable Selection

Select battery cables of the proper length and thickness to avoid a voltage drop which could affect engine cranking speed and starting dependability.

Battery cable size and length: (Gauge x Length)

Positive cable: AWG No. 4 x 1.5 m (5.0 ft) maximum
Negative cable: AWG No. 4 x 2.3 m (7.5 ft) maximum



Always install on positive battery terminal a non-conductive protective cover to prevent accidental shorting of battery.

Regulator/Rectifier Installation

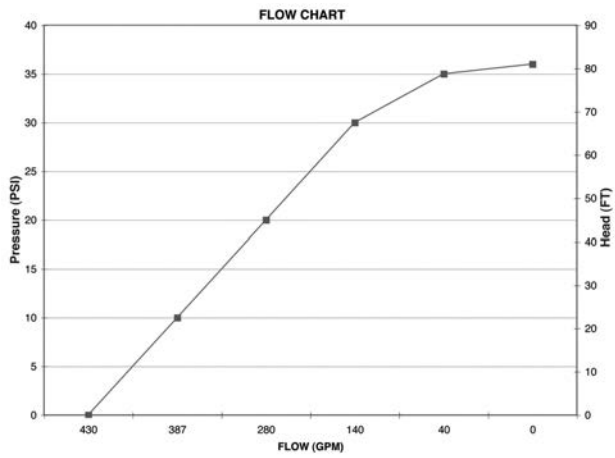
Use the 20A regulator/rectifier and the special wire harness when making connections to the 20A charging coils.

The regulator/rectifier has cooling fins integrated with the assembly. Install the regulator/rectifier in a place where the ambient temperature is lower than 40°C (104°F) and there is a fresh supply of cool air passing over the cooling fins. Mount the regulator/rectifier on the frame so that the vibration is 10g (RMS) maximum. Do not install it on the engine.

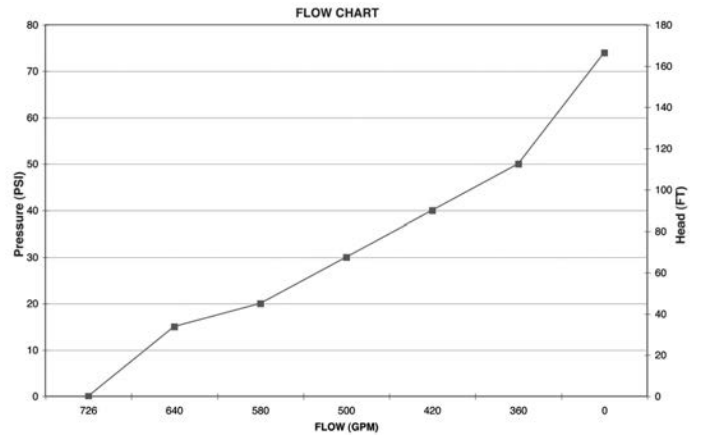
Install a 25A fuse between the engine switch and the starter solenoid battery lead to protect the regulator rectifier circuits (see pages 31 and 32).

Oil Pressure Switch

The oil pressure switch is normally closed, completing the circuit between its terminal and ground. The circuit is opened when the operating pressure is above 1.0 kg/cm² (98 kPa 14.22 psi). The oil pressure switch can be wired to a warning device such as a buzzer (12 Vdc 0.3A or above) or a lamp (12V 3.4W maximum).



Flow Chart for 333PIH13, 333PI16, 333PBI



Flow Chart for 444PIH24, 444PI20, 444PBI



333PIH13



333PI16

333 Series

- 333PI16
- 333PBI
- 333PIH13



444PIH24

444 Series

- 444PIH24
- 444PBI
- 433PBI