A Complete Engine Rebuild - My Way

In my last article I talked about the importance of maintenance to your engine. Now let's look at doing a complete engine rebuild to an engine that has not been properly maintained. These are the steps I follow when I do a rebuild. You see, I believe their is more to a rebuild then rings and a new spark plug. An engine rebuild is a major project and proper preparation is needed. Start by purchasing a repair manual for the engine you are working with. This manual is invaluable in giving specifications and repair procedures.

Ideally, the preparation for a rebuild starts by a visual inspection, followed by running the engine if possible and observing the problems it has. You may want to run a compression test, a cylinder leakdown test, and a crankcase vacuum manometer test if you have these tools. A cylinder balance test is a good idea on two cylinder engines. Here's a list of things I like to check before any disassembly occurs:

- **Check the oil to see if it is low or dirty.**
- **Check the fuel for contaminates and freshness.**
- **Examine the spark plug to see if it has oily carbon on it.**
- **Notice any fuel or oil leaks, blown gaskets, hoses etc.**
- **Look for loose linkages, plugged cooling fins, a loose governor shaft or carburetor shaft.**
- **If the engine is severely damaged and won't run, look for cracks or holes in the block.**
- **Take a good look at the air intake system. Has dirt been entering the carburetor air intake?**

Start the engine and observe any blue smoke, engine noises and lack of power. Does the engine misfire or rattle badly? Does the governor work ok? Does the engine idle ok? Is excessive smoke (blow-by) coming from the crankcase breather tube? All of the above can give you a good indication of what you will find when you disassemble this engine. If the engine does not smoke badly or make unusual noise, but lacks power, it may only need a valve grind or tuneup. Carbon buildup can be a real problem on gensets, pumps etc.

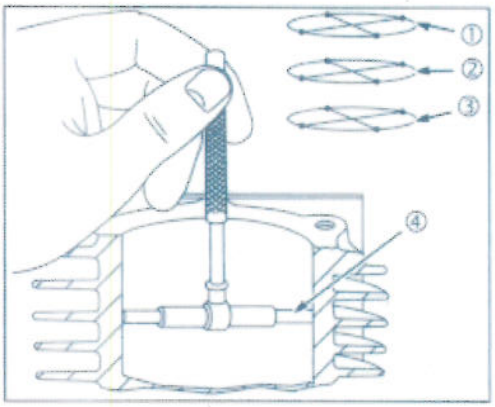
At this point you have decided the engine is smoking and needs a rebuild. I like to start by removing all the shrouding and use either compressed air or a pressure washer to clean the engine thoroughly before opening it up. You may want to take it to a car wash. This gives you a clean unit to work on. Leave the air filter on for this and duct tape the exhaust outlet and fuel cap vent. If you pressure wash the unit, blow dry with compressed air.

Most repair manuals give a disassembly procedures which you may follow if you like or use a variation of the one below. If you own a digital camera, take pictures of the governor springs, linkages and other items you may want to look at when it comes time to reassemble. Here's a suggested order

of disassembly for an L-head engine:

- **Remove the fuel tank, carburetor and governor linkages.**
- **Remove the valve cover and breather assembly.**
- **Remove the cylinder head and valves and inspect.**
- **Next take a good look at the valve seats and valve guides.**
- **Look for a wear ridge or carbon near the top of the cylinder. You will need to remove this before removing the piston.**
- **Remove the flywheel next, then open the crankcase up and remove the rod cap. You may want to use Plastigage and check the rod clearance at this time.**
- **Remove the piston next. I like to remove the top ring and fit it back in the cylinder to check the ring gap.**
- **The camshaft and crankshaft can come out next. You now should pretty much have a bare block setting in front of you.**

Now comes the really important part and you get to use your new repair manual. In the manual you will find specs and measurements on everything in the engine. Spend plenty of time measuring and listing all the parts that do not meet minimum or maximum specs. Note any excessive wear or scratches from dirt entering the engine. You don't want to cut corners here, because it's the difference between a good rebuild and a comeback (dirty word). It does no good to put a set of new rings in a cylinder that is worn beyond specs. If you don't have the equipment to measure properly, take it to a local machine shop and pay them to "mic it up" for you.

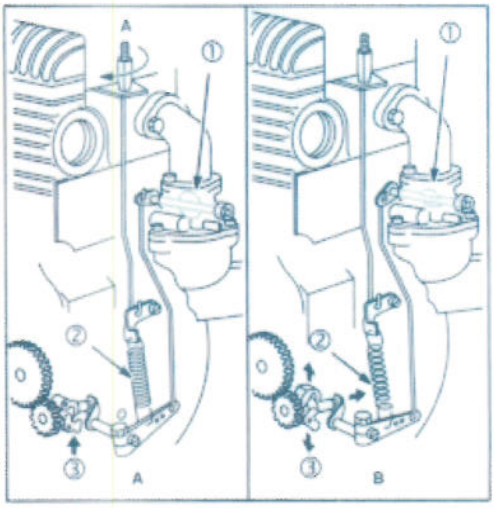


Rebuild Kits: Most engine companies do not sell rebuild kits and the ones being offered on the market are often from aftermarket companies or overseas sources. I recommend using genuine OEM replacement parts on your rebuild. Start with a gasket/seal set and add to this the parts you need after you get done with the measuring procedures above. These may include such items as a piston assembly, rod assembly, valves, governor and carburetor kit. This way you will get just the parts you need in the correct sizes, assuring a quality job. Don't be mislead by aftermarket rebuild kits being a cheap shortcut to success, it's the care given to detail, plus the correct quality parts that make the job last many years.

I will not go into reassembly here as this can vary between models. Pay close attention to recommended procedures and torques. Make sure you understand how the governor linkages connect and any static governor adjustments that need to be made. I usually reassemble by building up a shortblock, then adding the components as groups in the reverse order that I disassembled them. With the spark plug out, turn the engine over often to feel for any binding or rubs. Apply plenty of oil on the internal parts of the engine when installing them. Don't forget to include new air, oil and fuel filters as part of your rebuild. Last but not least, keep it clean!!! Remember, contamination is your enemy. I hope this information gets you going in the right direction on your engine rebuild - Bruce Perrault

Understanding Governors

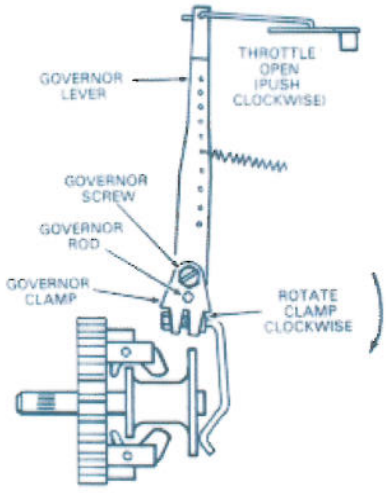
Probably the most important part of your engine, at least to the life of it, is the engine governor. Without a way of controlling engine speed, the engine would destroy itself in short order. Never overspeed an engine, especially without a load attached to it, even for a short time. I recently received a Honda gen-set for repair in which the governor had failed and the centrifugal force of overspeeding blew the magneto magnet into 100's of little pieces. So, you can see, overspeeding is something that needs to be taken care of immediately, because it can be a real hazard with metal coming loose at high speed.



So, how does a governor work? Most governors used on modern engines are known as "mechanical governors". In other words they are mechanically linked to the engine crankshaft and use crankshaft rotation speed as a drive force for the governor. Some drive off the camshaft, but the camshaft drives off the crankshaft. The governor usually consists of a gear and fly weights pushing against a spindle and shaft. This transfers a rotation motion into a back and forth motion which can open and close the carburetor throttle. The governor shaft is connected to the carburetor by an arm and linkage. A governor spring is attached to a hole in the arm and gives a counter resistance to the thrust put against the governor spindle by the rotating weights. It is the calibration of this spring that makes everything come out right to maintain a 3600 rpm speed. On variable speed engines, a control cable is connected to this spring to control the engine rpm's by varying the spring tension. All in all, it's a pretty simple device and for the most part very dependable.

So, why doesn't it work right? Most governor complaints fall into two categories:

- **Engine runs too fast or too slow.**
- **Engine surges or hunts.**



Before trying to solve either of these problems, you should do an inspection of the governor linkage and spring. Make sure everything is operating freely and the spring is not damaged or stretched. Also, check the governor static adjustment to see that all free play has been removed between the spindle and carburetor. The best way to do this is to move the throttle from idle to full open and note the way the governor shaft moves. If it goes clockwise, then loosen the clamp screw and with the throttle wide open turn the shaft all the way clockwise and re-tighten the nut. Make sure the throttle moves from idle to full open freely after making the adjustment. Your governor setup may look different then the picture, so refer to the engine repair manual for exact adjustment procedures.

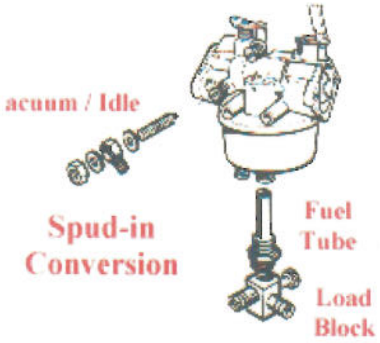
After making the above checks, restart the engine and see if the governor now operates correctly. With the engine at idle, move the governor lever with your finger to open the throttle and it should push the arm back toward idle if working properly. One way to do this test is with the

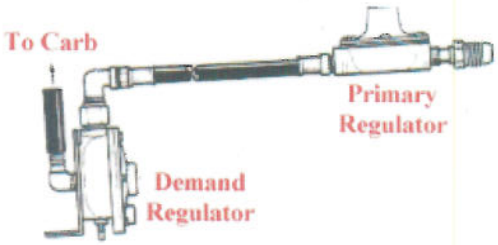
governor spring removed. If it still over speeds or has no push toward idle, you probably will need to have the internal parts checked inside the motor or recheck the static adjustment. This is not a job for everyone, so see your local repair shop.

The other problem that often occurs is governor hunting or surging up and down. Many times this is not the problem of the governor, but a partially plugged carburetor, especially a plugged idle circuit or worn linkage. If you can rule out these causes and have checked the adjustments I talked about above, then you may have a governor that is set too sensitive. In other words it reacts too quickly and over compensates for the speed. Many governor arms have several holes in the arm to change sensitivity. By moving the governor spring to a hole further away from the governor shaft you will make it less sensitive. Before playing with this, check the repair manual for the engine you have and see if it has a way of adjusting sensitivity. Sometimes you have to change governor springs, etc.

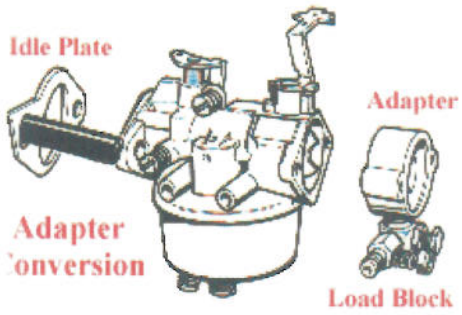
One last thing on governors. Many of the smaller lawnmowers used what is called an "air vane governor". This type of system uses the air flowing through the engine to operate a vane back and forth against a spring, just like the mechanical governor does. The big problem here is debris in the system blocking air flow. When this happens the engine will overspeed. So, with an air vane system it is very important to keep the cooling fins clean so the proper amount of air can move through the engine. The governor spring is precisely calibrated for an engine that has full air flow going through it.

I hope this information has been helpful and if I think of something I missed about governors, I'll include it here. The governor is a very important system on your engine that often gets overlooked - Bruce Perrault





Using Propane as a Fuel



Air cooled engines run very efficiently on propane as their fuel source. When properly installed, it is clean burning and safe fuel to use. Keep in mind that you need to figure about 5% less power output when using propane than gasoline as a fuel. Over the last thirty plus years, I have often been involved in propane fueled engines on generators and various other equipment. I'll try and pass along some of the knowledge I have gained in this article.

In addition to this, I have also written an article about Emission compliant engines. You may want to read this as the new EPA emission regulations are causing plenty of grief for those trying to modify new fuel systems. Propane conversions are easy to do, but specify guidelines must be followed to end up with an efficient safe system. Finding the proper LPG kit can be a challenge with all of the carburetors available today.

- **Propane Storage Tank - Where the propane is stored in liquid form under pressure.**
- **Primary Fuel Regulator - Reduces the pressure down to 6 ounces, before entering the demand regulator.**
- **Demand Regulator or Zero Governor - Where the fuel is held prior to entering the engine upon a vacuum demand from the carburetor intake.**
- **Load Block - Where the gas enters the carburetor through a load adjusting screw, many also have an idle adjusting screw.**
- **Electric Shutoff Solenoid - Used to positively shutoff the fuel to the demand regulator when the engine is not running, in case of a leak or rupture.**
- **Vacuum Switch - This switch is used to activate the electric solenoid in some applications. May also be designed to act as a stand alone disconnect.**

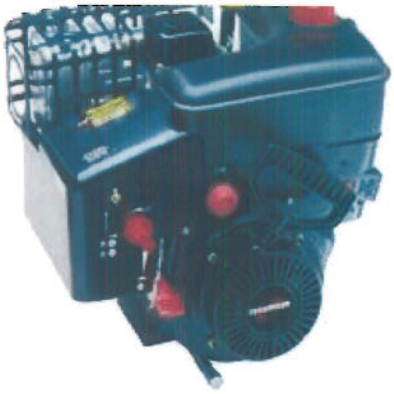
Propane is usually stored in a tank in liquid form. Most small engines run on Propane vapor, which is formed above the liquid in the tank. That is why the fuel is drawn from the top of the tank. The fuel is sent from the tank as high pressure vapor, up to 250 pounds. It is then reduced down to 6 ounces pressure by a primary regulator, before entering the demand regulator. The demand regulator is operated by a vacuum signal from the engine as it runs. The vacuum to the diaphragm of the regulator opens a needle valve and lets fuel flow to the carburetor. It is important that the vent hole in the regulator is not obstructed or the diaphragm cannot operate properly. Some systems have the primary and demand regulator all in one unit.

To meet safety precautions a shutoff solenoid or vacuum switch is installed before the demand regulator. This is particularly important if you do not turn the fuel supply off to the engine when the engine is stopped. In some applications a vacuum switch operates the electric solenoid. The important thing to remember here is that if the engine stops the fuel must be shut off to the demand regulator, by shutting off the power source to the solenoid.

When the engine cranks over, the solenoid circuit is activated and fuel is drawn from the demand regulator to the load block at the carburetor, where it is metered into the engine. Some models have a primer button on the demand regulator, a great help when starting with a recoil rope starter. Another important thing to do that is often overlooked is to set the spark plug gap at .018 when running propane on a small air cooled engine.

Precise Engine Repair does not offer conversion kits for sale. To find an LPG kit for your engine, do a search under propane conversion kits or see a local propane dealer. They may be able to help find a kit for your engine. I hope this article has answered a few questions and given you a better understanding of propane as a fuel - Bruce Perrault

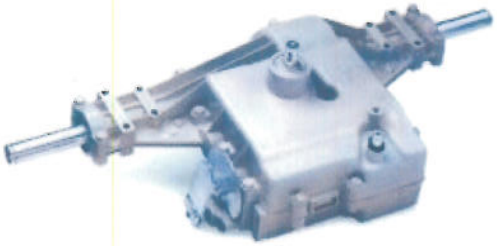
Tecumseh



Engines and Transaxles

"Small air cooled Engines and Transmissions"

"In 1895 John Lauson built his first internal combustion engine to make life easier for area Wisconsin farmers. In 1905, Lauson introduced an engine designed for cold Midwest winters. Dubbed the "Frost King", the engine circulated a solution of calcium chloride that helped it start and keep running in the coldest of temperatures." This was the beginning of the present Tecumseh engine.



The Lauson engine was bought by the Tecumseh Products company and became the Tecumseh engine we know today. They now produce engines in the 3hp to 25hp range, along with Peerless transmissions and transaxles for many applications. Tecumseh engines have been around a long time and it is a fine running engine. It has been call finicky by unknowledgeable people, but service techs know that when adjusted properly, it will out run most engines. The new engines of today run very well and meet the latest EPA emission regulations.

Tecumseh is an industry leader in producing engines for snowblowers. These cold weather engines are specially equipped to start and run in cold weather. You will see Tecumseh engines on virtually every brand of snow blower that is popular today. They come in 3hp to 13hp in both 2 and 4 cycle engines.

Closely resembling some of the snow engines, Tecumseh has 20 different utility engines in both horizontal and vertical crankshafts. These run from 2hp to 17.5hp and cover a wide range of application such as tillers, chippers, generators and pressure washers. These come in one cylinder, both L-head and overhead valve design.

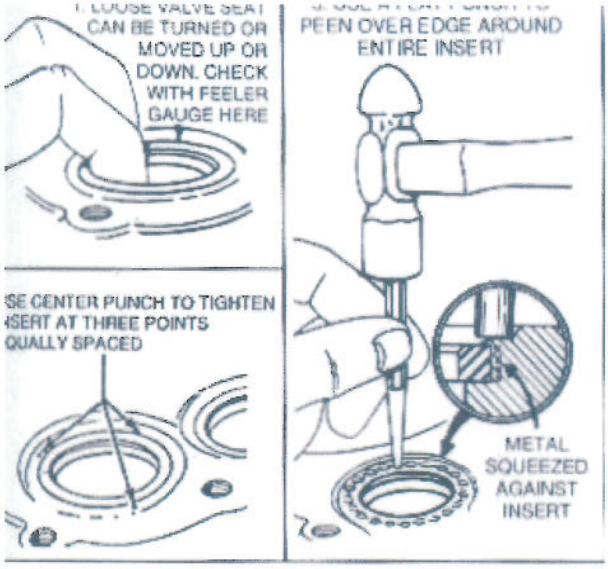
In addition to there utility engines, Tecumseh has a line of Power Sport engines designed for ATV, Mini-bike and Go-kart use. These engine have special features such as RV type throttle controls that return to idle when released. The Power Sport engines come in 3.5hp to 11hp.

Tecumseh is well know in the lawnmower circles, having been used on many of the Sears Craftsman mowers for many years. You will see them on many of the lawnmower brands out there today. The walk-behind mowers are 3.5hp to 7hp in both L-head and OHV design. You will find there OHV engines in 7hp to 25hp on many of the riding lawnmowers of today.

Tecumseh is the only engine manufacturer that builds transaxles and the proven Peerless transaxle has been used for many years on a majority of the mowers out there. These are being built in both manual shift and hydrostatic types. Many times you

not just replaced it). It may also indicate an exhaust valve set to wide or compression release not working. It could also indicate a bad starter. The point I'm trying to make is, the starter should be the last thing you replace, after you check everything else out. The chances of it being a bad compression release are less common, but check the valve clearance as it is easy to do.

By using a proven method of troubleshooting and taking some accurate measurements, you will head off any serious problems early and possible save having to buy that new starter. You may want to make these tests part of your annual preventive maintenance. There is nothing that will damage a starter faster then low voltage getting to it. As the voltage drops, the amps go up and this creates heat fast. I purposely did not cover testing with an ammeter because this is beyond the capability of most homeowners. Now that you have the engine starting good again, I will cover how to check the charging system in my next article. I would also recommend that you purchase the correct repair manual for your engine before doing extensive troubleshooting like this, either on the starting system or charging system. It will have more specific tests for the exact system you have. Hopefully, these two articles will take some of the mystery out of the 12 volt electrical systems - Bruce Perrault



Repairing Loose Valve Seats

I have received many request for information on what to do about a valve seat coming loose in Briggs & Stratton L-head engines. So, let's talk about it a little. Normally, a valve seat is good for the life of the engine, rarely giving a problem when the engine has normal maintenance done to it. The most common reason a valve seat comes loose is that the cooling fins on the engine become partially clogged and the engine overheats causing the aluminum to expand faster than the metal seat. The seat loosens up and can actually come completely out. When this happens it is possible to push the seat back in and peen the aluminum around the seat to hold it in. Doing this will normally change the seating capability of the valve, so the seat face should be cut and lapped to check the seat to valve fit.

If the seat is extremely loose, over .005 between the seat and block, it will need to be replaced. Replacing valve seats is beyond the scope of this article and should normally be done by a machine shop. Briggs & Stratton does offer special tools and instructions to do this in there repair manual. There is more information below about replacing valve seats. I have included a graphic from Briggs & Stratton that shows how to peen a valve seat. This is something that can be done without any special tools, but remember you will have to re-cut the face of the valve seat after doing this. This will take a valve seat cutter. It is also a good idea to check the valve guide for excessive wear at this time. Valve guide replacement can be done at most Briggs dealers.

Diagnosing a loose valve seat can be tricky, since when the engine cools down it will often tighten back up. If your engine runs good cold, but dies once it is hot, check the compression when hot and if it is low, you probably have a valve seat coming loose. Normally, problems with a hot engine with low compression are in the valve area. The exhaust seat usually comes loose, since most of the heat is in that area. Peening a valve seat successfully depends on how loose the seat is when you attempt the repair. Finding the problem early increases the success rate. I hope the above information helps you out and remember to keep those cooling fins clean and don't overload the engine. It's your first defense against valve problems - Bruce Perrault

The following information was submitted by a technical forum contributor. It pertains to Onan engines, but can be applied to others as well.

As an Onan dealer we see loose valve seats a couple of times a year. We have found that many times the seat has worn the block to the point that the replacement seat will not stay in the block. Rather than replace the block we have a shop install a new seat. The automotive machine shop machines the block to receive an automotive seat that is the correct diameter for the valve. The shop finds the correct seat depending upon the engine and valve requirements. The block is then heated 350 degrees F and the seat cooled (frozen in freezer or in liquid nitrogen). The seat then drops into the block without being driven in or pressed in. The seat is then cut to the right angle - Dwayne

will find a Tecumseh engine and transaxle in the same unit. Tecumseh makes a quality product and to lean more about there engines and transaxles visit the Tecumseh company website. If your need is to buy some genuine Tecumseh parts, then visit the Tecumseh section of our Web Store.

Loadbank Testing Generators

Over the years I have run loadbank tests on generators from 400 watts to large diesel standby systems. A good loadbank test is the only way to tell if the generator is up to specs and able to put out its full output. Simply plugging in a circular saw and pulling the trigger is not a load test. To properly do a load test you must monitor the voltage, amperage and frequency (hertz) while the generator is running with 75% to 100% of the rated load on it. Preferably, the test should be run from 5 to 30 minutes to test the circuit breakers or any other electrical or mechanical breakdown. The idea behind a loadbank test is to put the maximum rated load on the generator and see if it can handle it.

I will try to keep this article directed toward smaller generators like you will see in an RV or Portable units. Normally, these types of generators will be under 8000 watt, but some portables are going as high as 15kw now.

Let's start with RV generators, which normally are 120 volt units, except in some of the larger buses. 4000 watt units or smaller, usually have a single breaker and above that often have two breakers or circuits. You can plug into one of the outlets on the RV to check voltage and hertz, but most outlets are on a 20 amp breaker and even a 4000 watt unit is 33 amps. So, to do a full load test you will need to hot wire the loadbank in, usually at the junction box near the generator. If you have a larger unit with two breakers on the generator, you should run two load banks to test both circuits and the generator together at full output. Often these will be a 20 and 30 amp breaker. One common problem on rv's that will not pull a full load is a plugged muffler/spark arrester.

Portable generators present there own quirks when it comes to full load testing. Most portable generators are 120/240 volt and you can only get full output out of the 240 volt circuit. The 120 volt circuits normally run 1/2 the generator output for each circuit. The Honda pictured on the right is a common example of how the electrical panel is. Notice it has 5 receptacles. There are two ways to approach this when it comes to load testing. Get some 240 volt elements for your loadbank. Many of the smaller loadbanks use screw in cones. The other way is to use two load banks on 120 volts and put one on each circuit. The other thing you need to consider is many of the generators today are rated for maximum and continuous output. You want to run the load test at the continuous output rating. A 5000 watt unit might be rated 4500 watt or even 4000 watt continuous. You must get all this figured out before you run the load test.

A good load bank should contain a voltmeter, ammeter and hertz meter. It should also have switches to activate the load up to what the maximum amps you need for the unit you are testing. By going from full load to no load, you can check the governor sensitivity and at full load adjust the carburetor and check that the circuit breakers hold. Monitor the voltage and hertz to see the engine is developing full power. A loadbank tester may not be within the means of everyone, but when it comes to generator testing, a loadbank is your best friend, so use it carefully and use it often. - Bruce Perrault

Installing a New Shortblock

In my last article I talked about doing a complete rebuild to your engine. Your engine may be badly damaged and you have decided you don't want to tackle a complete rebuild or it is to costly. You have checked into a new engine and found it may not be available or need costly modifications for your application. Considering a shortblock as an option may prove to be the only way out to get the equipment in like new shape again and insure that you don't have to modify equipment. A shortblock may also prove to be very economical compared to other options if you can do the labor yourself. A shortblock normally contains a 90 day new parts warranty from the engine manufacturer covering defective material or workmanship, the same warranty that applies to any new part.

A new shortblock normally consists of all the internal engine parts, including the crankshaft, piston, rod, camshaft, valves and governor, but normally not the cylinder head and sometimes not the oil pan. If the shortblock is for an OHV engine, you will need to address any valve problems when transferring the head. All gaskets and seals needed to do the job are included. The beauty of a shortblock is you don't have to worry about internal parts and only need to install the external parts such as cylinder head, carburetor, linkages, magneto, flywheel, starter and shrouding. If you are considering a shortblock, here's a list of things to evaluate first, before doing your installation:

- **Is the carburetor in usable condition, throttle shafts not loose?**
- **If this is an OHV engine, how much head work needs to be done?**
- **Are the starting and charging systems working ok?**
- **Make a list of normal maintenance parts that should also be replaced.**
- **Make a list of any worn linkages, cracked shrouding that may need attention.**
- **What is the internal condition of the fuel tank, is it rusted?**

When considering a shortblock keep in mind that just replacing the shortblock may not put the engine in first class shape. You will also need to do such things as rebuild the carburetor and replace all filters and fuel line hose. New Briggs & Stratton shortblocks are designed for magnetron ignition and do not have a plunger hole for the points, so you may have to convert the ignition system to a magnetron if your engine was built prior to 1983.

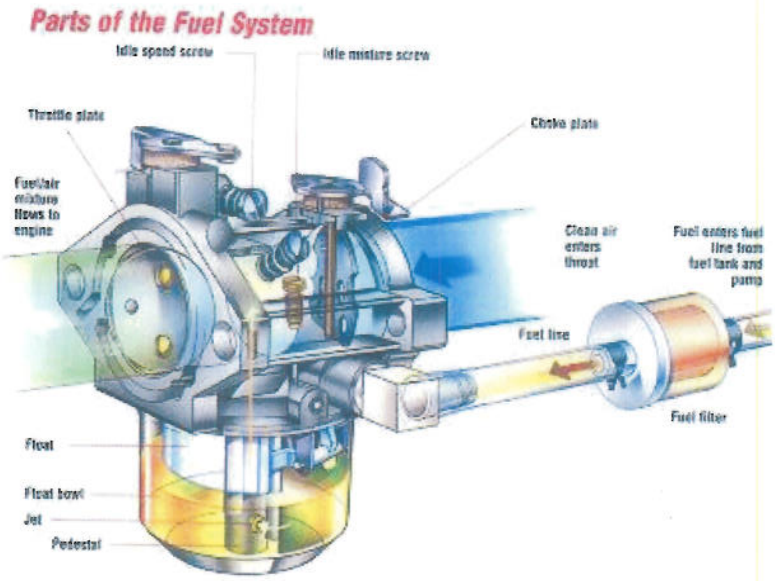
As with other repair procedures I always recommend purchasing a repair manual for your engine to help you make the proper torques and adjustment procedures for the governor and carburetor etc. You may also want to consider a flywheel puller to make that part of the job easier. If you own a digital camera, take pictures of the governor springs, linkages and other items you may want to look at when it comes time to install these items. Since you will not have to worry about the engine internal parts, you should clean and set the components aside in groups to be assembled in a logical order. Clean up the cylinder area and apply a teaspoon of oil around the upper cylinder before putting the head on. Here's a sequence I normally follow on an L-head engine:

- **Clean up and install the cylinder head, using proper torque and sequence.**
- **Install the valve cover/breather assembly, verify correct valve clearance.**

- **Install the carburetor and linkages, adjust governor free play.**
- **Install and torque the flywheel, magneto, charging and starter parts.**
- **Install all external shrouding and filters, fill with oil.**
- **Recheck all linkages, governor setting, throttle control and stop switch.**

One final note: The most important procedure you will do when installing a shortblock is adjusting the governor and linkages. Make sure this is done along with filling the crankcase with the proper engine oil, before attempting a startup. You now have an engine that is in everyway as good as a new one and should give you just as many hours of service if you were careful in both your evaluation and repair. Now pull the rope or turn the key and enjoy your new/old engine with the satisfaction that you made this fine piece of machinery - Bruce Perrault

Carburetor Rebuild



Carburetor and fuel problems can fall into several categories and it is important to determine what is happening before proceeding with a rebuild on the carburetor. If the carburetor is leaking fuel especially while setting or just not getting fuel, you may have a contaminated fuel problem. You should look first at the fuel in your tank for any signs of dirt, water, rust or varnish build up. Before you consider rebuilding or replacing the carburetor you must have good clean fuel flow to it. When possible install the proper fuel filter for your application. Non-fuel pump engines use a different filter then fuel pump engines in most cases. It does no good to clean a carburetor and put contaminated or old fuel back into it. In some cases a rusty or badly varnished fuel tank will need to be replaced.

If you followed my advice above, you now have fresh clean fuel available to the carburetor. Now you will need to determine whether to rebuild your existing carburetor or replace it. Many of the carburetors today can cost $100 or more and the rebuild kit price sounds attractive. One piece of advice here. A new carburetor will almost always be better then a rebuilt one! I have rebuilt carburetors that did not perform well after the rebuild, so a rebuild is not a 100% fix. It is a very economical fix in many cases when compared to a new carburetor and your free labor, plus it's kind of fun to do. Here's a list of things to think about when evaluating whether to rebuild your carburetor:

- **Does the engine run well under load, does it idle ok, does the governor hunt?**
- **Is the carburetor in usable condition, throttle shafts, linkages loose?**
- **After removing the bowl, do you have water corrosion, varnish or dirt?**
- **Is there any signs of warpage on the mounting surfaces?**
- **Is the float and bowl ok, are they pitted and possibly leaking?**
- **Is the carburetor leaking fuel while just setting, possibly into the crankcase?**

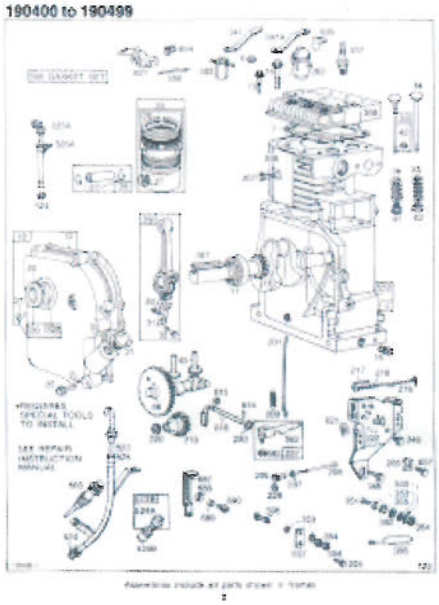
After evaluating the questions above, you will be able to make a more informed decision on whether to rebuild or replace your carburetor. Clean up is important, especially if you have a varnish problem. If you have a water corrosion problem, which looks like a white powder rust, you may want to just replace the carburetor. Carburetor cleaner will not clean water corrosion. Carburetor cleaners comes in two types. The cold emersion cleaner (dip-tank) and carb/choke spray. The dip tank is best and you can buy a one gallon can for about $15 at auto supply places. This is caustic stuff and don't put any non-metal items in it. Carb/Choke spray like Gum-Out works fine and probably best for the average homeowner. It has the added advantage of having pressure to blast the little passages. A piece of soft shipping tag wire is your next best weapon to run through the little holes.

Now comes the actual rebuilding part. I would not recommend that you take the carburetor totally apart until you have the repair kit. You do need to determine if you need a new float, bowl or other parts not included in the repair kit. Most repair kits include a needle valve and all gaskets. I normally do not remove the throttle or choke shaft unless I am replacing them. If you do, be sure to lock tight or replace the screws. These can make a nice mark on your piston when they come out later. Clean all the passages good and run the tag wire through all the little holes. If in doubt on the float setting, just set it parallel with the base. Set the initial jet screws at 1-1/2 turns out and fine tune after you have it running. Many of the newer engines will not have adjustable jets or maybe only an idle jet adjustment. You are now ready to re-install everything, making sure your governor linkage works freely. Pull the rope or turn the key and listen to it - Bruce Perrault

Briggs & Stratton Parts

"Illustrated parts list and more"

Briggs & Stratton has made available on their website the latest illustrated parts list as PDF files. You may also download owners manuals and find information to help you identify your engine model number, all from this same page. These parts list are exactly the same as we use on microfiche when ordering parts. You may also be interested in the MS-5637 CD that is available on our On-line Store. This CD has all the current illustrated parts list and also replacement engine/shortblock data.



Once you are on the Briggs website, enter your engine model and type number in the form at the top right. Click the search button to find your parts manual, then choose "View PDF". Once the IPL is in Acrobat Reader, you may find it better to save the PDF file to your hard drive for quicker viewing later. Do this from within the reader by clicking on the diskette in the menu bar. You can also print out your IPL or owners manual.

Briggs uses a system of reference numbers to identify each part and then breaks that part down by engine type number. If your type number is not listed under a reference number, use the first part number, which is usually the most common part.

Note: If you need help locating your engine numbers, click on "link" in the search area, after you click the Goto Parts Lookup button below.

We offer a 5% to 15% discount off retail price on Briggs & Stratton engine parts. Simply click the Contact Us button and complete the form. Include the part number and or description of the items you are interested in and any questions or details you may have. We'll email you a price quote and instructions on how to order on-line. Many popular genuine Briggs & Stratton parts are already listed on our WebStore.

Testing 12 Volt Starter Systems

You go out Saturday morning to mower the grass and your mower engine barely turns over and won't start, now what. The first thought is new starter, but that may not help and it's the most expensive part. Let's look at it from a technician's put of view and how to troubleshoot it first. The first thing you need to do is purchase a digital multimeter to troubleshoot with. These can be had for about $59 at places like Sears or auto parts stores. They should look something like the picture and have a DC volt scale on them. They have many uses around the home.

Set the meter to DC volts. Connect the voltmeter red lead to the post on the starter and the black lead to ground. Crank the engine and if it is below 9.5 volts, you have a problem (but you already knew that). Before going any further, inspect the battery for corrosion, especially on the terminals. If you have any corrosion or wet acid, you need to take care of this first and don't connect your new multimeter to the battery until you have clean terminals or they will be ruined by the acid. You can use warm water and baking soda to neutralize the acid or they make battery cleaner in spray cans, along with battery terminal protector spray. I would also purchase a small wire brush to shine up the connections. You can use grease instead of protector spray if you wish. I wouldn't apply this until your done testing and everything is ok again.

After you have cleaned up the battery and terminals good and before you connect the leads again, connect your voltmeter to the battery terminals. A fully charged battery will read 12.5 volts. Below 12.2 and you should charge it and below 11 volts may indicate a bad cell in the battery or almost completely discharged. In any case, you may need to charge the battery or have it tested and replaced before putting it back in and hooking up the leads. In any case you should now have a fully charged or new battery.

Now your ready to crank the engine and make some more test to verify the condition of your solenoid, leads and connections between the battery and the starter. You need to check both the hot and ground side as a problem can be in either. You're going to perform what is known as a voltage drop test. You do not want the voltage to drop more then 1/2 volt between the battery and the starter. If it does, you have some bad components or connections and it's just a matter of working toward the starter until you find the culprit. To do the test, simple connect the red lead to the positive battery terminal and the black lead to the starter terminal. You should read 12.5 volts. Ground the spark plugs or mag, so the engine won't start and crank the engine for about 5-10 seconds and observe the voltmeter. It should drop to somewhere between .2 and .5 volts while cranking. Note - you are also testing the solenoid contacts when you do this test. Connect the black lead to the negative battery post and red lead to ground on the starter and repeat the test. If you can, keep the total voltage drop near or below .5 volts for both circuits. You can also check voltage drop across suspect individual connections, cables and solenoid contacts by connecting the leads, one on each side of the suspect area.

Now, one final test and we're done. Move the red lead to the starter post, the black lead should be connected to ground and leave the engine disabled, so it won't start. Crank the engine about 10 seconds and observe the voltmeter. You should read 9.5 volts or higher and the starter should be turning over normally. If the voltage is lower, it may indicate a bad battery (assuming you have