OPERATOR'S, ORGANIZATIONAL, AND DIRECT SUPPORT MAINTENANCE MANUAL

FOR

FORCED ENTRY AND RESCUE EQUIPMENT

MODEL 30 SPREADER

MODEL B101 GASOLINE POWER UNIT

NSN:4240-00-574-4098

HEADQUARTERS, DEPARTMENT OF THE ARMY

1 OCTOBER 1986

Purchased under Contract No.
DAAK01-85-C-B030
Model B101 Gasoline Power Unit
Model 30 Spreader

INDEX

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(continued)

Note: GASOLINE ENGINE SERVICE & REPAIR INSTRUCTION AND ILLUSTRATED PARTS LIST HAVE BEEN INCLUDED WITH THIS MANUAL.

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INTRODUCTION

Model 30 Spreader

The AMKUS Model 30 Spreader has proven to be the most advanced rescue tool on the market today. The Model 30 Spreader is capable of performing any spreading or prying apart of any object of objects. The Model 30 is also capable of pulling together or apart any objects. The Model 30 is primarily used in rescue operations to free trapped victims from wreckage.

Model B101 Gasoline Power Unit

The standard AMKUS power unit uses a 3.5 horse power 4-cycle Briggs & Stratton gasoline engine to power a two stage axial piston hydraulic pump. The hydraulic pump operates at 10, 000 p.s.i. and delivers a constant flow of safe non-caustic mineral base hydraulic fluid to the rescue tools allowing smooth efficient operation.

The power unit is equipped with a two gallon steel reservoir and comes standard with 20 ft. of steel braided hydraulic hose. The entire power unit is surrounded by a tubular stainless steel roll cage which provides protection to the unit during storage, transportation and during use. The roll cage also provides handles for easy carrying and convenient storage of hydraulic hoses.

ITEMS FURNISHED UNDER
DAAKO1-85-B030

1) Model 30 hydraulic spreading tool complete
1) Accessory chain package attachment for Model 30 Spreader
1) Model B101 4-cycle gasoline driven hydraulic pump complete with 20' of hydraulic hose and couplings complete.

ITEMS REQUIRED TO OPERATE
MODEL B101 Gasoline Power Unit and Model 30 Spreader

*One quart high quality detergent engine oil (see enclosed Briggs & Stratton operating and maintenance instructions.)

*One pint of regular unleaded gasoline (see enclosed Briggs & Stratton operating and maintenance instructions.)

*Two gallons of approved hydraulic oil (AMKUS anti-wear hydraulic oil, Part No. AMK-OIL-65211)

Amkus, Inc. 5203 Thatcher Rd. Downers Grove, IL 60515 312/963-6575 TWX 910-695-3226

TABLE OF SPECIFICATIONS

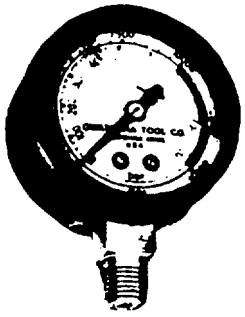
MODEL 30 SPREADER

Weight: 44 pounds
Spreading Force: Maximum 20, 000 pounds
Closing Force: Maximrum 15, 000 pounds
Maximrm Spreading Distance: 32 inches
Length: 28 11/16 inches
Width: 11 1/2 inches
Depth: 8 inches

MODEL B101 GASOLINE POWER UNIT

Weight: 85 pounds
Length: 20 1/2 inches
Width: 17 1/2 inches
Height: 22 inches
Oil Capacity: 2 gallons
Engine: 3.5 h.p. Briggs & Stratton
Pump': , axial piston type

SPECIAL TEST EQUIPMENT REQUIRED



No. 9658 (GP107F)-Liquid filled pressure gauge with two scales: 0-10, 000 p.s.i. and 0-689 bar. 2½" dia. face. This gauge is filled with glycerin or silicon to dampen vibration and fluid pulsation.

TESTING AND ADJUSTMENTS

PRESSURE REGULATING CONTROL ADJUSTMENTS

Pressure Regulating Controls

The pressure regulating valve shown in Figure 4 can be adjusted to by-pass oil at a desired pressure setting and the pump will continue to run. The optional pressure switch, see Figure 4, can be adjusted to stop the pump motor at a desired pressure setting, and then restart the pump when the pressure falls below that setting.

Note: The pressure switch is generally adjusted with the pressure regulating valve to insure accuracy when setting a maximum PSI level. A pressure switch alone will break the motor's energy supply at a selected setting but the hydraulic pump will continue building pressure as it slows to a stop. The pressure regulating valve is adjusted at a setting slightly above the pressure switch setting to compensate by releasing the pressure developed by the hydraulic pump as it coasts to a stop. As a result, the pressure limit requirement can be held to approximately 300 p.s.i.

Adjusting the Pressure Regulating Valve

IMPORTANRT:

* Adjust the pressure regulating valve by increasing it to a desired pressure setting. Do not adjust it by decreasing from a higher to a lower pressure.

* Place pipe plugs as shown in Figure 4, in valve ports when adjusting pressure regulating controls.

Note: Range or pressure settings is from 1, 000 minimum to 10, 000

p.s.i. maximum-depending on the p.s.i. range preset for each pump model.

1 Loosen the lock-nut on the pressure regulating valve and turn the adjusting screw a few turns counter clockwise to decrease the pressure setting to a lower than desired pressure.

2. Connect the pump power supply and place the hydraulic flow control valve in the advance position. Set the motor control toggle switch on "Run".

3. Slowly turn the adjusting screw in the clockwise direction. This will gradually increase the pressure setting. When the desired pressure setting is reached, lock the adjusting screw in position by tightening the locknut.

The Model B101 has been pre-set to operate at 10, (300 p.s.i. To check and make the necessary adjustment, follow the above instructions. This should be done periodically once a year.

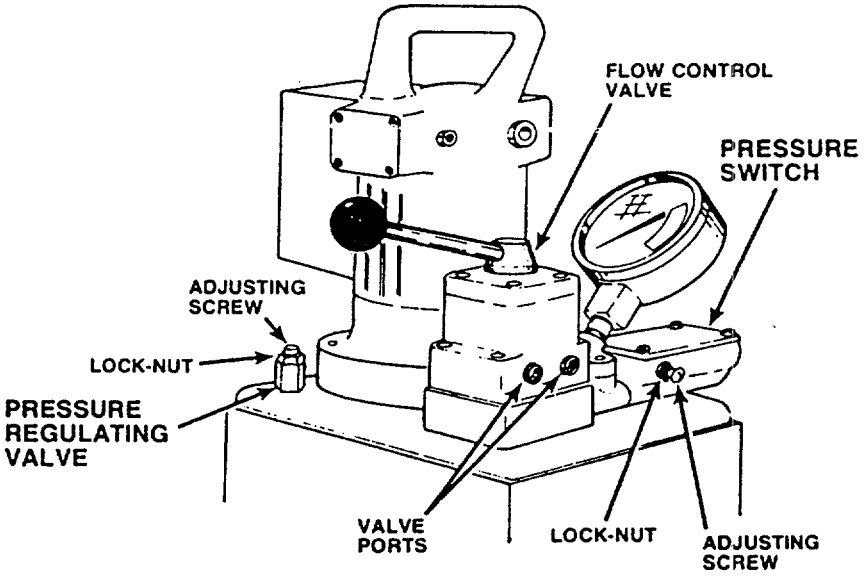


Figure 4

The Model B101 has been pre-set to operate at 10, 000 p.s.i. To check and make the necessary adjustment, follow the above instructions. This should be done periodically once a year.

STORAGE

Equipment should be stored preferably indoors until needed. The equipment should never be stored where the temperature is below 40°F. The equipment may be taken out and used where the temperature is below 40°F, however it is not advisable to store equipment where the temperature is below 40°F.

PREPARATION FOR RESHIPMENT

Equipment is packaged in accordance with Level A packaging. The equipment may be shipped in its original carton. The item should be placed in moisture proof plastic and sealed then placed back with original cartons with ample padding for protection.

AMKUS, Inc. 5203 Thatcher Road Downers Grove, IL 60515
(312) 963-6575 TWX 910-695-3226

LIFETIME WARRANTY

WHO IS PROTECTED

The high quality and reliability of AMKUS Rescue Tools and parts enable us to offer you the AMKUS Lifetime Warranty.

The AMKUS Lifetime Warranty provides, with a few exceptions, that all AMKUS Rescue Tools and parts are warranted against defects in materials and workmanship for as long as you own the product. If we determine that one of the AMKUS Rescue Tools Is defective, we will, at our option, repair or replace it.

EXCLUSIONS

This Lifetime Warranty protects the original owner and covers all defects in material and workmanship with exceptions, specified as follows: (1) damage caused by accident, any unreasonable use or neglect (including the lack of reasonable and necessary maintenance), deterioration, wear and tear, or mishandling; (2) damage occurring during shipment (claims should be presented to the carrier); (3) damage to or deterioration of any accessory other than AMKUS accessories: (4) damage from failure to follow instructions contained in your owner's manual; (5) damage resulting from repairs or alterations by someone other than AMKUS, Incorporated or an authorized AMKUS Warranty Station; (7) defects in electric or gasoline motors which are sold with the AMKUS products.
These motors are separately warranted by their manufacturer under the conditions stated in the separate warranty.

TO OBTAIN WARRANTY PERFORMANCE

If your AMKUS product ever needs service, write or call us at AMKUS, Incorporated, 5203 Thatcher Road, Downers Grove. Illinois 60515 (312) 963-6575. We may direct you to an Authorized AMKUS Distributor or ask you to send your unit to the factory for repair. Please do not ship your product without prior authorization.

This warranty is exclusive and AMKUS makes no other warranty of any kind whatsoever, expressed or implied, with respect to the products manufactured and sold by it, whether as to merchantability, fitness for a particular purpose or any other matter. No distributor, agent, employee, or representative of AMKUS has any authority whatsoever, to bind AMKUS to any affirmation, representation or warranty concerning AMKUS products or parts, except as stated herein.

WHO PAYS FOR WHAT

AMKUS will pay all labor and material expense for all repairs covered by this warranty. If necessary repairs are not covered by this warranty, or If a unit is examined which is not in need of repair, you will be charged with the repairs or the examination.

Although you must pay any shipping charges incurred in getting your AMKUS product to an AMKUS Warranty Station or to the factory, we will pay return shipping charges if the repairs are covered by the warranty.

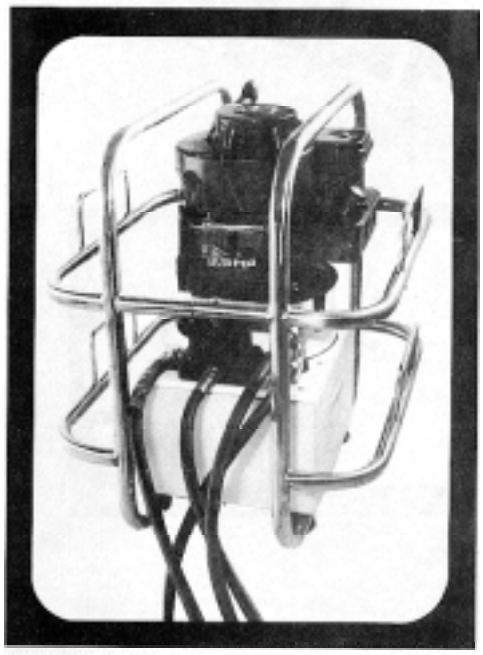
EXCLUSION OF CERTAIN DAMAGES

AMKUS liability is limited to the repair or replacement, at our option, of any defective product and shall in no event include incidental or consequential commercial damages of any kind. Some states do not allow limitations on how long an implied warranty lasts and/or do not allow the exclusion of incidental or consequential damages, so the above limitations and exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

The purpose of this exclusive remedy shall be to provide the buyer with repair or replacement of products or parts manufactured by AMKUS which have been found to be defective in materials or workmanship or negligently manufactured. This exclusive remedy shall not be deemed to have failed of its essential purpose so long as AMKUS is willing and able to repair or replace said defective products or parts In the pre- scribed manner.

AMKUS® RESCUE SYSTEM

Purchased under Contract No.
DAAK01-85-C-B030
Model B101 Gasoline Power Unit



POWER UNIT

The standard Amkus power unit uses a 3.5 horse power 4-cycle Briggs & Stratton gasoline engine to power a two stage axial piston hydraulic pump. The hydraulic pump operates at 10, 000 p.s.i. and delivers a constant flow of safe non-caustic mineral base hydraulic fluid to the rescue tools allowing smooth efficient operation.

The power unit is equipped with a two gallon steel reservoir and comes standard with two 20 ft. sections of double steel braided hydraulic hose.

The entire power unit is surrounded by a tubular stainless steel roll cage which provides protection to the unit during storage, transportation and during use.

The roll cage also provides handles for easy carrying and convenient storage of hydraulic hoses.

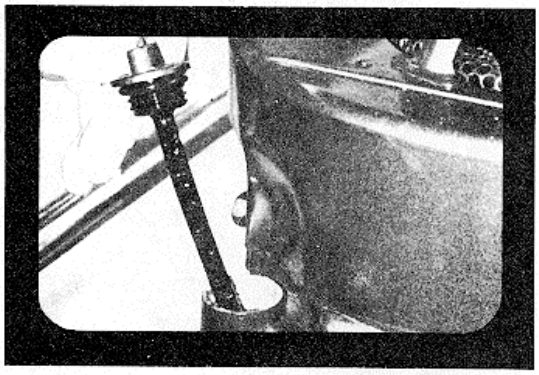
Amkus power units are available with 110v or 220v electric motors and may be equipped with optional hose reels.

For smaller requirements Amkus offers a 12v D.C. power unit which may be powered off the battery of the rescue vehicle.

Air powered foot operated hydraulic pumps are also available and make excellent back-up power sources.

NOTE: Your nearest Briggs & Stratton service center is listed in the yellow pages under "Engines" "Gasoline" or "Gasoline Engines". He is one of over 25, 000authorized dealers available to serve you.

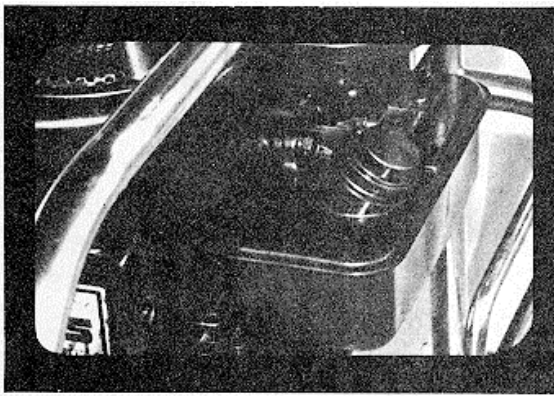
GENERAL MAINTENANCE

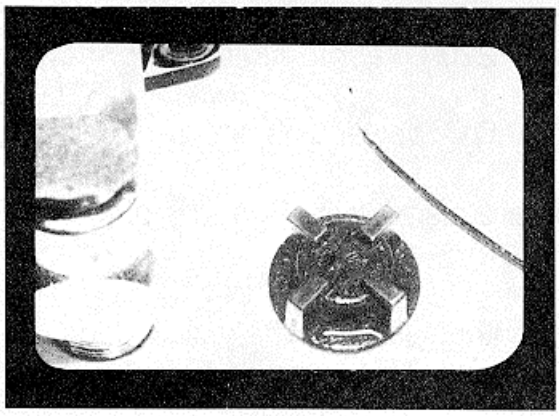


ENGINE OIL:
Remove cap and dipstick. Fill to full mark. Pour slowly to avoid over filling. Use a high quality detergent oil. Detergent oils keep the engine cleaner and retard the formation of gum and varnish deposits.

FUEL:
Remove the cap. Fill fuel tank with clean, fresh, "regular" leaded gasoline only. Avoid filling the fuel tank while the engine is hot or in operation.

NOTE: Do not mix oil with gasoline.



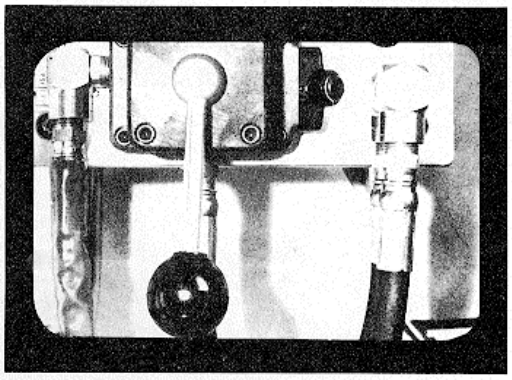


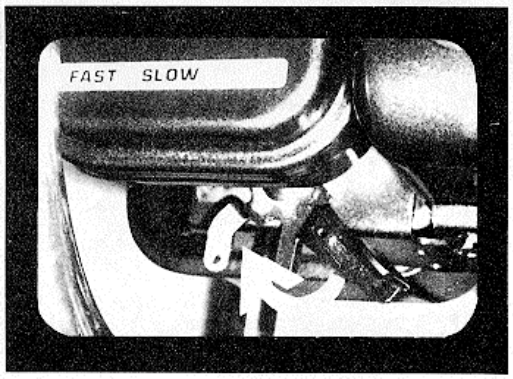
HYDRAULIC OIL:
Check oil after every three or four uses. Remove oil plug located on the top of reservoir. Fill reservoir one inch from the top. Use only Amkus mineral base hydraulic fluid.

NOTE: The small vent hole in the plug allows the unit to purge itself of air and or excess fluid. "Keep air vent open at all times."

STARTING PROCEDURE

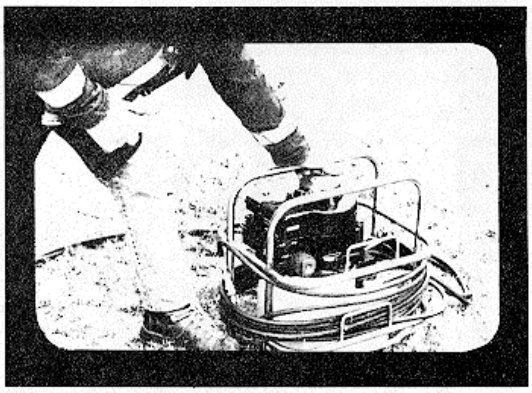
The operational 3-position valve should be in the center or neutral position before starting.



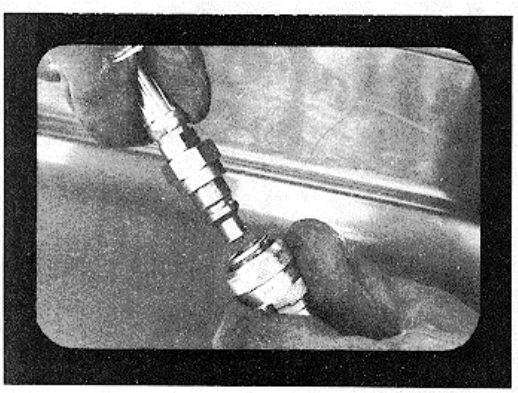


Move throttle lever to the fast position to start. Your Briggs & Stratton engine is equipped with an automatic choke. The position marked fast is the start and run position. To idle the engine move lever to the slow position. To kill engine move lever to the stop position.

Place foot at the base of the power unit and place one hand on the top of the roll cage. Grasp starter grip and pull with short rapid strokes until engine is started.



OPERATIONS



HOSE CONNECTION:

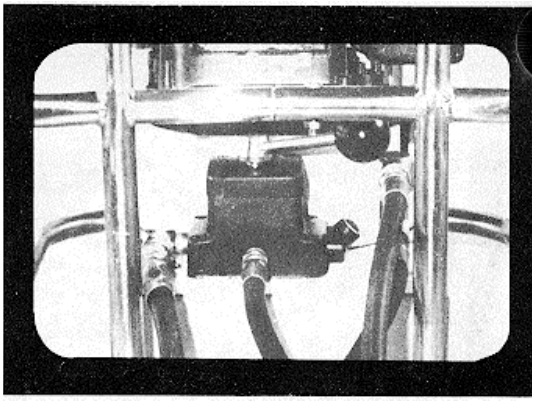
It is recommended to connect hoses before starting power unit. To connect, rotate sleeve on the female coupling until locking pin falls into notch. Pull back on sleeve, insert male coupling into female coupling and release sleeve. Rotate sleeve again to assure locking.

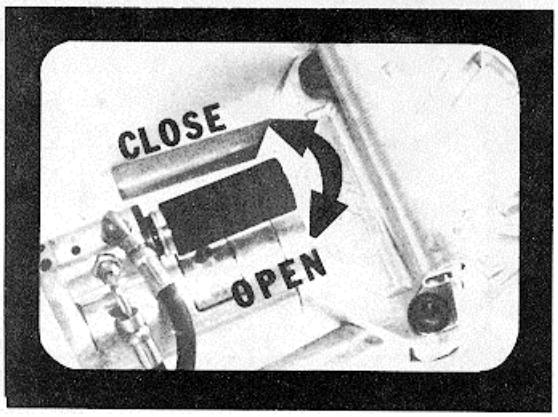
NOTE: Any tool may be connected to either set of hoses.

OPERATIONAL 3-POSITION VALVE:

Switching the valve to the right will direct the hydraulic fluid to the right set of hoses. Switching the valve to the left will direct the flow of hydraulic fluid to the left set of hoses. If valve is positioned in the center the hydraulic fluid will dump back into tank.

NOTE: The center position is a neutral position and neither of the tools connected to the hoses will operate. After rescue tools have been connected to the hoses you must direct valve to the left or right before operating tools.





CONTROL VALVE:

All Amkus rescue tools are equipped with identical twist grip control valves. To operate, twist handle to the right to open (Out). Twist handle to the left to close (In). All control valves are equipped with dead man type feature, by releasing the handle it will automatically spring back to the center position and tool will stop.

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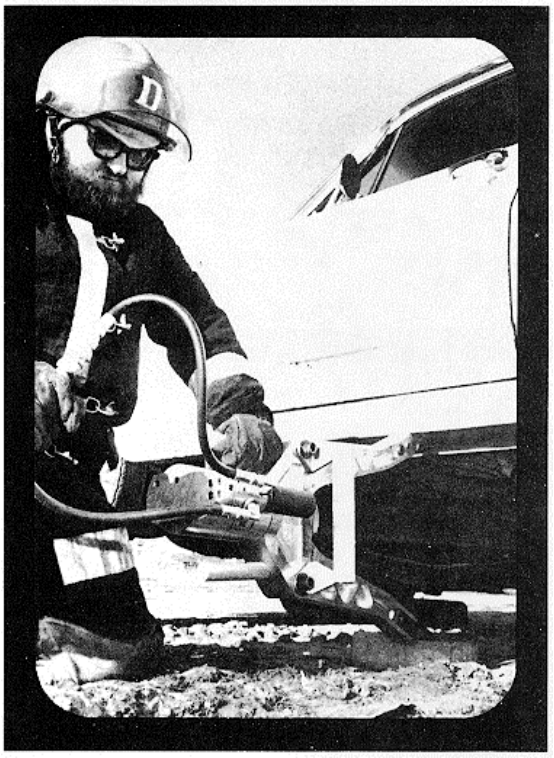
DAAK01-85-C-B0[30]
Model B101 Gasoline Power Unit
Model 30 Spreader

SPREADER



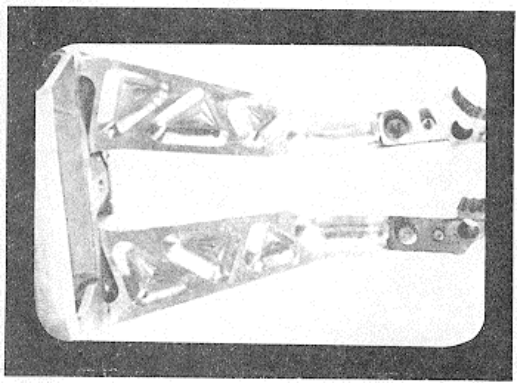
The Model 30 Spreader weighs 44 lbs. with hose, oil and tips; ready to use. It will produce up to 20, 000 lbs. of spreading force. The control handle is located over the cylinder for ease of left or right hand operation.

The spreader is evenly balanced at its crossbar. The control handle on this tool and on all other tools, (the control is the same) has a built-in check valve. The spreader will hold its position under load even if the hoses are disconnected. When you disconnect this tool or any of the other tools, no pressure will build up behind the coupling so you may reconnect while the tool is under load.

CHAIN PACKAGE

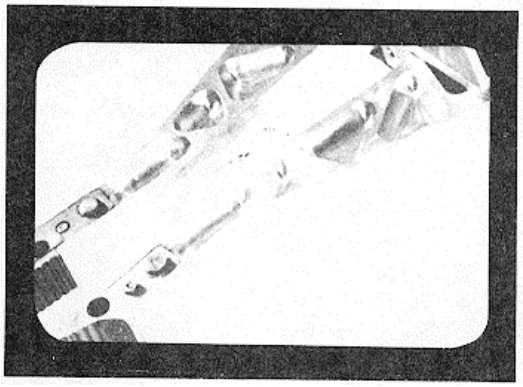
When hooking up the chain package there is no need to remove the tips of the spreader. The U-bolt is designed in such a manner that when you pull the pin up to clear sliding over the spreader arm, the pin cannot come completely out of the U-bolt assembly. This eliminates any loose parts and saves a considerable amount of time when hooking up the chain package. Once the U-bolt is in place over the arm, drop the pin into the hole in the arm of the spreader and turn to hand tight.

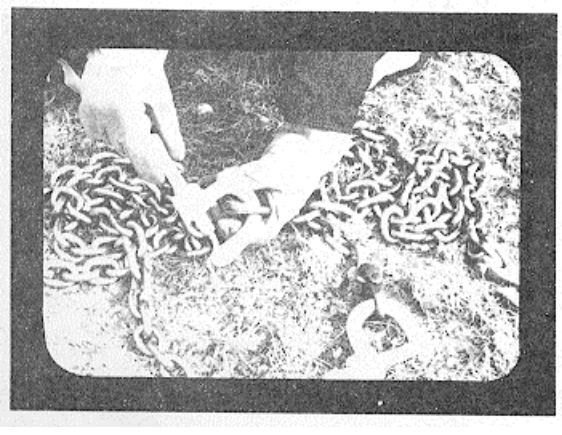
SPREADER MAINTENANCE



The Amkus spreader should be kept clean and free of dirt and foreign materials. All bolts should be checked and tightened periodically. Threaded fittings should be kept snug.

Every six months, remove the rack guard and spreader arms. Clean and service with the lubricant suggested by your Amkus dealer. Then reassemble to specifications.



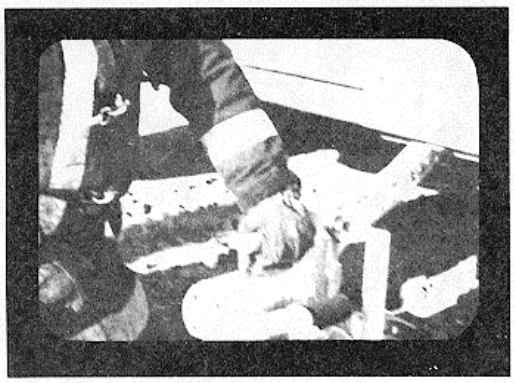


CHAIN MAINTENANCE

Chains should be kept clean, then wiped with a rag with a small amount of light machine oil. Any excess should be wiped off.

RESCUE PROCEDURES

While this book provides photos of currently recognized rescue procedures, It does not eliminate the need for practice and field training. We at Amkus encourage you and your department to seek out and participate in proper technical training. Learn in a safe manner, always using the best and safest equipment available.

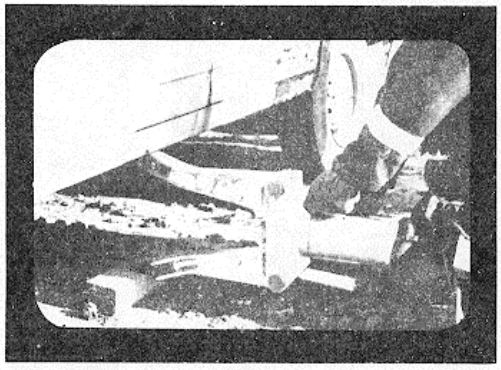


STABILIZING VEHICLE

The Amkus spreader may be used as initial stabilization during a rescue, if there is a critical need for immediate access. Adequate cribbing must follow this procedure.

LIFTING VEHICLE

Place the spreader on the block and open the spreader slowly. Cribbing must be built up during this procedure to keep the vehicle from falling if slippage occurs.

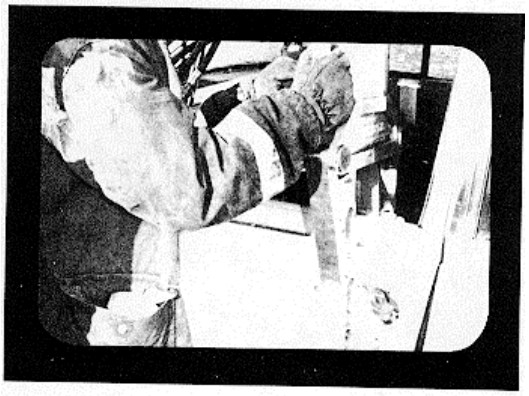


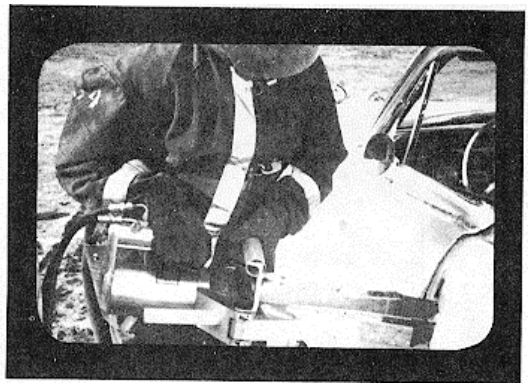
CRUSHING DOOR DOWNWARD:

Place spreader in the center of window. Open until one arm is positioned on the top of the door and the other is positioned on the car top. Open spreader until door crushes downward exposing lock mechanism.

SQUEEZING THE DOOR:

Open spreader to the half open position. Insert one arm on the inside of the car door and the other arm on the outside of the car door. Close spreader crushing door inward until locking mechanism is exposed.



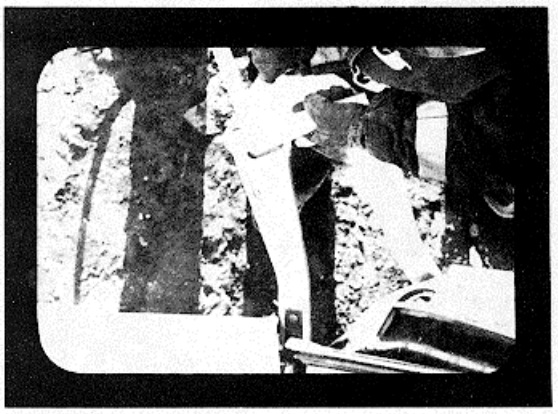


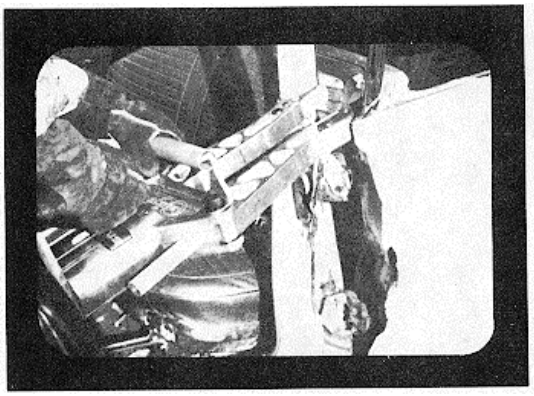
OPENING THE CAR DOOR:

After exposing the locking mechanism, place the tips of the spreader above or below the lock. Open spreader until pin is pulled free from the lock.

OPENING DOOR:

Open spreader gradually inching the tool deeper toward the lock mechanism. If spreader is opened past the recommended distance (1 or 2 in.) the metal will usually tear making the opening of the door extremely difficult.





OPENING THE DOOR HINGE SIDE FIRST:

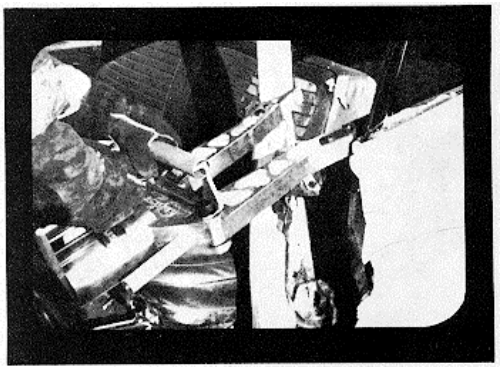
Spread metal until hinge is exposed. Place tips directly above or below hinge. Open spreader until hinge breaks and door is pulled free.

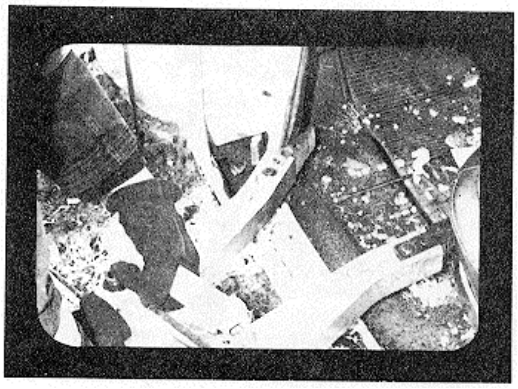
WARNING:

NOTE: Do not place spreader tips directly into the hinge. Tool may slip out under force.

PLACEMENT OF SPREADER:

It is recommended to remove the top hinge first before removing the bottom hinge. This will force the door downward into the ground during the removal.



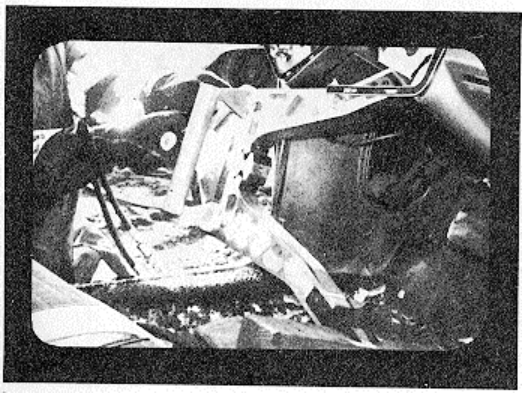


SLIDING BACK THE SEAT:

Place one tip of the spreader on the front kick panel and the other tip on the frame of the seat. Open spreader until seat slides freely back on the track.

SLIDING THE SEAT BACK FURTHER:

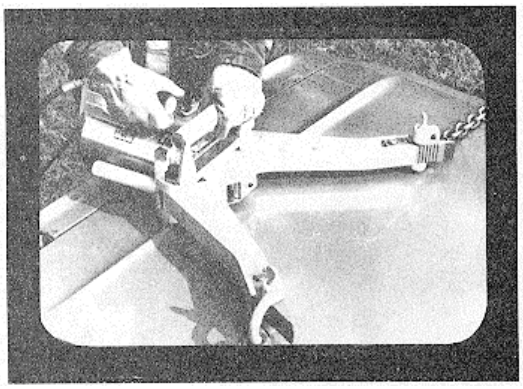
Slide seat as far as it is needed for medical personnel to gain adequate room to remove and treat patient.



LIFTING THE STEERING COLUMN:

Place cribbing on floor directly below column. Place one tip of the spreader on the cribbing and the other under the column. Open slowly making sure you have secured a good hold. Keep spreader pointed outward, this will allow more area to work around patient.

PULLING COLUMN



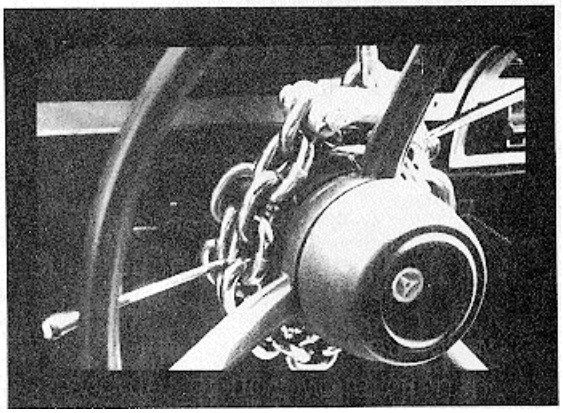
1. ATTACHING CHAIN PACKAGE

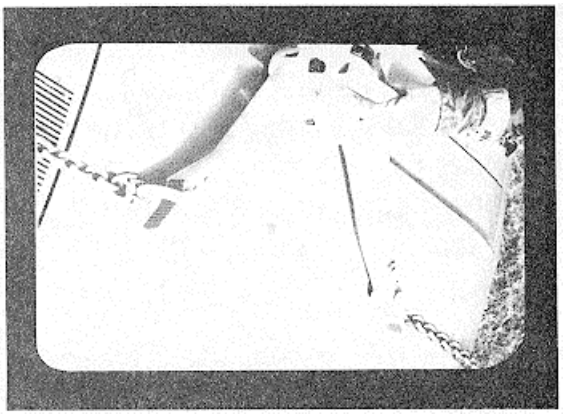
Place spreader in the open position on hood. Attach chain device to spreader arms. Be sure device pins are firmly seated (hand tight).

2. HOOK-UP PROCEDURE

Wrap chains around column as close to steering wheel as possible.

CAUTION: Should car have tilt wheel, chains must be placed below tilt level, so column does not break at the knuckle assembly.





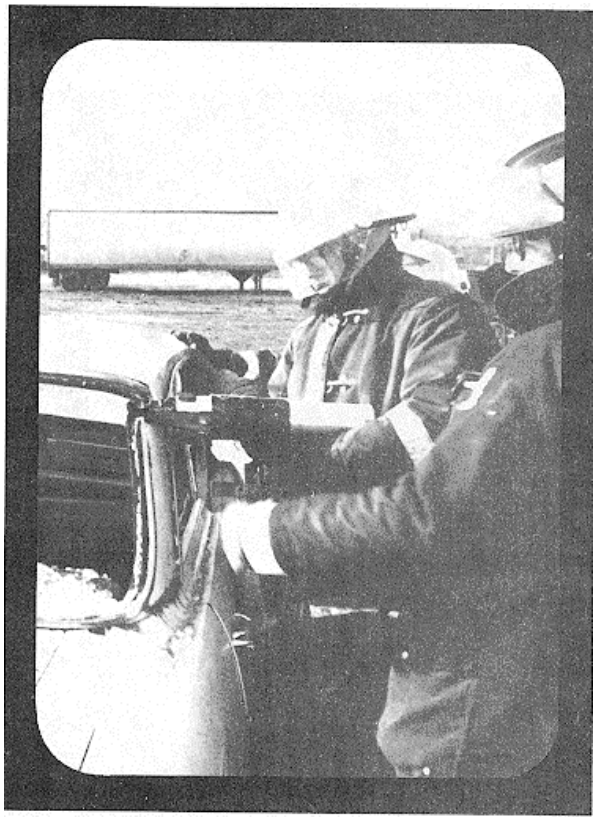
3. PULLING PROCEDURE

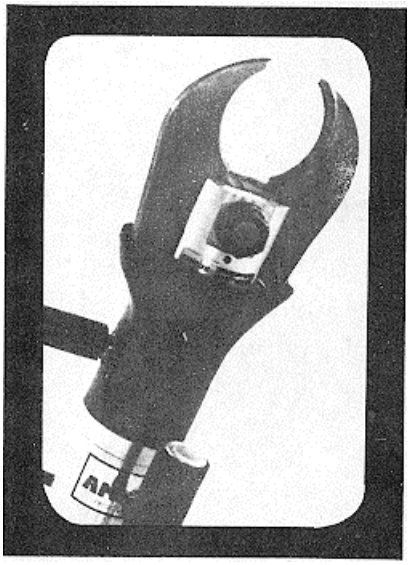
The other chain must be hooked under the vehicle around a substantial structure of the car (i.e., cross-member, A-frame or axle.)

CUTTER

The Model 25 Cutter weighs only thirty pounds and produces in excess of 60, 000 lbs. of cutting force. The cutter basically operates in the same manner as the spreader with the same control handle. The cutter is capable of cutting door posts, door struts, seatbacks, steering columns, and brake pedals. We do not recommend cutting steering columns under most conditions, but the capability is there if the victim needs to be removed from the vehicle immediately, as in the case of fire. It takes approximately five minutes to pull a steering column, but five seconds to cut it out.

With the Model 25 Cutter, you are not held to a 90 degree angle when you are cutting a loose end. You will notice that there will be no snapping or flying parts when you make the cuts.



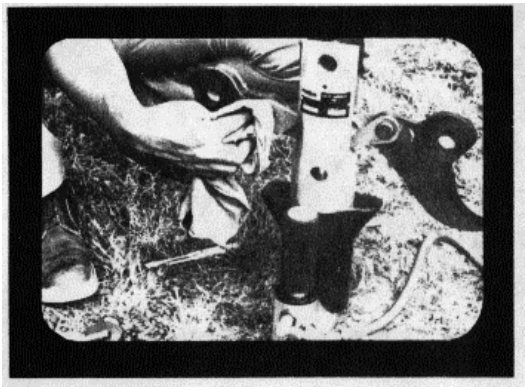


MAINTENANCE

The cutter must be kept clean, free from dirt & any foreign materials. Periodically check and tighten all bolts. Cutter center bolt must be kept tight to prevent damage to blades. To check, hold cutter up into the light, close cutter, if light or a space appears between blades, tighten top nut gradually until the gap is closed.

CUTTER MAINTENANCE:

Every six months remove center bolt & blades. Clean and lubricate with the lubricant suggested by your local Amikus distributor. This is a necessity to maintain the cutter in top condition and is required for keeping your warranty in force.

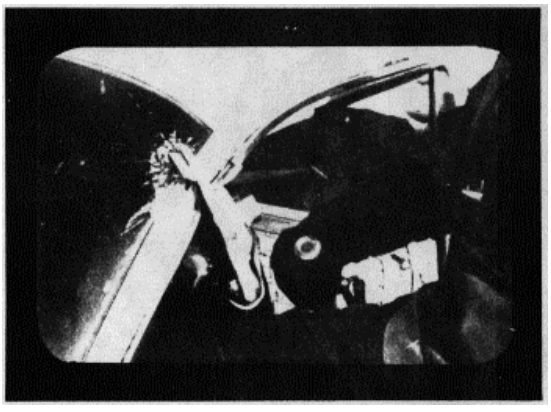


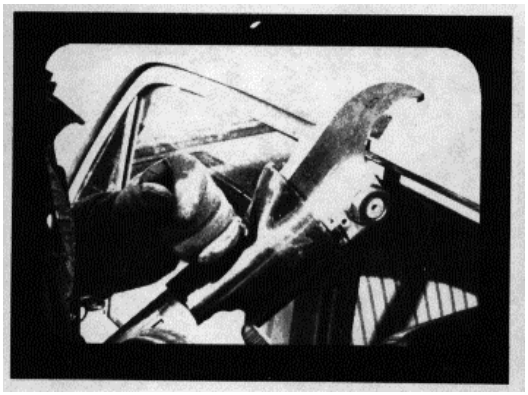
CUTTING PROCEDURE

WARNING: While this book provides photos of currently recognized vehicle extrication procedures, it is not intended to be a training manual. We encourage the operators of this equipment to seek qualified technical training.

CUTTING THE ROOF POSTS:

When operating the cutter, allow cutter to seek its own path for cutting. Roof posts may be cut with the windshield in place or with it removed.



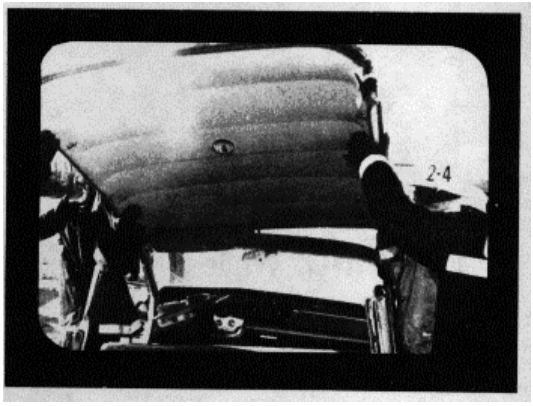


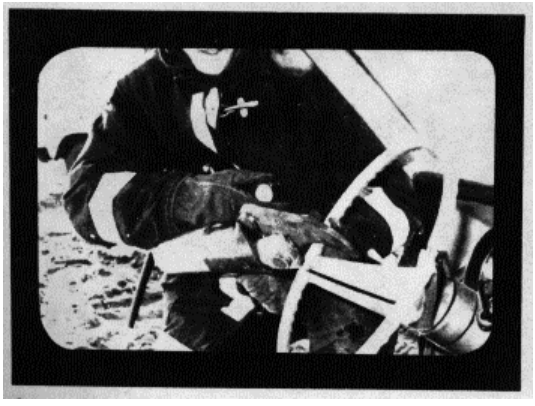
FOLDING THE ROOF OPEN:

Cut the A and B posts at the base of the windshield. Then make one cut on each side of the roof just behind the front seat. Lift simultaneously on each side of the roof until the roof is creased along the top. Fold and pull roof back.

REMOVING THE ROOF:

It may be necessary to remove the entire roof to gain access to the back seat. As many as three cuts along the back may be needed to remove the roof entirely.



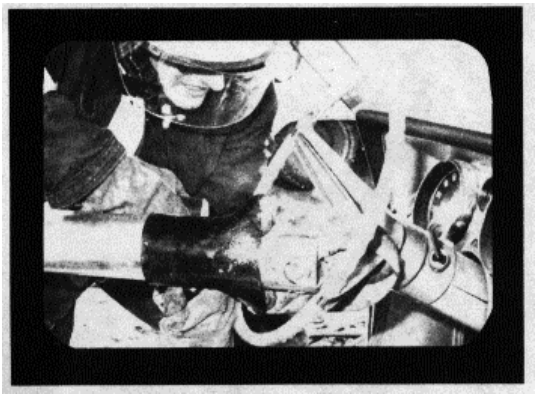


CUTTING THE STEERING WHEEL RING:

Place ring in the round stock cutter located at the base of the blades. Close cutter holding the ring with one hand until cut is made.

CUTTING THE STEERING WHEEL RING SUPPORTS:

While holding the wheel with one hand, close cutter until the steering wheel supports are cut. This will allow the complete removal of the steering wheel.



CAUTION

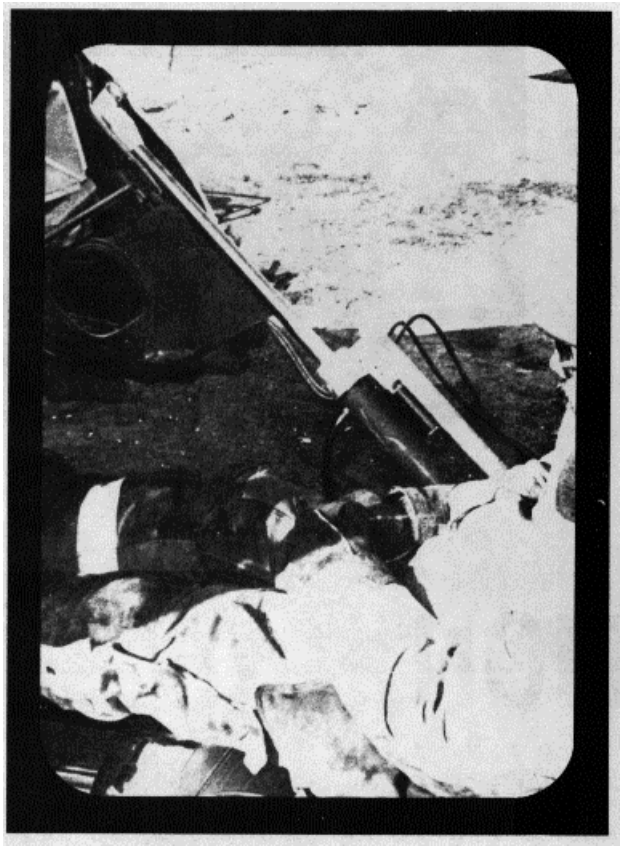
Although the Amkus cutter is extremely powerful, it is recommended that hardened steel not be cut. Small indentations may develop on the blade surface and possible blade breakage may occur. Items such as the steering wheel and the brake pedal are case or surface hardened and can be cut.

PERSONAL EQUIPMENT

WARNING:

It is recommended that each operator wear a full set of protective turnout gear.

- √ PROTECTIVE HELMET
- √ PROTECTIVE GLOVES
- √ FULL EYE PROTECTION (A Shield May Not Be Adequate)
- √ PROTECTIVE COAT
- √ BUNKER PANTS
- √ PROTECTIVE BOOTS (Steel Toed)

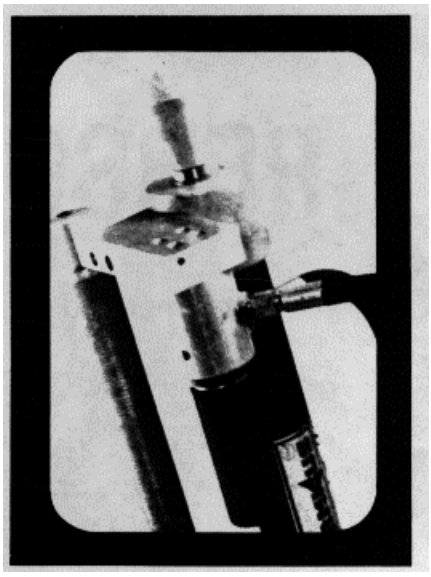


RAMS

The Model 60, 40, and 30 Rescue Rams are three other accessories that make up the Amkus Rescue System. The Model 60 will extend from a closed 34 inches to 60 inches and with a 10 inch extension piece, a maximum of 70 inches. The Model 40 will extend to a maximum 50 inches and the Model 30 to a maximum 40 inches. Each ram will produce a maximum of 40,000 lbs. of pushing force and is extremely valuable in situations where large heavy equipment is involved; such as tractor trailer accidents and train derailments.

MAINTENANCE

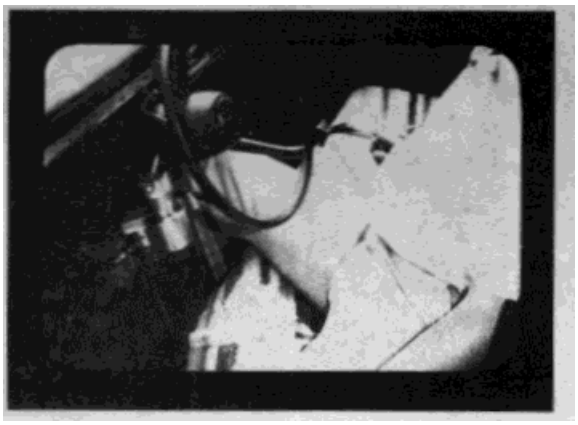
The Amkus rams are virtually maintenance free. Keep them clean and periodically tighten all bolts and fittings.



RESCUE PROCEDURE

RAMS

CAUTION:
While this book provides photos of currently recognized vehicle extrication procedures, it is not intended to be a training manual. We at Amkus encourage each operator to seek qualified technical training.



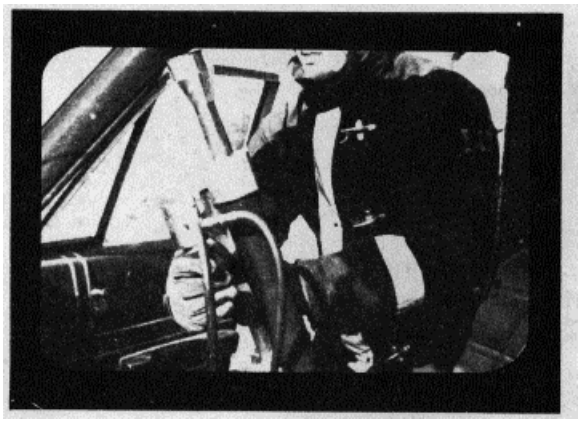
LIFTING THE STEERING COLUMN:

Place ram directly under column open (extend) ram until column is lifted freeing patient. Remember to take extreme caution when working in close proximity to an injured patient.

PUSHING THE DASH:

To push the dash place the base of ram on the car floor just at the base of the center post. Place nose piece of ram firmly against the A or B post. Open (extend) ram until dash moves forward.

NOTE: Making a cut with the cutter on the front kick panel may make this procedure easier. Remember to always use ram base plates whenever possible.



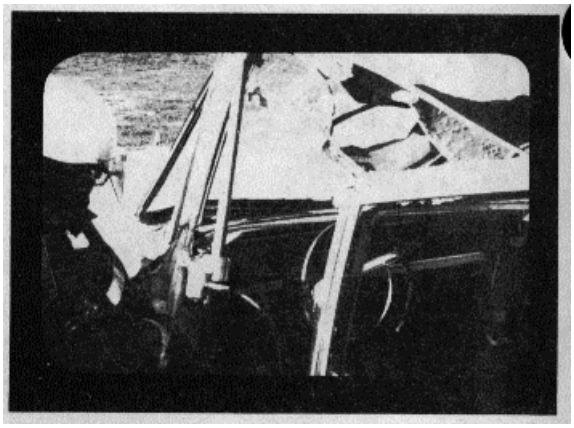
LIFTING THE ROOF WITH THE RAM:

Place base of ram on the car floor directly under A or B post. Open (extend) ram until post breaks free.

LIFTING THE ROOF WITH THE RAM:

Making a cut with the cutter at the base of the windshield on the A and B posts will usually allow you to remove the windshield with the roof during this procedure.

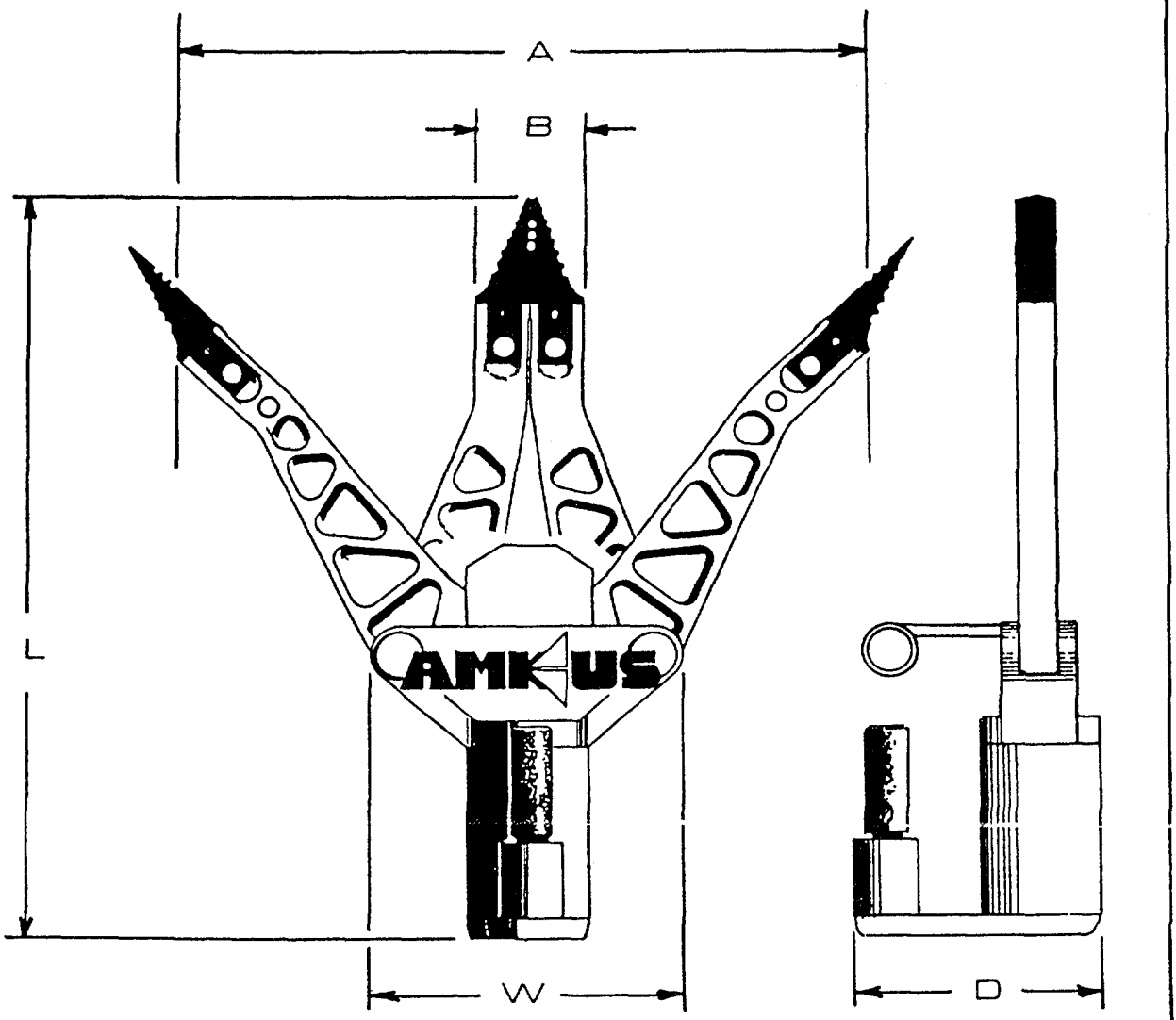
NOTE: It is difficult attempting this procedure without making these cuts.



CUT ROOF BEFORE LIFTING WITH RAM:

Making a cut on the roof just behind the front ;eat on each side of the vehicle will allow the roof to crease along those cuts and enable you to fold roof back.

Model 30 Spreader



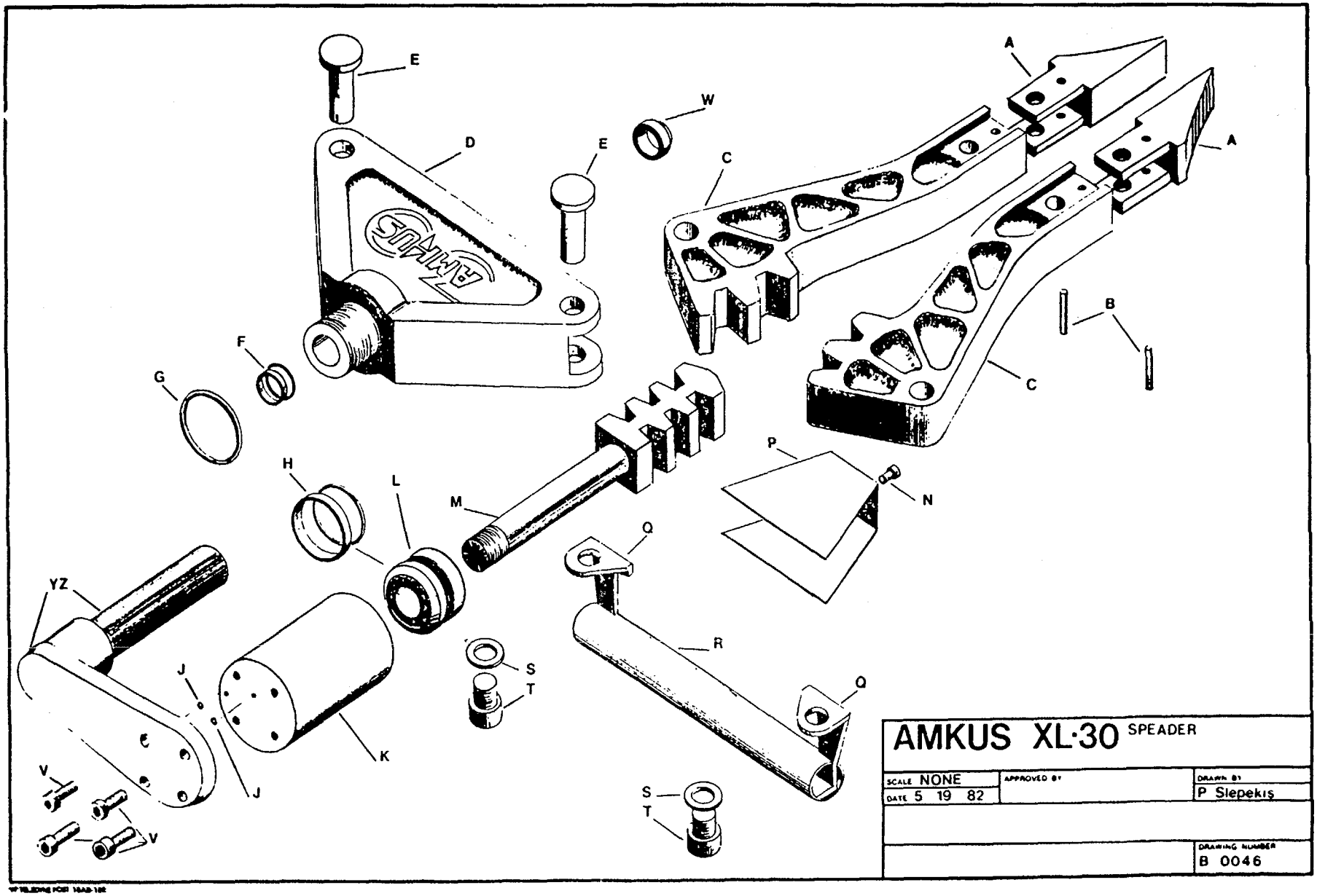
Weight: 39 7/8 pounds

Spreading Force:	At the beginning	B approximately	14,000 pounds
	At the end	A approximately	21,000 pounds
Closing Force:	At the beginning	A approximately	15,000 pounds
	At the end	B approximately	13,500 pounds

L=28 11/16 inches
W=11 1/2 inches
D= 8 inches

* Major components fabricated of high tensile strength Alcoa aluminum material 7075-T651.

Maximum Spreading Distance : 32 inches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AMKUS XL-30 SPEADER
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APPROVED BY
DRAWN BY
P Slepekis
DRAWING NUMBER
B 0046

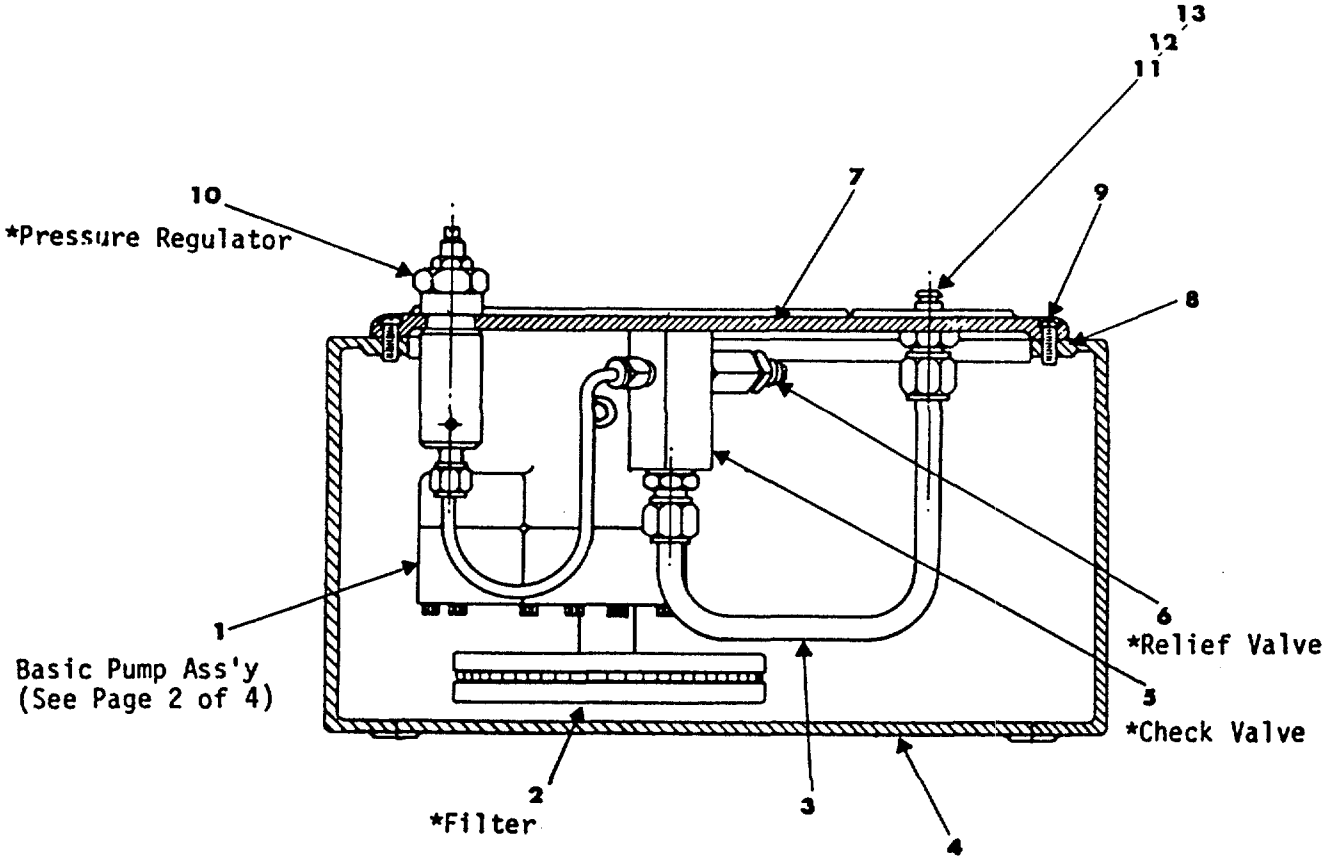
AMKUS 30 Spreader
Parts Price List
Effective January 1, 1985

Part Number		Description	
A	46-01	Spreader Tips	142.00
B	46-02	Steel Pin & Bushing Assembly	26.50
C	46-03	Arms	769.00
D	46-04	Bracket	917.60
E	46-05	Pivot Pin	55.85
F	46-06	Rod Seal	5.95
C	46-07	Cylinder Seal	11.85
H	46-08	Piston Seal	57.30
J	46-09	Valve Plate Seal	.75
K	46-10	Cylinder	392.00
L	46-11	Piston	94.30
M	46-12	Rod-Rack	410.00
N	46-13	Guard Screw	.45
P	46-14	Guard	29.50
Q	46-15	Handle Support Left or Right	31.00
R	46-16	’Handle Tube	34.50
S	46-17	Washer	1.75
T	46-18	Pin Bolt	2.75
V	46-19	Valve Plate Bolt	.60
W	46-20	Rod Wiper	2.90
Y	46-21	Valve Plate	87.85
Z	46-22	Valve	795.00

PARTS LIST

Hydraulic Power Unit

Model B101



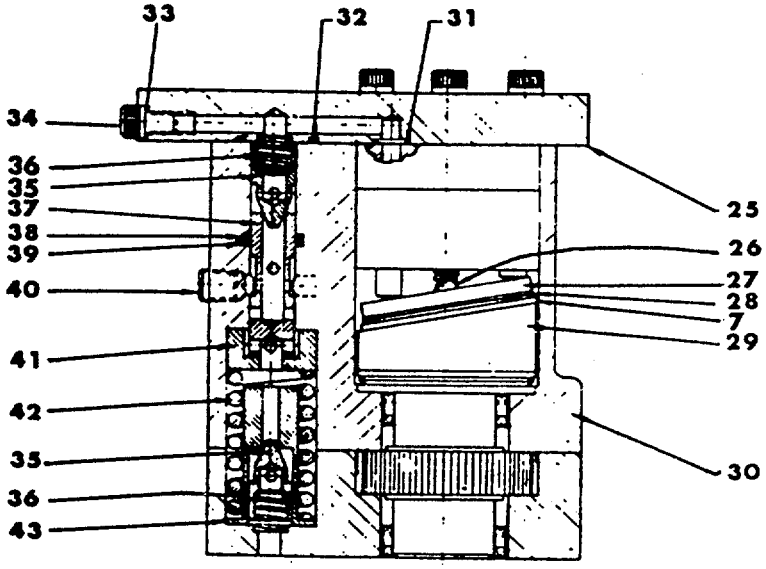
PARTS LIST

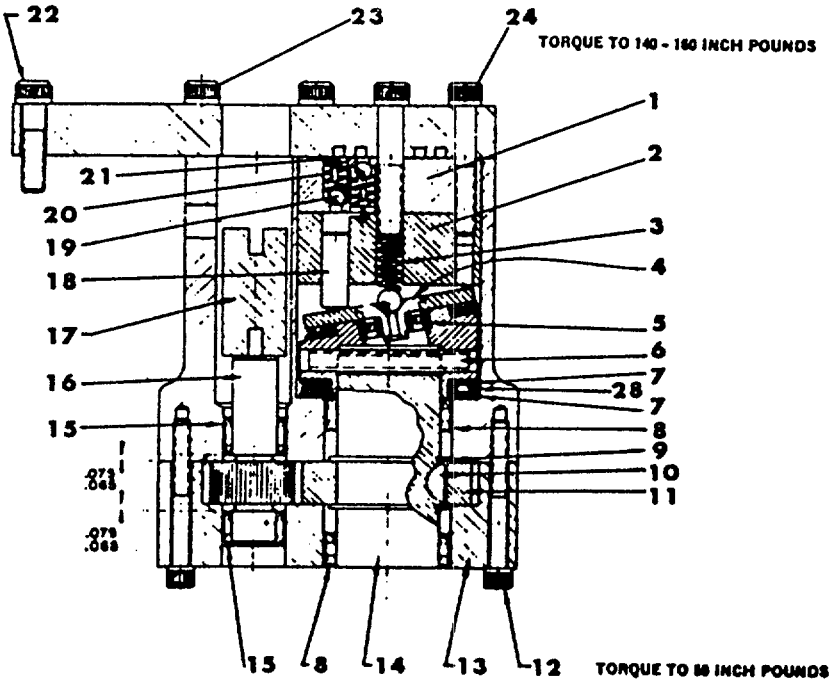
Item No.	Part No.	No. Reqd.	Description
1	27206	1	Basic Pump Assy. - Y-26 Series
	28349	1	Basic Pump Assy, - Y-60 Series
2	21345	1	Filter Assy.
3	30541	1	Tube - Assy.
4	40063-BL2	1	Reservoir - 2 Gal.
	21856	1	Reservoir - 5 Gal.
	21857	1	Reservoir - 7 Gal.
5	21277	1	Check Valve Assy.
6	21278	1	Relief Valve Assy. Y-25
	21278-50	1	Relief Valve Y-60
7	40064	1	Cover Plate
8	40164	1	Gasket
9	10177	10	Screw - Cover 1/4"-20 x 3/4" Lg.
10	22360	1	Pressure Regulator Assy.
11	20787	1	Fitting - Valve Connection
12	10268	1	"0" Ring (-012)
13	10311	1	Back Up Washer (-012)
	202120	1	Name Plate - (Not Shown)
	20937	1	Filler Plug - (Not Shown)

PARTS LIST

Hydraulic Power Unit

Pump Section

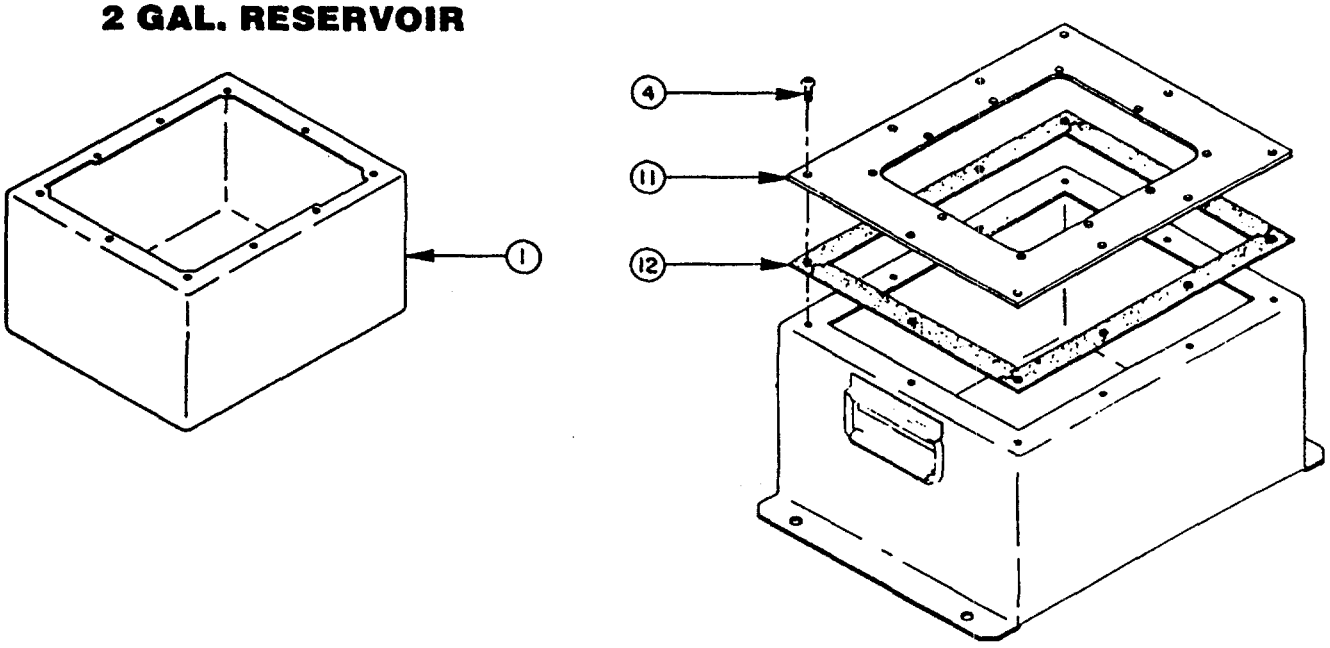




PARTS LIST

Item No.	Part No.	No. Req'd	Description	Item No.	Part No .	No. Req'd	Description
1	40630	1	Pump Block - Y-26	21	24549	6	Spring Guide - Y-26
	41048	1	Pump Block - Y-60		24549	12	Spring Guide - Y-60
2	41062	1	Pump Barrel - Y-26	22	10016	3	Cap Screw ½-20 N.C. x 1"
	41063	1	Pump Barrel - Y-60	23	10020	9	Cap Screw ¼-20 N.C. x 1¼
3	10361	1	Spring	24	10023	7	Cap Screw ¼-20 N.C. x 1½
4	23547	1	Top Bearing Plate	25	50411	1	Plate
5	11814	1	Ball Bearing	26	10375	1	Steel Ball
6	11955	1	Roll' Pin	27	23548	1	Top Plate
7	11813	3	Needle Thrust Race	28	11228	2	Needle Bearing
8	11064	2	Needle Bearing	29	23549	1	Angle Plate
9	11261	2	Retaining Ring	30	40120	1	Pump Body
10	11821	.1	Woodruff Key	31	10266	1	"0" Ring
11	23557	1	Driven Gear	32	10303	1	"0" Ring
12	10001	12	Cap Screw	33	10442	1	Copper Washer
13	30533	1	Pump End Plate	34	10002	1	Cap Screw
14	23556	1	Shaft	35	20771	2	Poppet
15	11199	2	Needle Bearing	36	10425	2	Spring
16	21272	1	Drive Gear	37	20849	1	Spool
17	21091	1	Coupling	38	10271	1	"0" Ring
18	21628	3	Piston - Y-26	39	10312	1	Back Up Washer
	21628	6	Piston - Y-60	40	10427	1	Pipe Plug
19	12223	6	Check Ball - Y-26	41	23255	1	Spring Cap
	12223	12	Check Ball - Y-60	42	10426	1	Spring
20	10445	6	Spring - Y-26	43	23256	1	Spring Guide
	10445	12	Spring - Y-60				

2 GAL. RESERVOIR



PARTS LIST

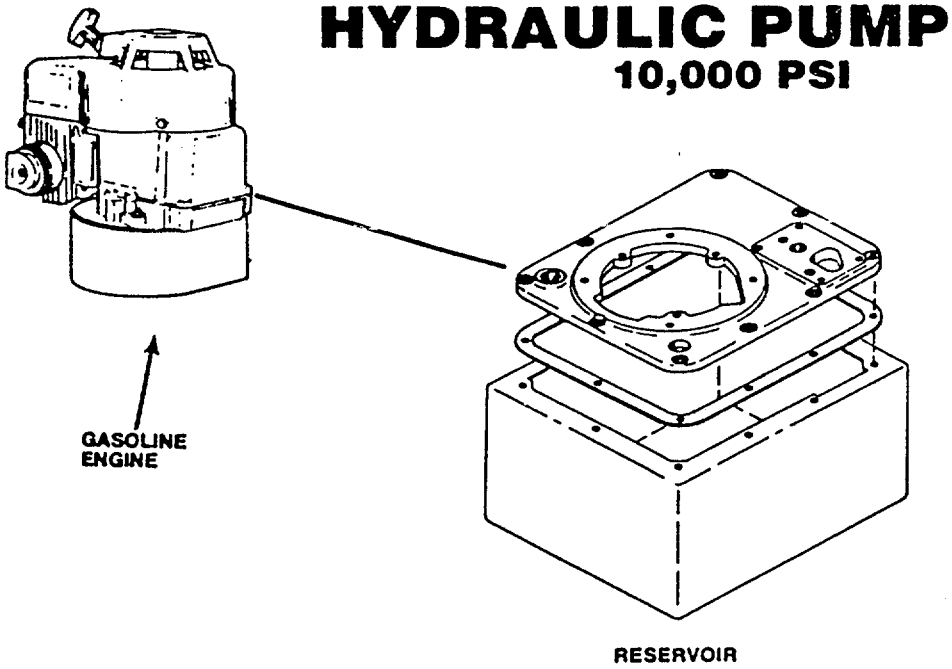
Item No.	Part No.	No. Req'd	Description
1	40063BL2	1	2 Gal. Reservoir(7 E)
	60597-OR9	1	2 Gal. Reservoir with handles & drain
4	10177	10	Mach. Screw
11	0191AL2	I	Adapter
12	40490	1	Gasket

OPERATING AND MAINTENANCE INSTRUCTIONS FOR

Model B 101

GAS POWERED TWO-STAGE HYDRAULIC PUMP

10,000 PSI



NOTE:

- Carefully Inspect the pump upon arrival. The carrier, not the manufacturer, Is responsible for any damage resulting from shipment.
- Read and carefully follow these Instructions. Most problems with new equipment are caused by Improper operation or Installation.
- The hydraulic power unit can be ordered with "building block" flexibility. The customer may choose from a variety of motors, controls, reservoirs, and other options. Because of the many options available, those instructions will Include directions for options that your particular pump may not have.
- Do not attempt to Interchange motors without first consulting the Technical Service Department at( )

LITHO IN U.SA.

SAFETY PRECAUTIONS

WARNING - Hydraulic Hose

- Before operating the pump, make sure all hose connections are tight - use the proper tools to tighten connections.
- Do not overtighten the connections. Connections need only be tightened securely and leak-free. Overtightening may cause premature thread failure or high pressure fittings to split at pressures lower than their rated capacities.
- Shut off the motor before breaking any connection in the system. Shift the flow control valve two times to release all system pressure.
- Should a hydraulic hose ever burst or rupture, immediately shut off the pump. Never attempt to grasp a leaking hose under pressure with your hands. The force of the escaping hydraulic fluid could cause serious and permanent injury.
- Avoid any conditions which could damage the hose and impair the pump's performance. Never allow the hose to kink, twist, curl or bend so tightly that the oil flow within the hose is blocked or reduced. This could damage the hose and possibly result in serious injury to persons working in the immediate vicinity.
- Do not subject the hose to any potential hazard (ex: fire, extreme heat or cold, heavy impact or sharp surfaces) which might rupture or weaken the hose.
- Do not use the hose to lift or move the equipment connected to it.
- Periodically inspect the hose for signs of wear. Never use a defective hose with any pressurized equipment.
- Always consult the manufacturer before painting the hose(s). Never paint the couplers!
- Hose material and coupler seals must be compatible with the hydraulic fluid used.
- Avoid contact with creosote-impregnated timber or fabrics.

Pump

- Never exceed the PSI hydraulic pressure rating noted on the pump name plate.
- Never tamper with the internal high pressure relief valve!

WARNING - Power Supply (Gasoline Engine)

- Read the instruction manual for the gasoline engine before using.
- Do not allow fuel to splash on the engine when refueling.
- Do not add fuel when the engine is running or very hot.

HYDRAULIC PUMP SET-UP PROCEDURE

Gasoline Powered Version

Consult the instruction manual included for the gasoline engine.

Hydraulic Hook-up and Valve Operation

- Clean the areas around the oil ports of the pump and hydraulic cylinders.
- Inspect all threads and fittings for signs of wear or damage and replace as needed. Clean all hose ends. couplers, or union ends.
- Remove the plastic thread protectors from the hydraulic oil outlets.
- Refer to literature included with valve(s) for valve operation and installation instructions.

Filling the Reservoir

1. Clean the area around the filler cap to remove all dust and grit. Any dirt or dust in the oil can damage the polished surfaces and precision built components of this pump.
2. Retract all cylinders to the return position.
3. Remove the filler cap and insert a clean funnel and filter. Fill with hydraulic oil to within 1/2" from the top of the filler hole. Replace filler cap and make sure the breather-hole in the filler cap is open.
4. Cycle the pump (with cylinders attached) several times. Retract, the cylinders and recheck the oil level in the pump reservoir.

Draining and Flushing the Reservoir

IMPORTANT: Clean the pump exterior before the pump interior is removed from the reservoir.

1. Remove the ten screws that fasten the motor and pump assembly to the reservoir.
   IMPORTANT: Do not damage the gasket or bump the filter or hydraulic pressure regulating valves when lifting the pump and motor off the reservoir (See Figure 3).
2. Clean the inside of the reservoir and fill with a suitable flushing oil. Rinse the filter clean.
3. Place the pump and motor assembly back onto the reservoir and secure with two machine screws assembled on opposite corners of the housing.

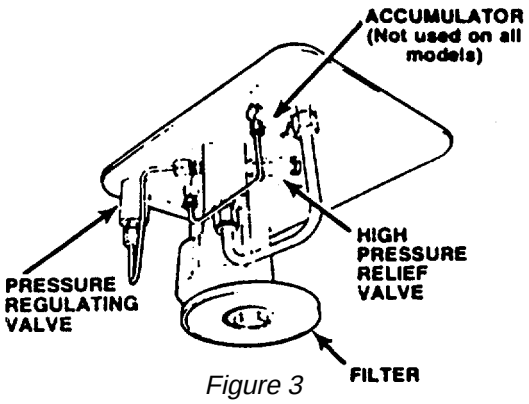


Figure 3

4. Run the pump for several minutes. Then disconnect the motor and pump assembly and drain and clean the inside of the reservoir.
5. Fill the reservoir with an approved, high-grade hydraulic oilReplace the pump and motor assembly (with gasket) on the reservoir and rethread the ten screws. Tighten securely and evenly.

Adding Oil to the Reservoir

- Use only an approved, high-grade hydraulic oil
- Clean the entire area around the filler plug before removing the filler plug.
- Use a clean funnel with filter when adding oil.
- Cylinder(s) must be fully retracted and the power supply disconnected when adding oil to the reservoir.

HYDRAULIC PUMP OPERATION

When operating the pump for the first time:

1. Check all valve and hose fittings to insure proper tightness, check the oil level in the reservoir, and start the pump motor.
2. Set the hydraulic control valve in the "neutral" or "return" position. Move the switch to "jog" several times, then set it on "run" and let the pump idle for a few minutes.
3. Set the hydraulic cylinder at a lower level than the pump and extend the ram out to its full travel several times to bleed air out of the system. Refer to section titled "Bleeding Air from the System" if the cylinder still responds in an unstable or slow manner.
4. Recheck the oil level in the reservoir, add oil if needed. The hydraulic system is now ready for full operation.
   NOTE: If an optional pressure switch has been ordered with the pump, adjust it now. Refer to the section titled "Pressure Regulating Control Adjustments".

PREVENTIVE MAINTENANCE

IMPORTANT:

- Disconnect the pump from the power supply before performing maintenance or repair procedures.
- Repairs and maintenance are to be performed in a dust-free area by a qualified technician.

Bleeding Air from the System

After use, air may accumulate in the hydraulic system if the reservoir oil level had been permitted to get too low. This air will cause the cylinder to respond in an unstable or slow manner. To remove this air:

1. The hydraulic cylinder(s) must be positioned on their side with the couplers located upward.
2. Remove any load from the cylinder(s) and cycle the hydraulic system through several cycles (fully extend and retract the cylinders).

IMPORTANT: Some of the single-acting spring return cylinders have a cavity In the rod that will form an air pocket. This type of ram must be positioned upside down when the hydraulic system is to be bled.

Hydraulic Fluid Level

- Check the oil level in the reservoir after each !0 hours of use.
- Proper oil level is within 1/2" of the filler plug when all cylinders are retracted.
- Drain, flush, and refill the reservoir with an approved, high-grade hydraulic oil, after approximately every 300 hours of use. The frequency of oil changes will depend upon the general working conditions, severity of use, and overall cleanliness and care given the pump.

Maintenance Cleaning

- Keep the pumps outer surface as free from dirt as possible.
- All unused couplers are to be sealed with thread protectors.
- Keep all hose connections free of dirt and grime.
- Be sure the breather hole in the filler cap is clean and unobstructed at all times.
- Equipment hooked up to the pump must be kept clean.

C A U T I 0 N: TROUBLESHOOTING GUIDE

⚠ WARNING

- To prevent Injuries, any repair work or troubleshooting must be done by qualified personnel familiar with this equipment.
- Use the proper gauges and equipment when troubleshooting.

NOTE:

- Depending on the pump version, it Is often best to check for leaks by using a hand pump and applying pressure to the suspect area without the motor running. Watch for leaking oil and follow it back to its source.

PROBLEM	CAUSE	SOLUTION
Pump is not delivering oil or delivers only enough oil to advance ram(s) partially or erratically	(1) Oil level too low.	*(1) Fill reservoir to within /2" of filler plug with all cylinders retracted.*
	(2) Loose fitting coupler to ram.	*(2) Check quick-disconnect couplings to cylinders. Inspect couplers to insure that they are completely coupled. Occasionally couplers have to be replaced because the ball-check does not stay open due to wear.*
	(3) Air in system.	*(3) Bleed the system.*
	(4) Air leak in suction line.	*(4) Check and tighten the suction line.*
Pump Is not delivering oil or delivers only enough oil to advance ram(s) partially or erratically (contd.).	(5) Dirt in pump or filter plugged.	*(5) Pump filter should be cleaned and if necessary, pump should be dismantled and all parts inspected and cleaned.*
	(6) Oil is bypassing through the double-acting cylinder.	*(6) By removing the ram and capping the hoses, the pump and valve can be checked. Observe whether or not the pump will hold pressure.*
	(7) Cold oil or oil is too heavy (Hydraulic oil is of a higher viscosity than necessary).	*(7) Change to lighter oil.*
	(8) Relief valve or low pressure unloading valve out of adjustment.	*(8) Readjust as needed.*
	(9) Reservoir capacity is too small for the size of the cylinder(s) used.	*(9) Use smaller cylinder(s) or larger reservoir.*
	(10) Defective directional valve.	*(10)Inspect all parts carefully and replace if necessary.*
	(11) Sheared drive shaft key(s)	*(11)Replace.*
	(12) Motor rotating in wrong direction.	*(12)3450 RPM motor, refer to electrical schematic on motor. 12,000 RPM electrical motor, reverse lead wires to brush holders. Air motor, air line connected into wrong port.*
	(13) Vacuum in reservoir.	*(13)Check for plugged vent in filler plug.*
	(14) Low pressure pump worn.	*(14)Remove end cap from low pressure gear pump. Clean pump and replace any worn gears, shifting spool, body or end cap.*

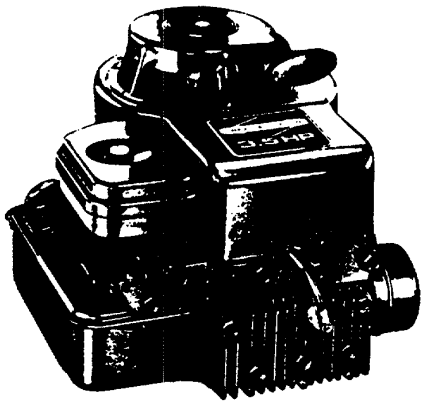
PROBLEM	CAUSE	SOLUTION
Pump will not build full pressure (contd.).	(3) Check the external pressure regulator. Check the relief valve setting.	*(3) Lilt the pump from the reservoir but keep the filter immersed in oil Note the pressure reading when the relief valve begins to open up. It functioning normally, it should start to leak off at relief valve pressure.*
	(4) Look for internal leakage in double-acting cylinders.	*(4) Remove the cylinder from the pump. If the pump builds full pressure. the cylinder is detective.*
	(5) Check for leaks in the flow control valve.	*(5) Clean and reset or replace parts.*
	(6) Inspect the pump for internal leakage. Check high pressure pump inlet or outlet ball checks.	*(6) Same proc6dure as above but look for leaks around the entire inner mechanism. It there are no visible leaks the high pressure pump subassembly may be leaking. Remove all parts. Check the valve head assembly body for any damage to the seat area. Clean and re-seat it necessary. Inspect for damage and replace parts if necessary, then reassemble.*
	(7) Sheared key(s).	*(7) Replace.*
	(8) Inadequate air pressure (air motor only).	*(8) Increase air pressure.*
	(9) Shifting spool seat and/or shifting spool poppet (located under high pressure pump assembly) is worn.	*(9) Clean and reset or replace.*
	(10) Shifting spool O-ring (Located within shifting spool bore) worn or broken	*(10)Remove O-ring and backup washer (through low pressure pump assembly end) with O-ring pick. Replace.*
Cylinder(s) will not retract.	(1) Check the system pressure; if the pressure is zero, the control valve is releasing pressure and the problem may be in the cylinders, (mechanical link-age connected to cylinders), or quick-disconnect couplings.	*(1) Check the cylinders for broken return springs and check couples to ensure that they are completely coupled. Occasionally couplers have to be replaced because one check does not stay open in the coupled position.*
	(2) Defective valve.	*(2) Check valve operation and inspect parts. Replace if necessary.*
	(3) Inadequate air pressure (air motor model only).	*(3) Increase air pressure.*
Pump delivers excess oil pressure.	(1) Check pressure gauge. (2) Relief valve not properly set.	*(1) Calibrate gauge.* *(2) Reset the relief valve.*
Gasoline engine.		*(1) Refer to Instruction Manual included with gasoline engine.*

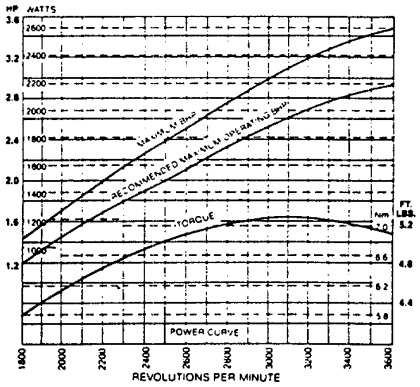
Pump builds pressure but cannot maintain pressure.	(1) Check to see if there are any external leaks. If no oil leakage is visible, the problem is internal. If using a double-acting cylinder, remove it from the system to ensure that the leak is not in the cylinder.	*(1) Reseal leaking pipe littings with pipe sealant.*
	(2) To test for a leaking control valve, lift the pump from the reservoir but keep the filter in the oil. Remove the drain line to see if the oil is leaking from the valve. If the valve is not leaking, the internal check valve could be leaking. Refer to the note concerning checking for oil leaks at the beginning of this Trouble-shooting Guide.	*(2) Clean, reseat or replace control valve parts. If the internal check valve(s) are leaking, the pump must be dismantled and the seat areas repaired, poppets replaced, etc.*
	(3) Leaking pressure switch seal.	*(3) Repair or replace as needed.*
Pump will not build full pressure.	(1) Faulty pressure gauge.	*(1) Calibrate gauge*
	(2) Check for external leakage.	*(2) Seal any faulty pipe fitting with pipe sealant.*

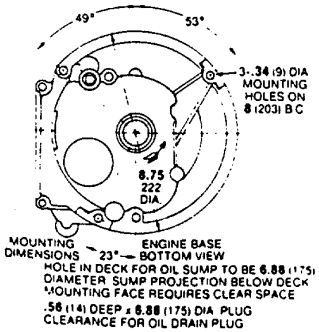
3.5 HP @ 3600 RPM – Series 92900

Model 92902
Blade Brake Clutch

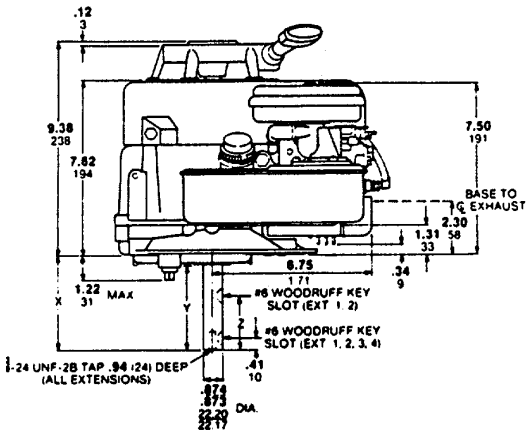
	Model 92902 Type 5015-01
Air Cleaner	Oil Foam
Bearings, Main	2 Plain Bearings
Bore	2.56" (65.1 mm)
Breather - Vent	Thru Air Cleaner
Carburetor	Pulsa-Jet
Choke	Automatic Choke
Control	Manual Friction
Crankshaft	**261691 - 7/8" 2 Woodruff D&T 3/8-24**
Cylinder	Aluminum Alloy
Deflector	Side Out
Displacement	9.02 cu. in. (148 cc)
Flange Mount	8.00 B.C.
Fuel Filter	In Tank
Fuel Tank Capacity	1 Quart (.95 L)
Governor	Pneumatic
Ground Wire Terminal	W/O
Muffler	Round Lo-Tone
Oil Capacity	1.25 Pint (.6 L)
Oil Fill and Drain	Dipstick in Cylinder
Paint	Industrial Gray
Shut-Off, Ignition	Remote Stop
Starting, Electric	W/O
Starting, Manual	12 o'clock - Compression Release
Speed Set - No Load	31/3300 RPM
Stroke	1.75" (44.4 mm)
Valve, Exhaust	Austenitic
Valve, Intake	Martensitic

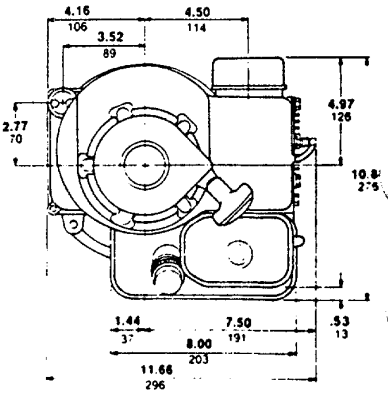


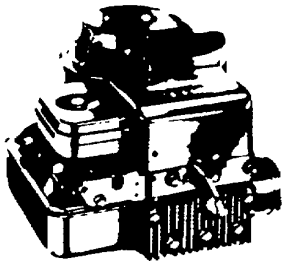




EXT	C/S NO	DIMENSION		
		X	Y	Z
1	261691	3.16" (80 mm)	2.72" (69 mm)	1.84" (47 mm)

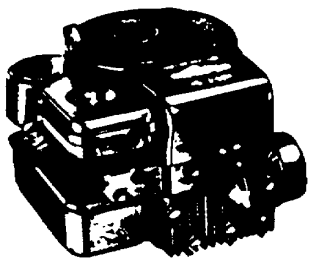






Briggs & Stratton
OPERATING AND MAINTENANCE INSTRUCTIONS
MODEL SERIES

92900



IN THE INTEREST OF SAFETY

DANGER: DO NOT RUN THE ENGINE IN AN ENCLOSED AREA. Exhaust gases contain carbon monoxide, an odorless and deadly poison. A FIRE OR EXPLOSION CAN OCCUR RESULTING IN PERSONAL INJURY IF THE FOLLOWING INSTRUCTIONS ARE NOT FOLLOWED.

1. DO NOT FILL GASOLINE TANK while engine is running. Refuel, ONLY, after engine has cooled down.
2. Do not operate the engine when an odor of gasoline is present or other explosive conditions exist.
3. If gasoline is spilled, move machine away from the area of the spill and avoid creating any source of ignition until the gasoline has evaporated.
4. DO NOT STORE, SPILL OR USE GASOLINE NEAR AN OPEN FLAME, or devices such as a stove, furnace, water heater which utilize a pilot light, or devices which can create a spark.
5. Refuel outdoors preferably, or only in well ventilated areas.
6. DO NOT OPERATE ENGINE WITHOUT A MUFFLER. Inspect periodically and replace, if necessary.
7. Periodically clean the muffler area to prevent grass, dirt and combustible material from accumulating.
8. DO NOT use this engine on any forest covered, brush covered or grass covered unimproved land unless a spark arrester is attached to the muffler.
9. Except for adjustment, DO NOT operate the engine if air cleaner or cover directly over the carburetor air intake is removed.

WARNING: DO NOT RUN ENGINE AT EXCESSIVE SPEEDS. Operating an engine at excessive speeds increases the danger of personal injury. DO NOT TAMPER WITH GOVERNOR SPRINGS, GOVERNOR LINKS OR OTHER PARTS WHICH MAY INCREASE THE GOVERNED ENGINE SPEED.

A.N.S.I. Standard Safety Specifications for rotary power lawn mowers specify a maximum blade tip speed of 19,000 feet per minute (96.5 meters per second), primarily to reduce the danger from thrown objects.

Do not tamper with the engine speed selected by the original equipment manufacturer.

DO NOT TOUCH hot mufflers, cylinders or fins as contact may cause burns.

Dirt and grass clippings or other debris, in cooling fins or governor parts can affect engine speed. See cleaning instructions in MAINTENANCE section.

TO PREVENT HAND OR ARM INJURY, always pull starter cord rapidly to avoid kickback; starting engine with a loose blade or without a blade may cause a severe kickback.

ALWAYS KEEP HANDS AND FEET CLEAR OF MOVING OR ROTATING PARTS.

TO PREVENT ACCIDENTAL STARTING when servicing the engine or equipment, always remove the spark plug or wire from the spark plug and insert in holding tab shown on page 2.

WHEN WORKING ON EQUIPMENT

DO NOT STRIKE FLYWHEEL with a hard object or metal tool as this may cause flywheel to shatter in operation, causing personal injury or property damage. To remove flywheel, use Briggs & Stratton approved tools only.

IN THE INTEREST OF ENVIRONMENT

A muffler which leaks because of rust or damage can permit an increased exhaust noise level. Therefore, examine the muffler periodically to be sure it is functioning effectively. To purchase a new muffler, see SERVICE AND REPAIR INFORMATION.

WARNING: If this engine is not equipped with a spark arrester and is to be used on any forest covered, brush covered, or grass covered unimproved land, before using on such land a spark arrester must be added to the muffler. The arrester must be maintained in effective working order by the operator. In the State of California the above is required by law (Section 4442 of the California Public Resources Code). Other states may have similar laws. Federal laws apply on federal lands. See your Authorized Briggs & Stratton Service Center for spark arrester muffler options.

SERVICE & REPAIR INFORMATION

If service or repair is needed, contact an Authorized Briggs & Stratton Service Center. To serve you promptly and efficiently, the Service Center will need the model, type and code number on your engine.

Each Authorized Service Center carries a stock of original Briggs & Stratton repair parts and is equipped with special service tools. Trained mechanics assure expert repair service on all Briggs & Stratton engines.

Major engine repairs should not be attempted unless you have the proper tools and a thorough knowledge of internal combustion engine repair procedure.

Your nearest service center is listed in the "Yellow Pages" under "Engines, Gasoline" or "Gasoline Engines". He is one of over 25,000 authorized dealers available to serve you.

This illustrated book includes "Theories of Operation", common specifications, and detailed information covering the adjustment, tune-up and repair procedures for 2 through 16 H.P. single cylinder, 4 cycle models. It is available from any Authorized Briggs & Stratton Service Center. Order as Part Number 270962.

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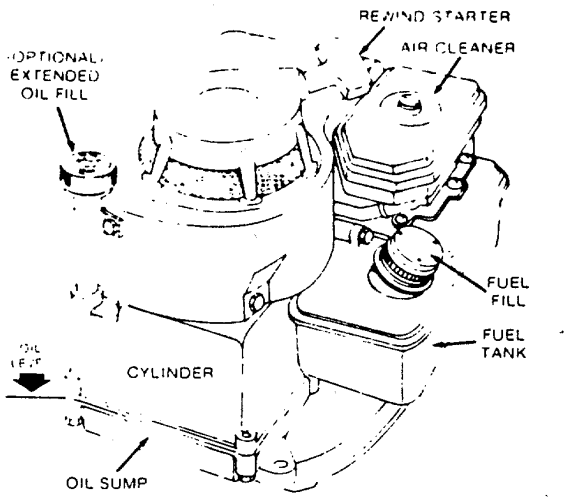
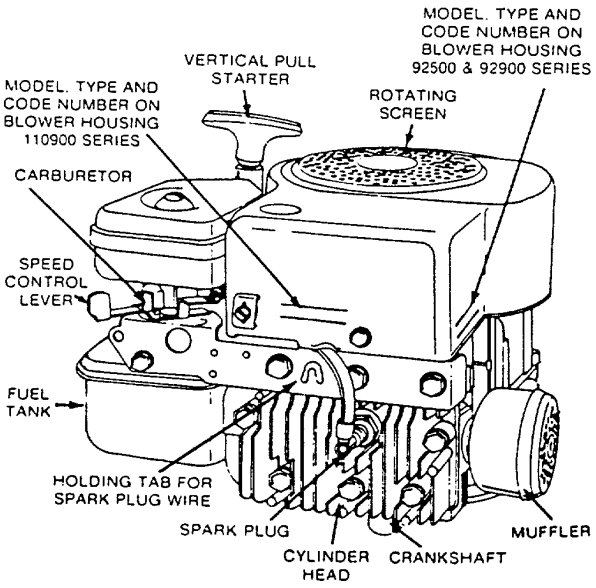
BRIGGS & STRATTON

BRIGGS & STRATTON CORP.
Milwaukee, Wisconsin 53201





FORM NO 270361-5 83
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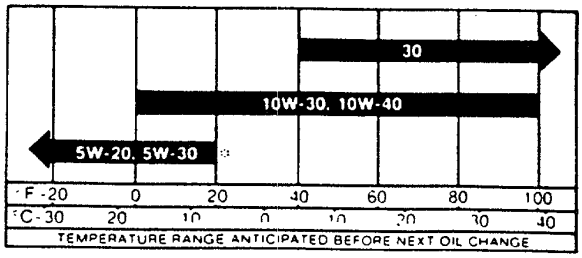
BEFORE STARTING

READ THE OPERATING INSTRUCTIONS OF THE EQUIPMENT THIS ENGINE POWERS

Use a high quality detergent oil classified "For Service SF, SE, SD or SC" Detergent oils keep the engine cleaner and retard the formation of gum and varnish deposits. Nothing should be added to the recommended oil.

RECOMMENDED SAE VISCOSITY GRADES

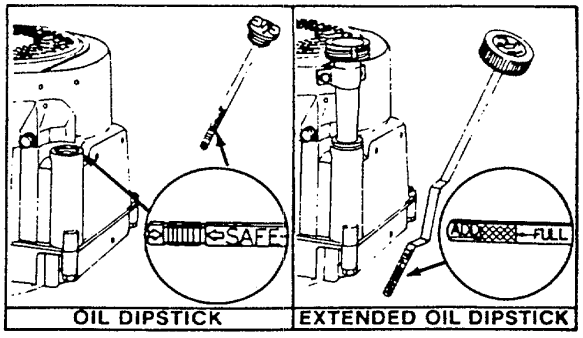


*If not available, a synthetic oil may be used having 5W-20, 5W-30 or 5W-40 viscosity.

TO FILL WITH OIL

Place engine level. Clean area around oil fill before removing oil dipstick.

OIL FILL. Remove oil dipstick. FILL TO FULL MARK on dipstick, POUR SLOWLY. Capacity approximately 1 ½ pints (0.6 liters). When checking oil level, screw dipstick assembly firmly but slowly until cap bottoms. DO NOT OVERFILL. Dipstick assembly must be securely assembled to tube at all times when engine is operating.



FUEL RECOMMENDATIONS

Our engines will operate satisfactorily on any gasoline intended for automotive use. DO NOT MIX OIL WITH GASOLINE.

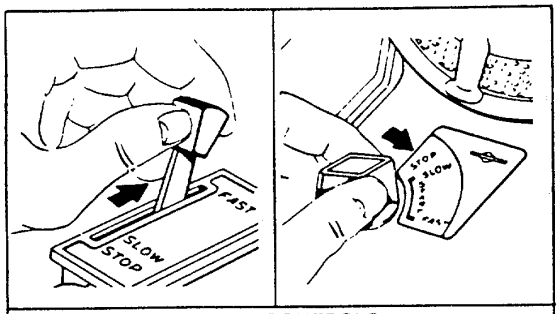
We recommend the use of clean, fresh gasoline with a minimum rating of 77 Octane. Lead-free, low-lead or regular grade leaded gasolines are acceptable. The use of lead-free gasoline results in fewer combustion deposits.

DO NOT fill fuel tank to point of overflowing. Provide approximately 1/4" of tank space for fuel expansion.

STARTING

Start, store and fuel engine in a level position

SPEED CONTROL LEVER: Move speed control lever to "RUN" or "FAST" position

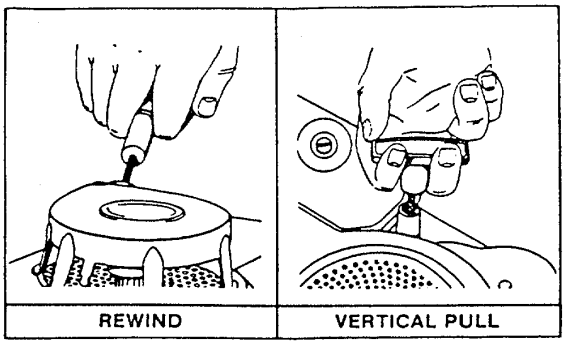


TYPICAL CONTROLS

TO START ENGINE

DANGER: ALWAYS KEEP HANDS AND FEET CLEAR OF MOWER BLADE OR OTHER ROTATING MACHINERY.

Rewind/Vertical Starter. Grasp starter grip as illustrated and pull out cord rapidly to overcome compression and prevent kickback. Return starter grip slowly. Repeat if necessary.



REWIND | VERTICAL PULL

TIPS TO OBTAIN BEST STARTING PERFORMANCE:

a. Restart a warm engine with speed control lever in IDLE or SLOW position.

b. Start engine with mower on sidewalk or driveway where the cutting blades are out of the grass in an unloaded condition.

   If starts must be made on the lawn, move mower over previously cut grass.

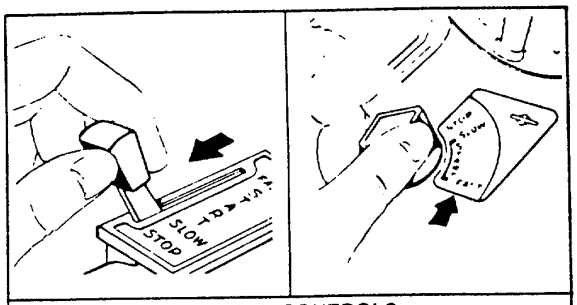
c. Keep the underside of the mower deck clean. Periodically remove any built up grass which might add resistance to the cutter blade.

IMPORTANT This engine features a unique Automatic Choke In case of flooding, move control to "STOP" and pull starter six times Then move control to "FAST" position and start engine If engine continues to flood, rotate the carburetor needle valve 1 8 turn clockwise to obtain a leaner mixture (See ADJUSTMENTS)

If the engine does not start easily, when cold, rotate the needle valve 1 8 turn counterclockwise (richer mixture)

TO STOP ENGINE

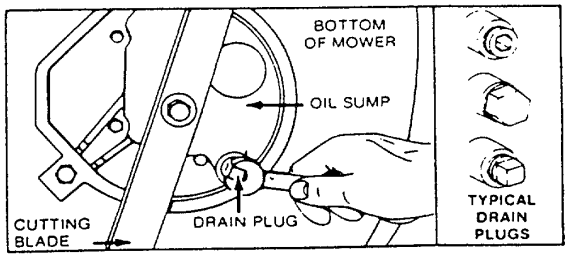
Move engine speed control lever to "STOP" position

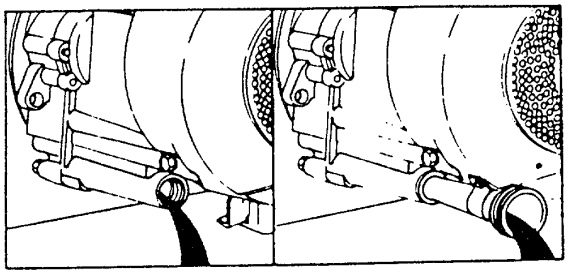


TYPICAL CONTROLS

MAINTENANCE

WARNING: TO PREVENT ACCIDENTAL STARTING when servicing the engine or equipment, always remove the spark plug or wire from the spark plug and insert in holding tab shown on page 2.





DRAINING ENGINE OIL

CHECK OIL LEVEL regularly — after each five hours of operation. BE SURE OIL LEVEL IS MAINTAINED

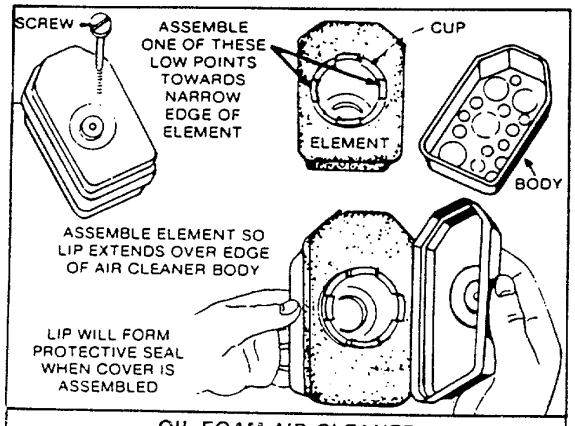
CHANGE OIL after first five hours of operation. Thereafter change every 25 hours of operation. Change oil while engine is warm. Oil may be drained through oil drain on bottom of engine. To drain completely, always place engine level when draining through the bottom. Oil may also be drained through oil fill as shown.

CAUTION: When tipping, empty fuel tank and keep engine spark plug or muffler side up.

TO SERVICE AIR CLEANER

Clean and re-oil foam element at three month intervals or every 25 hours, whichever occurs first.

NOTE: Service more often under dusty conditions.



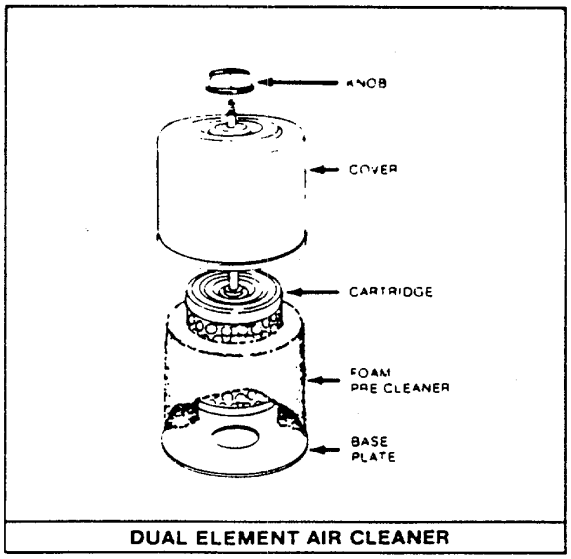
OIL FOAM AIR CLEANER

OIL FOAM AIR CLEANER

1. Remove screw.
2. Remove air cleaner carefully to prevent dirt from entering carburetor.
3. Take air cleaner apart and clean.
   a. WASH foam element in kerosene or liquid detergent and water to remove dirt.
   b. Wrap foam in cloth and squeeze dry.
   c. Saturate foam with engine oil. Squeeze to remove excess oil.
4. Reassemble parts and fasten to carburetor.

DUAL ELEMENT AIR CLEANER (OPTIONAL)

1. Remove knob and cover.
2. Remove foam pre-cleaner by sliding it off of the paper cartridge.
3. a. Wash foam pre-cleaner in kerosene or liquid detergent and water.
   b. Wrap foam pre-cleaner in cloth and squeeze dry.
   c. Saturate foam pre-cleaner in engine oil. Squeeze to remove excess oil.
4. Install foam pre-cleaner over paper cartridge. Reassemble cover and screw down tight.

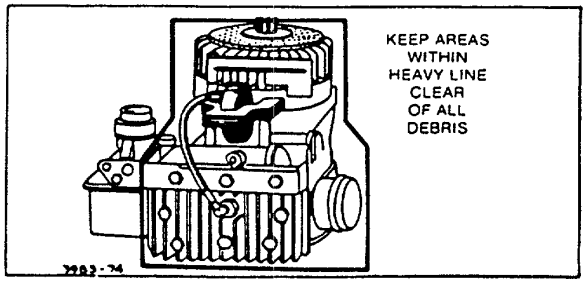


DUAL ELEMENT AIR CLEANER

Yearly or every 100 hours, whichever occurs first, remove paper cartridge. Clean by tapping gently on flat surface. If very dirty, replace cartridge, or wash in a low or nonsudsing detergent and warm water solution. Rinse thoroughly with flowing water from inside out until water is clear. Cartridge must be allowed to stand and air dry thoroughly before using. Service more often if necessary.

CAUTION: Petroleum solvents, such as kerosene, are not to be used to clean cartridge. They may cause deterioration of the cartridge. DO NOT OIL CARTRIDGE. DO NOT USE PRESSURIZED AIR TO CLEAN OR DRY CARTRIDGE.

CLEAN COOLING SYSTEM — Grass, chaff or dirt may clog the rotating screen and the air cooling system, especially after prolonged service cutting dry grasses. Yearly or every 100 hours, whichever occurs first, remove the blower housing and clean the area shown to avoid overspeeding, overheating and engine damage. Clean more often if necessary.

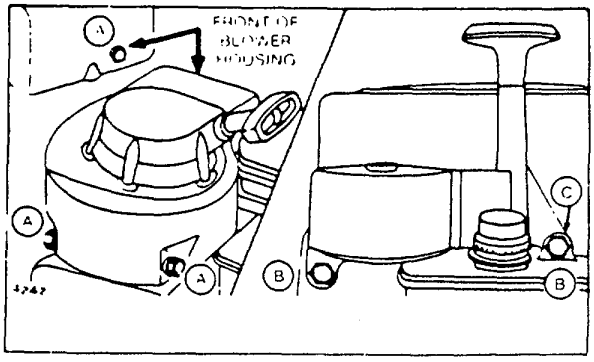


DANGER: Periodically clean muffler area to remove all grass, dirt and combustible debris.

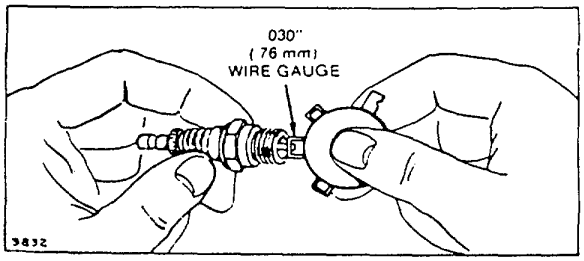
TO REMOVE THE BLOWER HOUSING

To remove the blower housing on Rewind Starter Models, remove three screws labeled "A". Lift housing to remove.

On Vertical Pull – First remove two screws "B" used to attach starter to engine. Then remove three screws "A". Lift housing to remove. Note position of spacer between starter and cylinder at "C".



SPARK PLUG — Clean and reset gap at .030" every 100 hours of operation.



CAUTION: Do not blast clean spark plug. Spark plug should be cleaned by scraping or wire brushing and washing with a commercial solvent.

Sparking can occur if wire terminal does not fit firmly on spark plug, or if stop switch vibrates against spark plug. Reform terminal or repair switch if necessary.

SPARK ARRESTER EQUIPPED MUFFLER — If engine muffler is equipped with spark arrester screen assembly, remove every 50 hours for cleaning and inspection. Replace if damaged.

CLEAN ENGINE — Remove dirt and debris with a cloth or brush. Cleaning with a forceful spray of water is not recommended as water could contaminate the fuel system.

ADJUSTMENTS

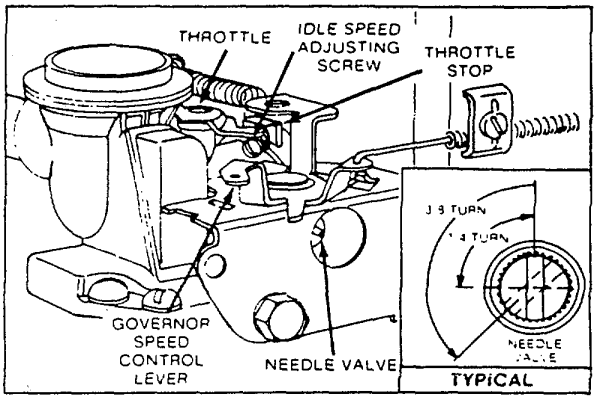
CARBURETOR ADJUSTMENTS

Minor carburetor adjustment may be required to compensate for differences in fuel, temperature, altitude or load.

NOTE: The air cleaner must be assembled to carburetor when running engine. The best carburetor adjustment is obtained with fuel tank approximately 1/4 full.

TO ADJUST CARBURETOR — Gently turn needle valve clockwise until it just closes. Valve may be damaged by turning it in too far.

Next, open the needle valve 1-1/2 turns counterclockwise. This initial adjustment will permit the engine to be started and warmed up (approximately 5 minutes) prior to final adjustment.



FINAL ADJUSTMENT

Place speed control lever in "FAST" position. Turn needle valve in (clockwise) until engine just starts to slow. Now open needle valve 3/8 turn (counterclockwise, see inset above). Then rotate throttle counterclockwise and hold against throttle stop while adjusting idle RPM by turning idle speed adjusting screw to obtain 1750 RPM. Release throttle — engine should accelerate smoothly. If engine does not accelerate properly, the carburetor should be re-adjusted, usually to a slightly richer mixture by turning needle valve counterclockwise 1/8 turn more.

CONTROL ADJUSTMENTS:

The speed control must be properly adjusted to stop, start and operate the engine at maximum speed.

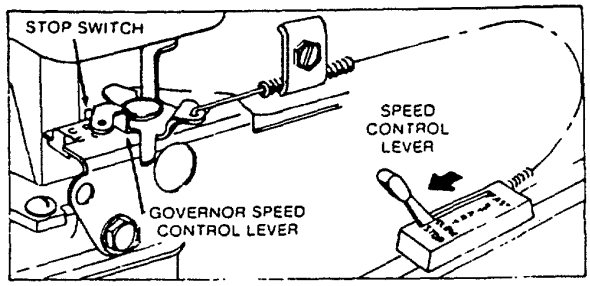
The acceptable operating speed range is 1800 to 3600 RPM.

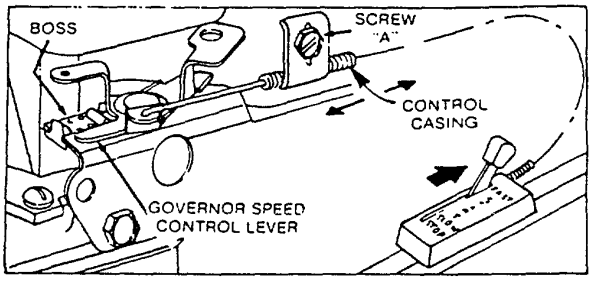
Idle speed is 1750 RPM. The manufacturer of the equipment on which the engine is used, specifies the top governed no load speed at which the engine may be operated. DO NOT EXCEED this speed.

TO CHECK OPERATION

Move the speed control lever to "STOP" position. The governor speed control lever must fully contact the stop switch as shown.

With the speed control lever in "FAST" position, the governor speed control lever should just touch the boss as shown.





To Adjust Speed Control:

1. Loosen casing clamp screw "A".
2. Place speed control lever in "FAST" position.
3. Move control casing forward or backward until governor speed control lever just touches boss as shown.
4. Retighten screw "A".

GENERAL INFORMATION

These engines are single-cylinder L-head, air-cooled type.

MODEL SERIES 92900

Bore	2-9/16" (65.09 mm)
Stroke	1-3/4" (44.45 mm)
Displacement	9.02 cu. in. (147.8 cc)
Horsepower Max.	3.5 @ 3600 RPM
Torque (Ft. Lbs.) Max.	5.26 @ 3100 RPM

The horsepower ratings listed are established in accordance with the Society of Automotive Engineers Test Code - J607. For practical operation, the horsepower loading should not exceed 85% of these ratings. Engine power will decrease 3½% for each 1,000 feet (304.8 m) above sea level and 1% for each 10° above 60° F (16° C).

In some areas, local law requires the use of a resistor spark plug so as to suppress ignition signals. If an engine was originally equipped with a resistor spark plug, be sure to use the same type of spark plug for replacement.

TUNE-UP SPECIFICATIONS

Spark Plug Type	Champion	Autolite
Short Plug	CJ-8	235
Long Plug	J-8	295
Resistor Short Plug	RCJ-8	245
Resistor Long Plug	RJ-8	306

Spark Plug Gap	.030" (.76 mm)
Intake Valve Clearance	.004" - .006" (.10 - .15 mm)
Exhaust Valve Clearance	.007" - .009" (.18 - .23 mm)

STORAGE INSTRUCTIONS

Engines to be stored over 30 days should be completely drained of fuel to prevent gum deposits forming on essential carburetor parts, fuel filter and tank.

NOTE: The use of a fuel additive, such as STA-BIL, or an equivalent, will minimize the formation of fuel gum deposits during storage. Such an additive may be added to the gasoline in the fuel tank of the engine, or to the gasoline in a storage container.

a. All fuel should be removed from the tank. Run the engine until it stops from lack of fuel. The small amount of fuel that remains in the sump of the tank should be removed by absorbing it with a clean, dry cloth.

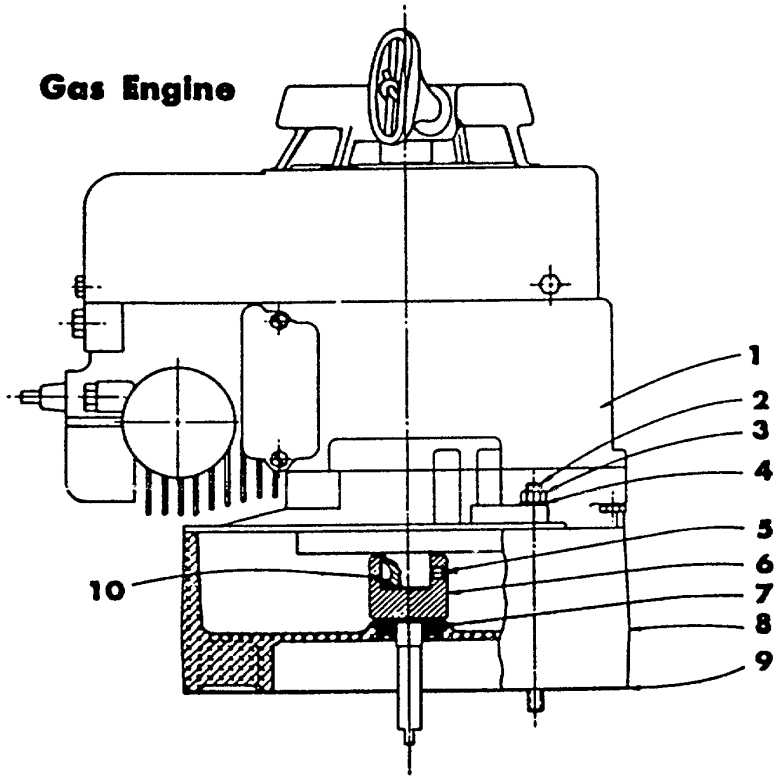
b. While engine is still warm, drain oil from crankcase. Refill with fresh oil.

c. Remove spark plug, pour approximately 1/2 ounce (15 cc) of engine oil into cylinder and crank slowly to distribute oil. Replace spark plug.

d. Clean dirt and chaff from cylinder, cylinder head fins, blower housing, rotating screen and muffler areas.

e. Store in a clean and dry area.

PARTS LIST
Hydraulic Power Unit
Motor Section



PARTS LIST

Item No.	Part No.	No Req.	Description
1	10946	1	Gas Engine
2	26804	3	Stud
3	13116	3	Lock Nut
4	10257	3	Washer
5	10556	1	Set Screw
6	32962	1	Shaft Extension
7	10439	1	Bearing
8	50384	1	Mounting Plate
9	40987	1	Gasket
10	10945	1	Woodruff Key
	10621	1	I Street Elbow (Not Shown)

FOREWORD

Before attempting an engine overhaul or tune,, it is necessary that your shop be equipped with proper tools, equipment and mechanics who are thoroughly familiar with Briggs & Stratton engine design and construction. With your shop thus equipped this book will serve as a guide in performing the various steps necessary to do a complete and satisfactory job.

In order to keep all tables as simple as possible. Only the basic engine models arelist4ed unless there is a difference between them and special models.

To make inspection of parts simple and accurate only the sizes at which they should be rejected are shown. This eliminates that necessity for figuring allowances for wear etc. If a part is worn larger (inside dimension such as magneto bearing) or smaller (such as crankshaft journal surfaces) than the given sizes they should be rejected and replaced with new parts.

Always use plug gauges wherever possible to 3liminate doubt and possible mistakes. You will find plug gauges illustration Section 13. Special repair parts, valve guides, valve seat inserts, contact po0int plunger bushing, etc, are not listed in the regular parts Lists and part numbers will be found only in this book.

The term "Inspect." "Check." "Test" and "Replace" are used as follows:

INSPECT - Visual inspection. Look for signs of wear scoring cracks, striped threads, etc.

CHECK - Measure by means of plug gauges. Feeler gauges, micrometer, scale, etc.

TEST - Analyze with proper testing equipment.

REPLACE - This usually means to take off the old part and re-assemble it or replace with a new one.

Illustrations do not necessarily designate a particular model and should only be used to identify repair procedures.

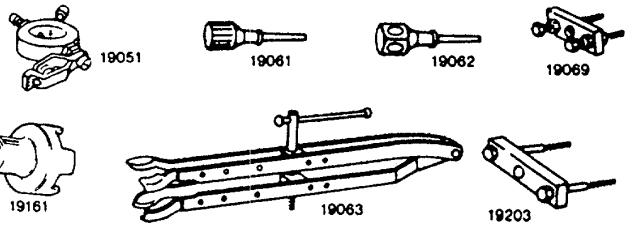
COMMON SPECIFICATIONS FOR

1. Spark plug gap: .030 All Models
2. Condenser capacity: .18 to .24 MFD. All Models
3. Contact point gap: .020 All Models

BASIC MODEL SERIES	IDLE SPEED	ARMATURE AIR GAP		VALVE CLEARANCE		VALVE GUIDE REJECT GAGE	TORQUE SPECIFICATIONS		
		TWO LEG	THREE LEG	INTAKE	EXHAUST		FLYWHEEL NUT FT. LBS.	CYLINDER HEAD IN. LBS.	CONN. ROD IN. LBS.
92000,	1750	.006 .010		.005 .007	.009 .011	19122	55	140	100

COMMONLY USED TOOLS FOR SERVICING

19051	Spark Tester, all models
19061	Carburetor jet screwdriver, all models
19062	Carburetor jet screwdriver, all models
19063	Valve spring compressor, all models
† 19161	Starter clutch wrench, use with ½" drive torque wrench
19203	Flywheel Puller, 170000 thru 320000 Aluminum Models & Cast Iron Models



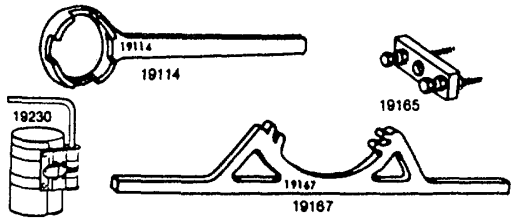
ALL POPULAR ENGINE MODELS

4. Top governed speed: See Briggs & Stratton Service Bulletin No. 467 or Engine Replacement Data

5. Crankshaft End Play: .002-.008 All Models

CRANKSHAFT REJECT SIZE			MAIN BEARING REJECT GAGE	CYLINDER BORE STD. ▲	INITIAL CARBURETOR ADJUSTMENT ALL MODELS		
MAG. JOURNAL	CRANKPIN	P.T.O. JOURNAL			CARBURETOR TYPE	TURNS OPEN FROM SEAT NEEDLE VALVE	IDLE VALVE
.8726	.9963	.8726	19166	2.5625 2.5615	One Piece Flo-Jet	2½	1½

BRIGGS & STRATTON ENGINES



Flywheel puller, all models thru 130000	19069
Piston ring compressor, all models	19230
Starter clutch wrench, all rewind starter models	19114
Flywheel Puller, 140000, 170000, 190000 & 250000 Models	19165
Flywheel holder, all models 6B thru 130000	19167

See Section 13 for Complete List of Tools

Section 1
GENERAL INFORMATION

Briggs & Stratton engines are of the same basic 4 stroke cycle design used in automobiles, aircraft trucks and tractors. As the name indicates, there are four strokes to one complete power cycle:

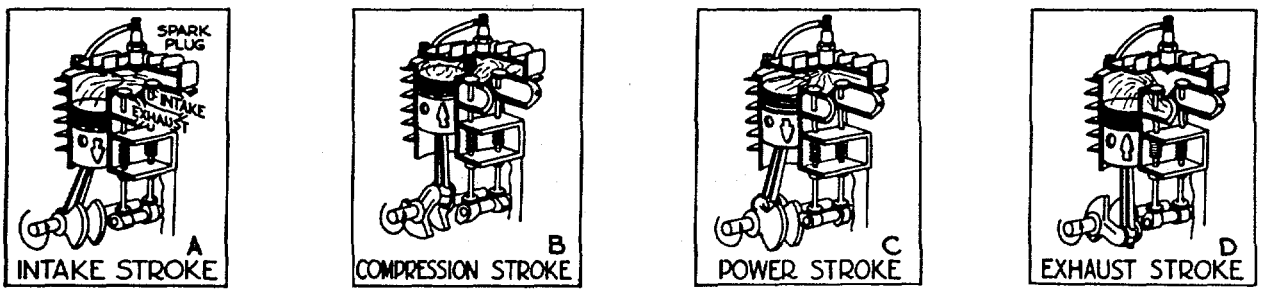


Fig. 1 - The 4-Stroke Cycle

a. INTAKE STROKE: The piston goes down, creating a vacuum in the cylinder which draws gas through open intake valve into the space above piston.

b. COMPRESSION STROKE: The piston comes up with both valves closed, highly compressing the gas into the space left between the top of the piston and cylinder head.

c. POWER STROKE: At this point the magneto sends high tension current to the spark plug, firing or exploding the compressed gas and driving the piston down.

d. EXHAUST STROKE: Exhaust valve opens and the upward stroke of the piston forces out all of the burnt gases, thus completing the power cycle.

CAUTION

Exhaust gases contain carbon monoxide which is odorless and a deadly poison. Proper care must be taken to provide efficient ventilation when running an engine indoors.

Fill the crankcase and air cleaner with proper oil before starting engine. See that oil level is maintained.

Do not fill the gasoline tank while the engine is running. Avoid spilling gasoline on a hot engine - This may cause an explosion and serious injury.

USE CLEAN GASOLINE

We recommend “regular” grade gasoline for all Briggs & Stratton engines. However, the use of lead-free, or low lead, gasolines will result in reduced combustion deposits and normally will improve engine life. Therefore, lead-free, or low lead, gasoline may be used, where available.

We also recommend that gasoline be purchased in small quantities, not more than a 30-day supply.
FRESH gasoline minimizes gum deposits, and also insures a fuel with volatility tailored for the season.

CORRECT LUBRICATION IS IMPORTANT

Any high quality detergent oil having the American Petroleum Institute classification "For Service SC, SD, SE or MS" can be used in Briggs & Stratton engines. Detergent oils keep the engine cleaner and retard the formation of gum and varnish deposits.

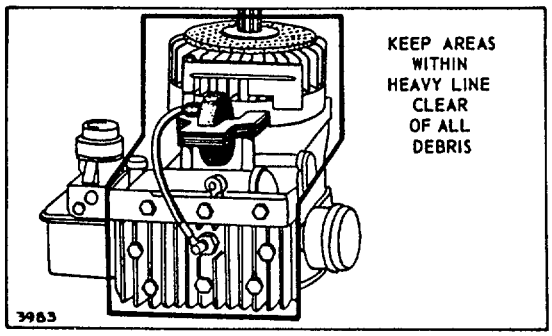
SUMMER	WINTER
(Above 400 F.)	(Under 40° F.)
Use SAE 30	Use SAE 5W-20 or SAE 5W-30
	If not available,
If not available,	Use SAE 10W or SAE 10W-30
Use SAE 10OW-30	
	Below 0° F,
or	Use SAE 10W or SAE 10OW-30
SAE 10W40	Diluted 10% with Kerosene

The oil recommendations are the result of extensive testing. No special additives should be used.

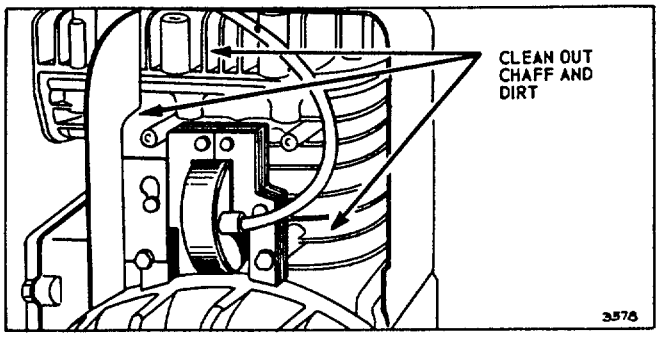
OIL SHOULD BE CHANGED AFTER EACH 25 HOURS OF ENGINE OPERATION. (More often under dirty operating conditions). In normal running of any engine, small particles of metal from the cylinder walls, pistons and bearings will gradually work into the oil. Dust particles from the air also get into the oil. If the oil is not changed regularly, these foreign particles cause increased friction and a grind- ing action which shorten the life of the engine. Fresh oil also assists in cooling, for old oil gradually becomes thick and loses its cooling effect as well as its lubricating qualities. The air cleaner should be serviced every 25 hours of engine operation. Dirty operating conditions re- quire more frequent servicing.

CLEAN COOLING SYSTEM

Grass particles, chaff or dirt may clog the air cooling system, especially after prolonged service in cutting dry grasses. Continued operation with a clogged cooling system may cause severe overheating and possible engine damage. The figures below show the blower housing removed and area to be cleaned. This should be a regular maintenance Operation.



Vertical Crankshaft



Horizontal Crankshaft

TUNE-UP PROCEDURE

A "Tune-Up", see the steps listed below, would normally be performed on relatively new engines brought in for minor difficulties. By performing these steps you will either be sure that the engine is functioning properly or will know what major repairs should be made.

The steps are also covered in the Overhaul Procedure and will normally be performed as a part of the complete overhaul.

STEP NO.	
1.	Remove air cleaner, check for proper servicing.
2.	Check oil level and drain. (Clean fuel tank and lines if separate from carburetor).
3.	Remove blower housing, inspect rope and rewind assembly and starter clutch.
4.	Clean cooling fins and entire engine. Rock flywheel to check compression.
5.	Remove carburetor, disassemble and inspect for wear or damage. Wash in solvent, replace parts as necessary and assemble. Set initial adjustment.
6.	Inspect crossover tube or intake elbow for damaged gaskets.
7.	Check governor blade, linkage and spring for damage or wear, if mechanical also check adjustment.
8.	Remove flywheel, check for seal leakage, both flywheel and PTO sides. Check flywheel key.
9.	Remove breaker cover and check for proper sealing.

STEP NO.	
10.	Inspect breaker points and condenser. Replace or clean and adjust. Check plunger.
11.	Check coil, inspect all wires for breaks, damaged insulation. Be sure lead wires do not touch flywheel. Check stop switch and lead.
12.	Replace breaker cover, use sealer where wires enter.
13.	Install flywheel, time engine if necessary. Set air gap. Check for spark with #19051 tester.
14.	Remove cylinder head, check gasket, remove spark plug, and clean carbon, inspect valves for seating.
15.	Replace cylinder head, torque to specified torque, set spark plug gap or replace plug if necessary.
16.	Replace oil and fuel, check muffler for restrictions or damage.
17.	Adjust remote control linkage and cable if used, for correct operation.
18.	Service air cleaner, check gaskets and element for damage.
19.	Run and adjust mixture and top speed.

OVERHAUL PROCEDURE

The Overhaul Procedure which follows is intended to help you to become accustomed to a systematic method of repairing Briggs & Stratton engines. Naturally these steps could be rearranged in different order but efficiency is obtained when the repair operations are performed in the same sequence every time. The exact procedure will vary according to the engine model being repaired.

The Overhaul Procedure can also be used as an index. For information on how to perform most opera- tions listed, refer to the page number or operation. Be careful to locate the instructions covering the specific model being repaired.

SECTION	PAGE NO.	DISASSEMBLY
8	1	Drain oil
3	1	Air cleaner and stud
		Fuel pipe and tank assembly
		Air cleaner elbow or pipe
		Carburetor and linkage
		Carburetor intake elbow
		Muffler
3	18 & 5	Check space between upper and lower carburetor body or carburetor to tank fit
3	18	Check throttle shaft and bushings for wear
		Disassemble carburetor
7	8 to 40	Electric starter (110 V) (12 V)
		Blower housing
6	1	Spin flywheel to check compression
2	1	Spark plug-adjust gap (.030") and clean and wash
		Fuel tank and bracket assembly or carburetor
2	3	Rope starter pulley
		Blower housing
2	6	Check air gap-armature to flywheel
5	1	Governor blade
8	3	Breather or valve cover
6	1	Cylinder head and shield
6	3	Check tappet clearance
6	2 & 3	Valve and springs
2	3	starter clutch
2	3 & 8	Flywheel
2	6	Breaker point cover
2	2 & 5	Check breaker point gap
2		Check breaker point plunger hole
2	4 & 7	Test condenser and remove if necessary

SECTION	PAGE NO.	DISASSEMBLY (Continued)
2	6	Test coil and remove if necessary
2	5	Breaker arm assembly and condenser
2	8 & 13	Breaker box
2	13	Breaker shaft
10	4 & 5	Check end play
10	1	Remove burrs from crankshaft extension
10	1	Crankcase cover, base or sump
10	7	Auxiliary drive
11	6	Damage seals
5	1 to 7	Mechanical governor parts
8	4	Inspect oil slinger
10	2	Cam gear
		Tappets
9	1	Connecting rod and piston
10	2	Crankshaft-inspect and check
2	12	Armature assembly and back plate
2	11 & 12	Rotor
2	6, 8, 12 & 13	Test coil or armature check leads
11	3	Crankcase cover or sump
10	2	Crankshaft- inspect & check
10	2	
		Cam shaft and gear
10	2	Check automatic spark advance
		Rapport
10	1	Cylinder-check bore, main bearing, valve guides and seats, cylinder bore
9	1	Disassemble connecting rod and piston
9	2 & 3	Check piston, rings, connecting rod, piston pin

SECTION	PAGE NO.	REPAIR
		Clean parts
11	1 & 2	Resize cylinder bore to next oversize
6	3 & 4	Replace valve guide- intake or exhaust
6	2	Reface valves and seats and lap
6	4 to 6	Replace valve seat insert
11	3 to 5	Replace main bearings
11	6	Replace oil seal
2	4	Install breaker point plunger, bushing and plunger in cylinder (Internal breaker)
2	9 & 10	Install breaker point plunger bushing and plunger in cylinder (External breaker)
2	6 & 8	Replace armature and governor blade
2	12 & 13	Replace coil or armature or both
10	3	Replace automatic spark advance, weight and spring
3	17 & 18	Replace throttle shaft bush ing
3	3 to 26	Repair carburetor
7	1, 2, 5 to 7	Replace rewind starter spring and rope
7	3	Starter clutch
11	3	Remove ball bearing and re-assemble to crankshaft

SECTION	PAGE NO.	REASSEMBLE (Continued)
10	3 & 4	Tappets, cam gear, camshaft
	5	Crankshaft and bearing support
	5	Crankshaft, bearing plate adjust crankshaft end play
9	3 & 4	Piston, piston pin, connecting rod, rings
8	4	Oil Slinger
5	1 to 7	Mechanical governor
6	3	Adjust valve tappet clearance
6	2 & 3	Valves, springs, retainer

SECTION	PAGE NO.	REASSEMBLE (Continued)
2	6 & 8	Coil, armature, governor blade
2	5	Breaker points(Internal system)
2	5	Condenser (Internal system)
2	13	Breaker shaft-Magna-Matic
2	13	Primary wire-Magna-Matic
2	8, 9 & 12	Adjust Armature timing
2	7 & 14	Condenser
2	7 & 14	Adjust and clean breaker points (External)
2	6 & 8	Breaker point cover
2	12	Coil and armature assembly
2	11 & 2	Adjust rotor timing
2	7 & 14	Breaker box cover
2	3	Flywheel and starter pulley or clutch
7	8 to 40	Electric starter (110 V)(12 V)
2	6, 8 & 9	Adjust air gap-armature to flywheel
2	1	Check spark
8	3 & 4	Breather or valve cover
6	1	Cylinder head and shield
2	1	Spark plug
		Muffler
		Intake elbow or carburetor and tank
4	1 to 12	Carburetor and linkage and governor controls
5	1	Check air vane governor
5	2 to 7	Check and adjust mechanical governor
		Blower housing
		Fuel filter parts. tank & line
		Air cleaner elbow or pipe
8	1	Fill crankcase with oil
		Start engine (fill with gas)
2	1	Check spark
6	1	Retighten cylinder head screws
3	7 to 27	Adjust carburetor
5	2, 3 & 6	Set governor to obtain correct engine speed (Remote controls)
3	1	Clean, fill, assembly air
		cleaner
		Spray engine and apply decals

CHECK- UP

Most complaints concerning engine operation can be classified as one or a combination of the following:

1. Will not start
2. Hard starting
3. Kicks back when starting
4. Lack of power
5. Vibration
6. Erratic operation
7. Overheating
8. High oil consumption

When the cause of malfunction is not readily apparent, perform a check of the Compression, Ignition and Carburetion Systems. This check- up, performed in a systematic manner, can usually be done in a matter of minutes. It is the quickest and surest method of determining the cause of failure. This check-up will point up possible cause of future failures, which can be corrected at the time. The basic check-up procedure is the same for all engine models, while any variation, by model will be shown under the subject heading.

NOTE: What appears to be an engine malfunction may be a fault of the powered equipment rather than the engine. If equipment is suspect, see Equipment, affecting engine operation.

Check Compression

Spin flywheel in reverse rotation (counterclockwise) to obtain accurate compression check. The flywheel should rebound sharply, indicating satisfactory compression.

If compression is poor, look for -

1. Loose spark plug
2. Loose cylinder head bolts
3. Blown head gasket
4. Burnt valves and/or seats
5. Insufficient tappet clearance
6. Warped cylinder head
7. Warped valve stems
8. Worn bore and/or rings
9. Broken connecting rod

Check Ignition

Remove the spark plug. Spin the flywheel rap- idly with one end of the ignition cable clipped to the 19051 tester and with the other end of the tester grounded on the cylinder head. If spark jumps the .166" tester gap, you may assume the ignition system is functioning satisfactorily. Try a new spark plug.

If spark does not occur look for -

1. Incorrect armature air gap
2 Worn bearings and/or shaft on flywheel side
3. Sheared flywheel key
4. Incorrect breaker point gap
5. Dirty or burned breaker points
6. Breaker plunger stuck or worn
7. Shorted ground wire (when so equipped)
8. Shorted stop switch (when so equipped)
9. Condenser failure
10. Armature failure
11. Improperly operating interlock system

NOTE: If engine runs but misses during opera- tion, a quick check to determine if ignition is or is not at fault can be made by inserting the 19051 tester between the ignition cable and the spark plug. A spark miss will be readily apparent. While conducting this test on Magna-Matic equipped engines, Models 9, 14, 19 and 23, set the tester gap at .060".

Check Carburetion

Before making a Carburation check, be sure the fuel tank has an ample supply of fresh, clean gasoline. On gravity feed (Flo-Jet) models, see that the shut-off valve is open and fuel flows freely thorough the fuel line. On all models, in- spect and adjust the needle valves. Check to see that the choke closes completely. If engine will not start, remove and inspect the spark plug. When plug is wet, look for -

1. Over choking
2. Excessively rich fuel mixture
3. Water in fuel
4. Inlet valve stuck open (Flo-Jet carburetor)

If plug is dry, look for -

1. Leaking carburetor mounting gaskets
2. Gummy or dirty screen or check valve (Pulsa-Jet and Vacu-Jet carburetors)
3. Inlet valve stuck shut (Flo-Jet carburetors)
4. Inoperative pump (Pulsa-Jet carburetors)

A simple check to determine if the fuel is getting to the combustion chamber through the carburetor is to remove the spark plug and pour a small quantity of gasoline through the spark plug hole. Replace the plug. If the engine fires a few times and then quits, look for the same condition as for a dry plug.

Equipment - Effecting Engine Operation

Frequently, what appears to be a problem with engine operations, such as hard starting, vibration, etc., may be the fault of the equipment powered rather than the engine itself. Since many varied types of equipment are powered by Briggs and Stratton engines, it is not possible to list all of the various conditions that may exist. Listed are the most common effects of equipment problems, and what to look for as the most common cause.

Hard Starting, Kickback, or Will Not Start

1. Loose blade - Blade must be tight to shaft or adaptor.
2. Loose belt - a loose belt like a loose blade can cause a back-lash effect, which will counteract engine cranking effort.
3. Starting under load - See if the unit is dis-engaged when engine is started; or if engaged, does not have a heavy starting load.
4. Check remote Choke-A-Matic control assembly for proper adjustment.
5. Check interlock system for shorted wires, loose or corroded connections, or defective modules or switches.

Vibration

1. Cutter blade bent or out of balance - Remove and balance
2. Crankshaft bent - Replace
3. Worn blade coupling - Replace if coupling allows blade to shift, causing unbalance.
4. Mounting bolts loose - Tighten
5. Mounting deck or plate cracked - Repair or replace.

Power Loss

1. Bind or drag in unit - If possible, disengage engine and operate unit manually to feel for any binding action.
2. Grass cuttings build-up under deck.
3. No lubrication in transmission or gear box.
4. Excessive drive belt tension may cause seizure.

Noise

1. Cutter blade coupling or pulley - an over- size or worn coupling can result in knocking, usually under acceleration. Check for fit, or tightness.
2. No lubricant in transmission or gear box.

BRIGGS & STRATTON NUMERICAL MODEL NUMBER SYSTEM

This handy chart explains the unique Briggs & Stratton numerical model designation system. It is possible to determine most of the important mechanical features of the engine by merely knowing the model number. Here is how it works:

A. The first one or two digits indicate the CUBIC INCH DISPLACEMENT.
B. The first digit after the displacement indicates BASIC DESIGN SERIES, relating to cylinder construction, ignition, general configuration, etc.
C. The second digit after the displacement indicates POSITION OF CRANK- SHAFT AND TYPE OF CARBURETOR.
D. The third digit after the displacement indicates TYPE OF BEARINGS and whether or not the engine is equipped with REDUCTION GEAR or AUXILIARY DRIVE.
E. The last digit indicates the TYPE OF STARTER

	FIRST DIGIT AFTER DISPLACEMENT	SECOND DIGIT AFTER DISPLACEMENT	THIRD DIGIT AFTER DISPLACEMENT	FOURTH DIGIT AFTER DISPLACEMENT
CUBIC INCH DISPLACEMENT	**BASIC DESIGN SERIES**	**CRANKSHAFT, CARBURETOR GOVERNOR**	**BEARINGS, REDUCTION GEARS & AUXILIARY DRIVES**	**TYPE OF STARTER**
6 8 9 10 11 13 14 17 19 20 23 24 25 30 32	0 1 2 3 4 5 6 7 8 9	0 - 1 - Horizontal Vacu-Jet 2 - Horizontal Pulsa-Jet 3 - Horizontal (Pneumatic) Flo-Jet (Governor) 4 -Horizontal (Mechanical) Flo-Jet (Governor) 5 - Vertical Vacu-Jet 6 - 6 - Gear Reduction 7 - Vertical FIo-Jet 8 - 8 - Auxiliary Drive 9 - Vertical Pulsa-Jet	0 - Plain Bearing 1 - Flange Mounting Plain Bearing 2 - Ball Bearing 3 - Flange Mounting Ball Bearing 4 - 4 - Elec. Starter-Generator- 12 Volt, -Belt Drive 5 - Gear Reduction (6 to 1) 6 - Alternator Only * (6 to 1) Reverse Rotation 7 - 7 - Electric Starter, 12 Volt Gear Drive, with Alternator 8 - Vertical-pull Starter Perpendicular to Crank shaft 9 - Auxiliary Drive Parallel to Crankshaft	0 - Without Starter 1 - Rope Starter 2 - Rewind Starter 3 - Electric-110 Volt, Gear Drive 5 - Electric Starter Only - 12 Volt, Gear Drive *Digit 6 formerly used for “Wind-Up" Starter on 60000, 80000 and 92000 Series

EXAMPLES

To identify Model 100202:

10	0	2	0	2
10 Cubic Inch	Design Series 0	Horizontal Shaft-Pulsa-Jet Carburetor	Plain Bearing	Rewind Starter

Similarly, a Model 92998 is described as follows:

9	2	9	9	8
9 Cubic Inch	Design Series 2	Vertical Shaft-Pulse-Jet Carburetor	Auxiliary Drive Parallel to Crankshaft	Vertical Pull Starter

Repair Instructions IV (Form 4750)
Section 2
IGNITION

Three basic types of ignition systems are used -

1. MAGNETRON™ ignition, a self-contained transistor module (no moving parts) and ignition armature.

2. A flywheel type, having either an internal or external breaker system. Fig. 4 and Fig. 25.

3. The Magna-Matic system, having the armature and rotor behind the flywheel, and an external breaker system. Fig. 44.

Check Ignition

Remove the spark plug. Spin the flywheel rapidly with one end of the ignition cable clipped to the 19051 tester and with the other end of the tester grounded on the cylinder head. If spark jumps the .166" (4.2 mm) tester gap, you may assume the ignition system is functioning satisfactorily. Fig. 1.

NOTE: Flywheel must rotate at 350 RPM, mini- mum with MAGNETRON™ ignition.

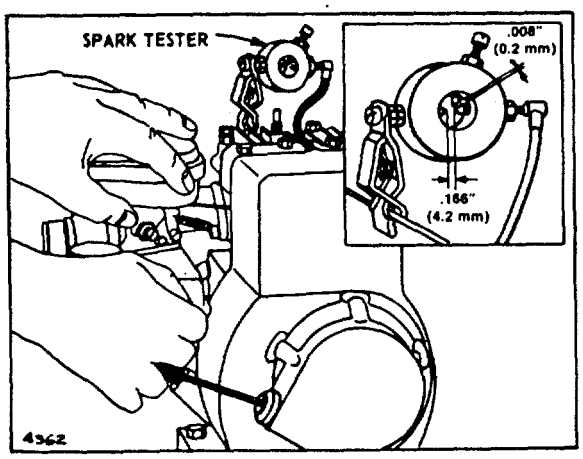


Fig. 1. - Checking Spark

NOTE: If engine runs but misses during operation. a quick check to determine if ignition is or is not at fault can be made by inserting the 19051 tester between the ignition cable and the spark plug. A spark miss will be readily apparent. While conducting this test on Magna-Matic equipped engines, Models 9, 14, 19 and 23, set the tester 'gap at .060" (1.5 mm).

SPARK PLUG

The plugs recommended for Briggs & Stratton engines are as follows:

1-1/2" Plug	2" Plug	Manufacturer's Part Number
CJ-8	J-8	Champion
RCJ-8	RJ-8	Champion Resistor
235	295	Autolite
245	35i6	Autolite Resistor
WS9E	-	Robert Bosch
3/4"	13/16"	Plug wrench (deep socket)

Spark Plug Cleaning
Clean spark plug with a pen knife or wire brush and solvent and set gap at .030" (0.75 mm) for all models. If electrodes are burned away, or the porcelain is cracked, replace with a new plug. DO NOT USE ABRASIVE CLEANING MACHINES. Fig. 2.

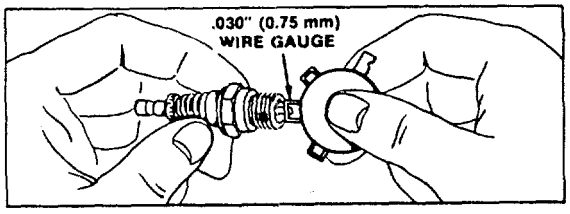


Fig. 2. - Adjusting Spark Plug Gap

Coil and Condenser Testing
All Models

Use an approved tester to test coils and condensers. Specifications are supplied by the tester manufacturer or refer to MS-7862, Testing Briggs & Stratton Ignition Coils.

TABLE NO. 1
SPECIFICATIONS FOR ALL POPULAR ENGINE MODELS

1. **Spark plug gap: .030" (0.75 mm)**
2. **Condenser capacity: .18 to .24 M.F.D.**
3. **Contact point gap: .020" (0.50 mm)**

BASIC MODEL SERIES	ARMATURE				FLYWHEEL PULLER PART NO.	FLYWHEEL NUT TORQUE		
	TWO LEG AIR GAP		THREE LEG AIR GAP					
	Inches	Milli-Meter	Inches	Milli-Meter		Foot Pounds†	Kilo-gram meter†	Newton meter†
92000	.006 .010	0.15 0.25	.012 .016	0.30 0.41	19069	55	† 7.6†	74.6†

IGNITION
MAGNETRON™

The flywheel is located on the crankshaft with a special metal key. It is held in place by a Belleville washer and nut or starter clutch. The flywheel key must be in good condition to assure)roper location of the flywheel for ignition timing. DO NOT use a steel key under any circumstances. Use only the soft metal key, as originally supplied.

The keyway in both flywheel and crankshaft should not be distorted. Flywheels used are made f aluminum, zinc or cast iron.

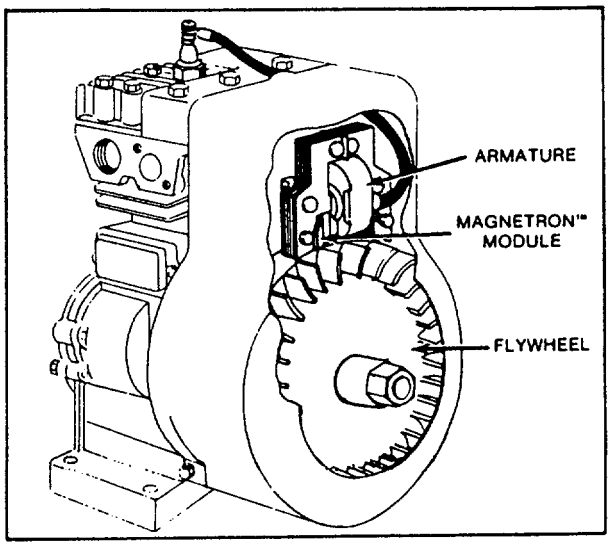


Fig. 3. - MAGNETRON™ Ignition

IGNITION
Flywheel Type - Internal Breaker

The flywheel is located on the crankshaft with a soft metal key. It is held in place by a nut or starter clutch. The flywheel key must be in good condition to insure proper location of the flywheel for ignition timing. DO NOT use a steel key under any circumstances. Use only the soft metal key, as originally supplied.

The keyway in both flywheel and crankshaft should not be distorted. Flywheels used are made of aluminum, zinc or cast iron.

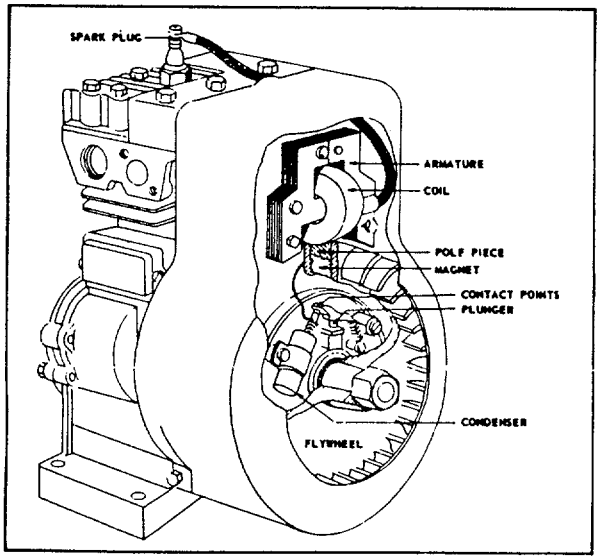


Fig. 4. - Flywheel Ignition Internal Breaker

REMOVING ARMATURE AND MAGNETRON™ IGNITION

The flywheel does not need to be removed to service MIAGNETRON"' except to check keyways and flywheel key.

Remove armature screws and lilt oil' armature. Use breaker point condenser P/N 294628 or 01.3/16" pin punch to release stop switch wire from MAGNETRON™ module. Fig. 5. Stop switch wire is soldered to module and armature primary wires. Unsolder to disconnect.

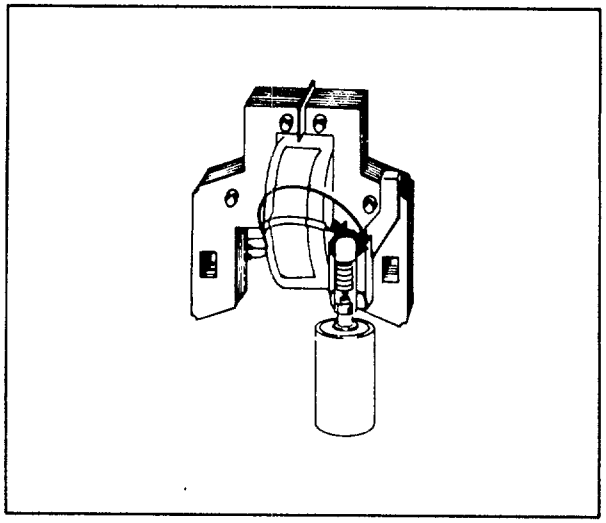


Fig. 5. - MAGNETRON™ Module

REMOVING MAGNIETRON™ MODULE

Unsolder armature ground wire from module wire, Fig. 6. Remove tape and move module ground wire to clear armature coil and laminations. Push module retainer away from laminations and push module off laminations,.

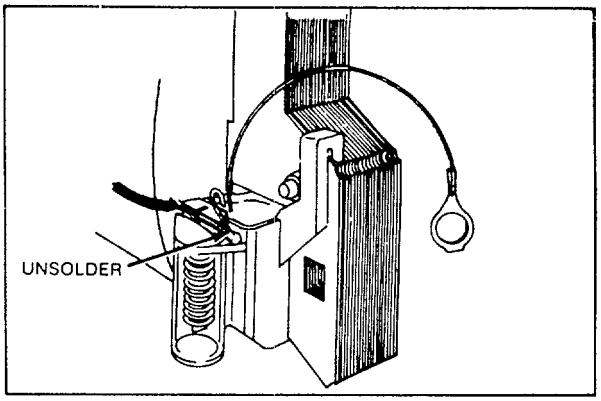


Fig. 6. -

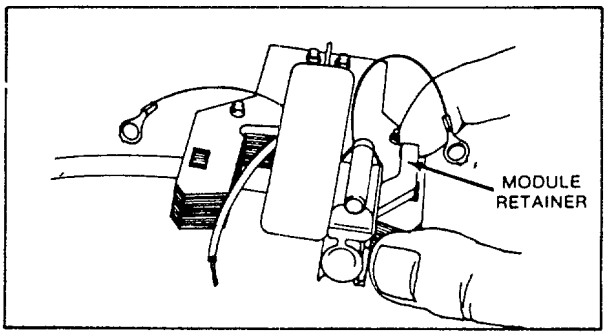


Fig. 7. -

IGNITION
MAGNETRON

INSTALLING MAGNETRONT" MODULE

Module is installed in reverse order of removal. Note that module retainer must be on back side of coil laminations, Fig. 8. Use Permatex'" or similar sealant to hold ground wires in place, Fig. 8.

Ignition timing is controlled by the location of the flywheel and crankshaft keyways on aluminum engines. On cast iron engines, refer to page 9.

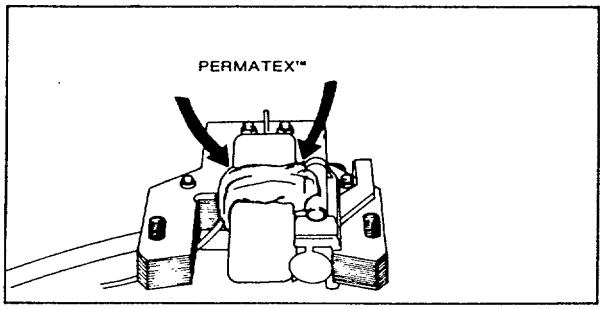


Fig. 8. -

Remove Flywheel Nut or Starter Clutch

On flywheels of 6-3/4" (171 mm) diameter or less, use flywheel holder 19167, to keep flywheel from turning. On rope starter engines. the 1/2" diameter thread flywheel nut is left handed and the 5/8" diameter thread is right handed. Fig. 9. Starter clutch used on rewind and wind-up starter has a right hand thread. Fig. 10. Remove clutch using P/N 19114 starter clutch wrench or P/N 19244 or 19161 1/2" square drive starter clutch wrench.

For flywheels or larger diameter place a block of wood under flywheel fin to prevent flywheel turning while loosening nut or starter clutch. Clamp engine base securely. Fig. 11.

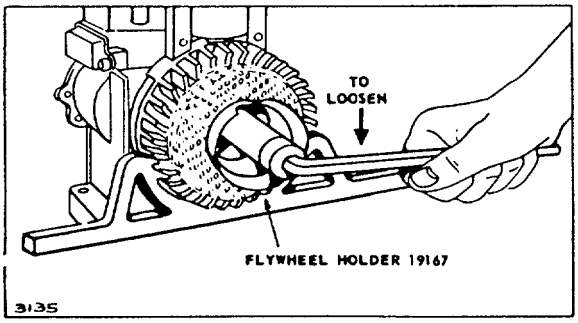


Fig. 9. - Loosen Flywheel, Rope Starter
(1/2" Dia. Threads)

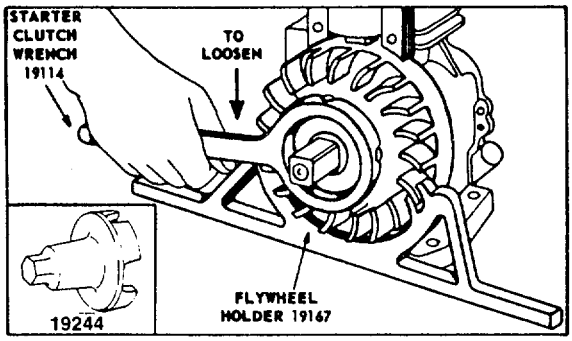


Fig. 10. - Loosening Flywheel
Rewind Starter and Wind-Up Starter Engines

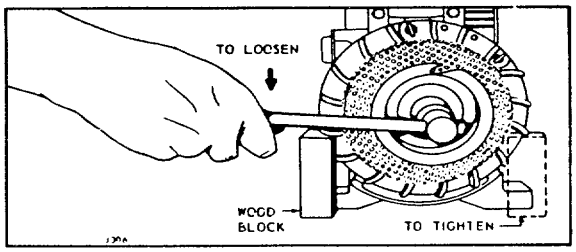


Fig. 11. - Loosening Large Flywheels

Remove Flywheel

Some flywheels have two holes provided for use of a flywheel puller. Use puller shown in Table 1. Leave nut loose on threads of crankshaft for puller to bear against, Fig. 12. Small cast iron flywheels do not require a flywheel puller. See note below.

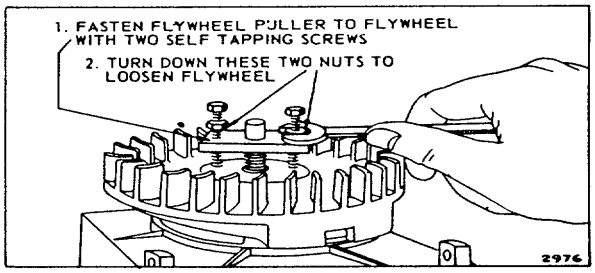


Fig. 12. - Removing Flywheel

NOTE: To remove small cast iron flywheels without puller holes. support the flywheel with a gloved hand. exerting an upward pull. Using a rawhide hammer. strike the outside rim of the flywheel with a sharp blow. Several blows may be required on an extremely tight flywheel.

NOTE: Care is required not to damage the flywheel fins. magnets or ring gear.

Removing Breaker Cover

Care should be taken when removing breaker cover, to avoid damaging cover. If cover is bent or damaged it should be replaced to insure a proper dust seal.

Breaker Points

Breaker point gap on all models is .020" (0.5 mm). Breaker points should be checked for contact and for signs of burning or pitting. Points set too wide will advance spark timing and may cause kick back when starting. Points gapped too close retard spark timing and decrease engine power.

Remove Breaker Points

Breaker point assemblies of style shown in Fig. 13 are removed by removing condenser and armature wires from breaker points clip. Loosen adjusting lock screw and remove breaker point assembly.

Breaker point assemblies of style shown in Fig. 14 are removed by loosening the screw holding the post. The condenser on these models also includes the breaker point. The condenser is removed by loosening the screw holding the condenser clamp.

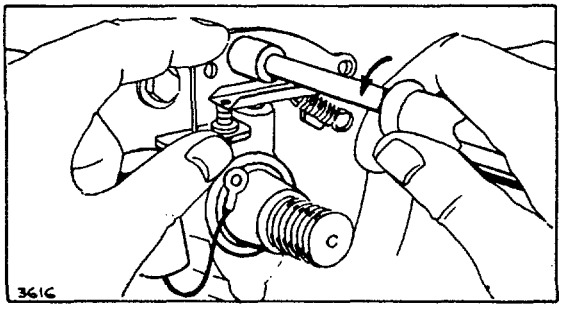


Fig. 13. - Breaker Point Assemblies

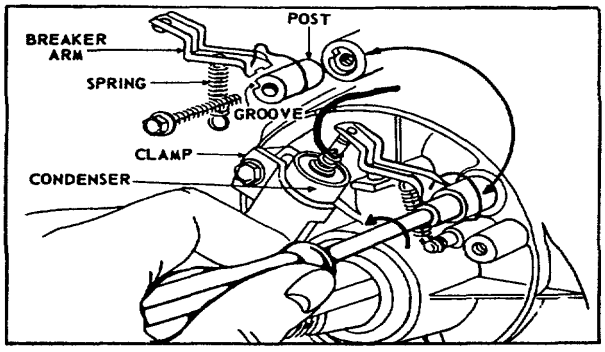


Fig. 14. - Breaker Point Assemblies

Check Breaker Point Plunger Hole

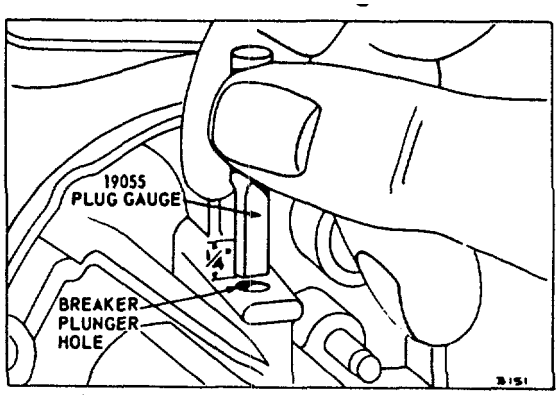


Fig. 15. - Checking Breaker Plunger Hole

If the breaker point plunger hole becomes worn excessively, oil will leak past the plunger and may get on the points, causing burning. To check, loosen breaker point mounting screw and move breaker points out of the way. Remove plunger. If the flat end of the 19055 plug gauge will enter the plunger hole for a distance of 1/4" (6.35 mm) or more, the hold should be rebushed. Fig. 15.

Install Breaker Point Plunger Bushing

To install the bushing, it is necessary that the breaker points, armature, crankshaft and starter be removed. Use reamer 19056, to ream out the old plunger hole. See Fig. 16. This should be done by hand. The reamer should be in alignment with the plunger hole. Drive the bushing 23513, with driver 19057 until the upper end of the bushing is flush with the top of the boss. Fig. 16. Finish ream the bushing with reamer 19058. All reaming chips or dirt must be removed.

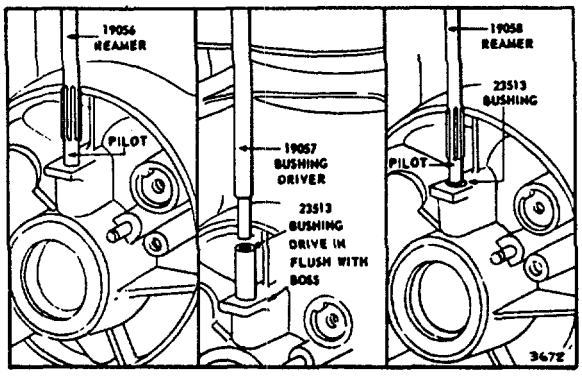


Fig. 16.- Installing Breaker Plunger Bushing

IGNITION
Flywheel Type - Internal Breaker

Breaker Point Plunger

If the breaker point plunger is worn to a length of .870" (22.1 mm) or less, it should be replaced. Plungers must be inserted with groove at the top when installed or oil will enter breaker box. See Fig. 17.

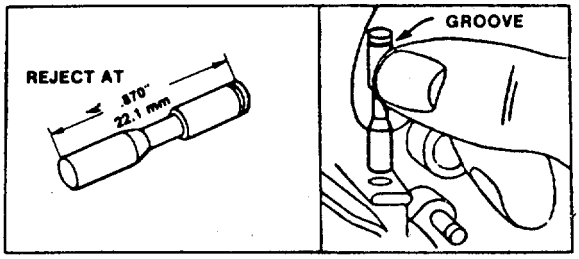


Fig. 17.

Install Breaker Points

Insert breaker plunger into the plunger hole in cylinder. Breaker points as shown in Fig. 14 are installed by placing the mounting post of the breaker arm into the recess in the cylinder so that the groove in the post fits the notch in the recess. Tighten the mounting screw securely. Use a 1/4" spinner wrench if available. Slip the open loop of breaker arm spring through the two holes in the arm, then hook closed loop of spring over the small post protruding from the cylinder. Push flat end of the breaker arm into the groove in the mounting post. This places tension on the spring and pulls arms against the plunger. If condenser post is threaded, attach the coil primary wire (and ground wire if furnished) with the lockwasher and nut. If primary wire is fastened to condenser with spring fastener, compress spring. Fig. 18, and slip primary wire (and ground wire where furnished) into hole in condenser post. Release spring. Lay the condenser in place and tighten the condenser clamp securely.

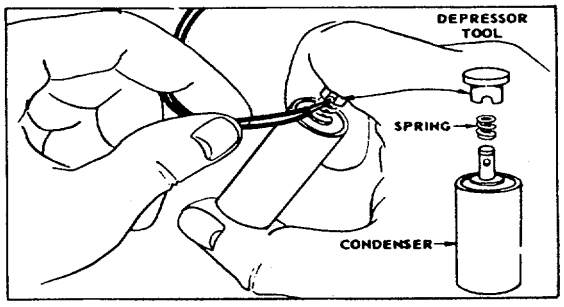


Fig. 18. -Assembling Condenser and Ignition Wires

When installing breaker point assemblies, as shown in Fig. 13, be sure the small boss on the magneto plate enters the hole in the point bracket. Mount points to magneto plate or cylinder with lock screw. Fasten the armature lead wire to the breaker points with the clip and screw. If these lead wires do not have terminals, the bare end of the wires can be inserted into the clip and screw tightened to make a good connection. Do not let the ends of the wire touch the point bracket or magneto plate or ignition will be grounded.

Adjusting Breaker Point Gap

Turn crankshaft until points open to widest gap. When adjusting breaker point assemblies as shown in Fig. 19, move condenser forward or backward with screw driver until a gap of .020" (0.5 mm) is obtained. Breaker points assemblies as shown in Fig. 20, are adjusted by loosening lock screw and moving contact point bracket up or down. Gap is .020" (0.5 mm).

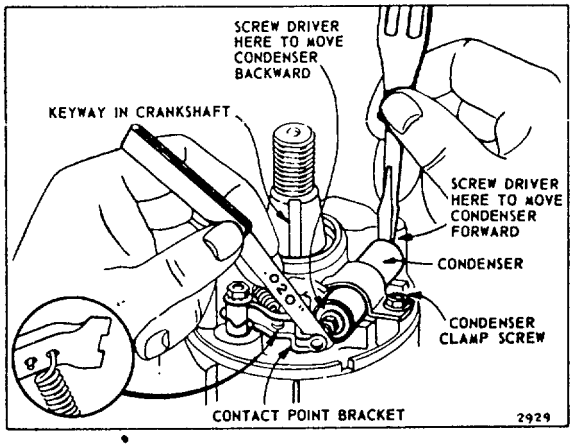


Fig. 19. - Adjusting Breaker Point Gap

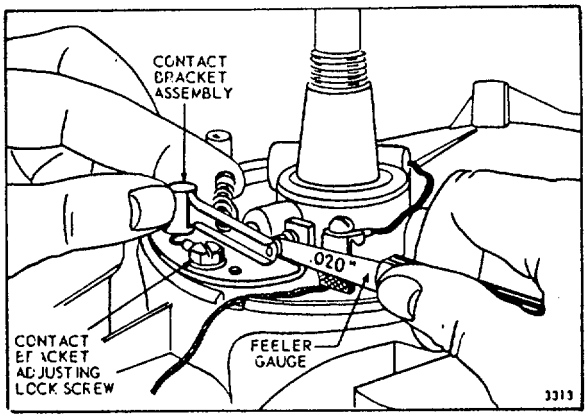


Fig. 20. - Adjusting Breaker Point Gap

NOTE: Always clean breaker points after adjustment. Open the points and insert a piece of lintless paper. Draw the paper through the points. Open points when removing paper so it will not tear, leaving paper between the points.

Breaker Point Cover

The breaker point cover, Fig. 21, protects the points from dirt. The opening for the primary and/or ground wire should be sealed with No. 2 Permatex'" or similar sealer to prevent dirt from entering the breaker box. Cover should not be distorted so as to lose its seal around the outer edge. Replace if damaged.

NOTE: Engines used for winter applications use vented breaker covers. See Engine Parts List.

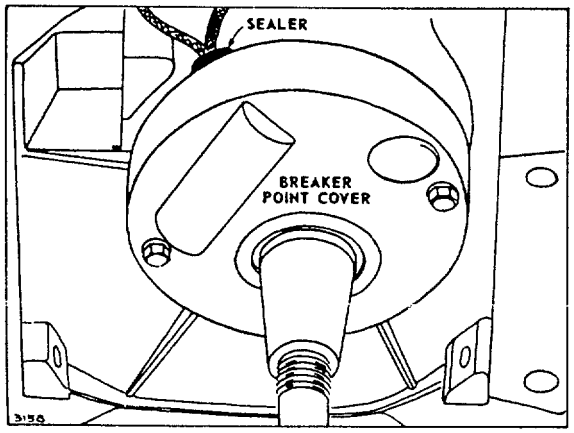


Fig. 21. - Breaker Point Cover

Install Armature

Install governor blade and armature, Fig. 22. The mounting holes in the armature laminations are slotted. Push armature up as far as possible and tighten one mounting screw to hold armature in place.

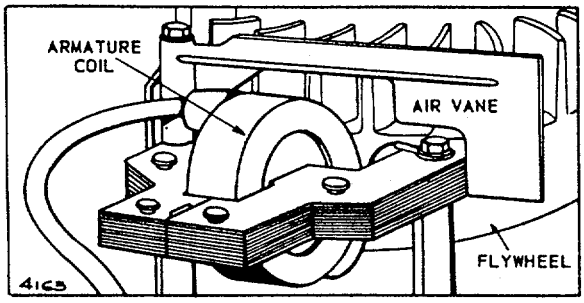
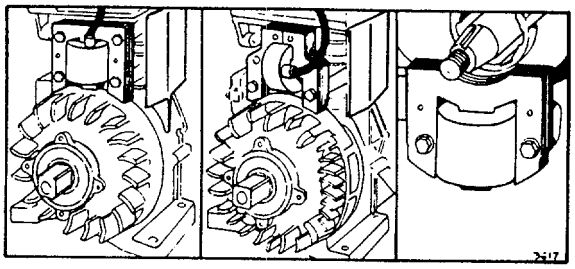


Fig. 22. - Install Armature and Governor Blade

Adjust Armature Air Gap

Three styles of armatures have been used (Fig. 23, Illus. 1, 2 and 3). Set air gap between the flywheel and armature as shown in Table 1. With armature up as far as possible, and one screw tightened, slip the proper gauge between armature and flywheel. Fig. 24. Turn flywheel until magnets are directly below the armature. Loosen the one mounting screw and the magnets should pull the armature down firmly against the thickness gauge. Then tighten the mounting screws.



Illus. 1 Illus. 2 Illus 3.

Fig. 23. - Armature Style Variations

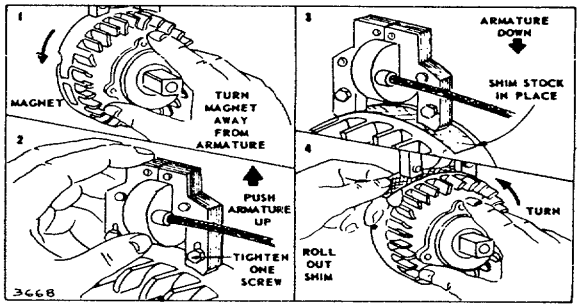


Fig. 24. - Adjusting Armature Air Gap

FLYWHEEL KEY

Inspect key for partial shearing. If sheared, replace. Check flywheel and crankshaft keyways for damage. If damaged, replace with new parts.

Install Flywheel, Nut and/or Starter Clutch

Remove all oil or grease, clean flywheel hole and tapered end of crankshaft before assembling flywheel to shaft. Insert zinc key into keyway. Slip spring washer over crankshaft with hollow side toward flywheel. To tighten flywheel nut or starter clutch, reverse removal operation. See "Remove Flywheel Nut or Starter Clutch." Torque to specifications; listed in Table No. 1.

Section 3
CARBURETION

AIR CLEANERS

A properly serviced air cleaner protects the internal parts of the engine from dust particles in the air. If the air cleaner instructions are not carefully followed, the dirt and dust which should be collected in the cleaner, will be drawn into the engine and become a part of the oil film, which is very detrimental to engine life; dirt in the oil forms an abrasive mixture which wears the moving parts, instead of protecting them. No engine can stand up under the grinding action which takes place when this occurs. The air cleaner on every engine brought in for a check up or repair should be examined and serviced. If the cleaner shows signs of neglect, show it to the customer before cleaning, and instruct him on proper care to assure long engine life.

NOTE: Replace air cleaner gaskets and mounting gaskets that are worn or damaged, to prevent dirt and dust entering engine through improper sealing. Straighten or replace bent mounting studs.

Service Oil Foam Air Cleaner

Clean and re-oil air cleaner element every 25 hours or at three month intervals under normal conditions. The capacity of the "Oil Foam" air cleaner is adequate for a full season's use without cleaning in average homeowner lawn mower service. (Clean every few hours under extremely dusty conditions.) See Figures 1 and 2.

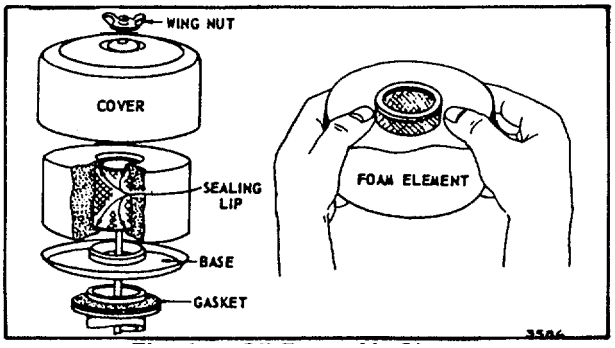


Fig. 1. - Oil Foam Air Cleaner

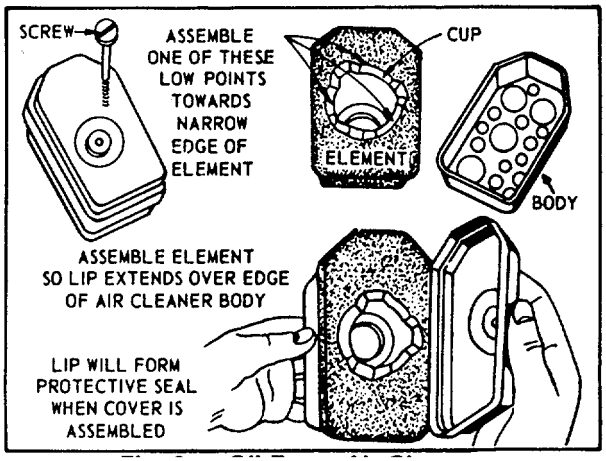


Fig. 2. - Oil Foam Air Cleaner

OIL FOAM AIR CLEANER (Figs. 1 and 2)

1. Remove screw o' wing nut.
2. Remove air cleaner carefully to prevent dirt from entering carburetor.
3. Take air cleaner apart and clean.
   a. WASH foam element in kerosene or liquid detergent and water to remove dirt.
   b. Wrap foam in cloth and squeeze dry.
   c. Saturate foam with engine oil. Squeeze to remove excess oil.
4. Reassemble parts and fasten to carburetor securely with screw or wing nut.

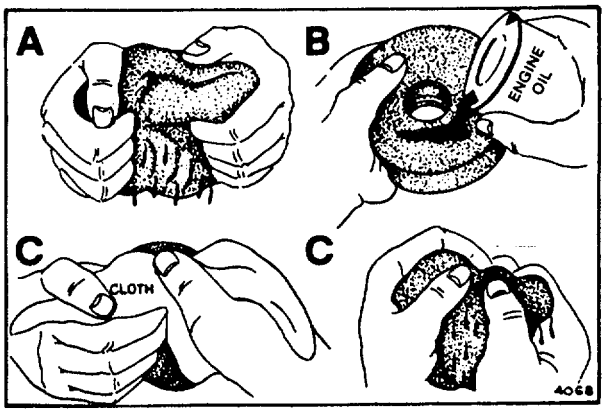
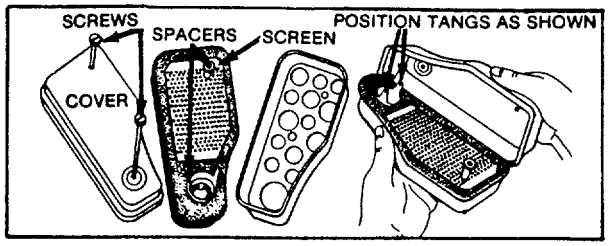
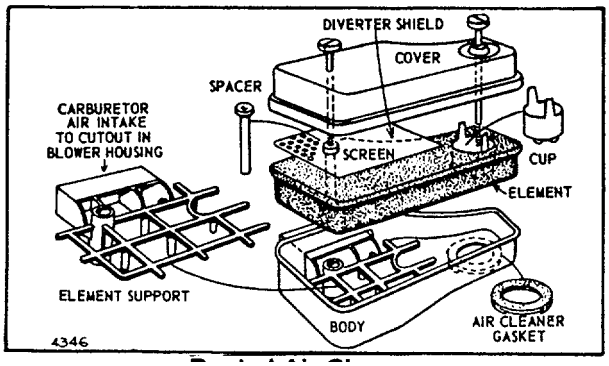


Fig. 3. - Cleaning Air Cleaner

CARBURETION
Air Cleaners
OIL FOAM AIR CLEANER VARIATIONS



Standard Air Cleaner



Ducted Air Cleaner

DUAL ELEMENT AIR CLEANER

Clean and re-oil foam pre-cleaner at three month intervals or every 25 hours, whichever occurs first.

NOTE: Service more often under dusty conditions.

1. Remove knob and cover.
2. Remove foam pre-cleaner by sliding it off of the paper cartridge.
3. a. Wash foam pre-cleaner in kerosene or liquid detergent and water.
   b. Wrap foam pre-cleaner in cloth and squeeze dry.
   c. Saturate foam pre-cleaner in engine oil. Squeeze to remove excess oil.
4. Install foam pre-cleaner over paper cartridge. Reassemble cover and screw knob down tight.

Yearly or every 100 hours, whichever occurs first, remove paper cartridge. Service more often if necessary. Clean by tapping gently on flat surface. If very dirty, replace cartridge, or wash in a low or non-sudsing detergent and warm water solution. Rinse thoroughly with flowing water from inside until water is clear. Cartridge must be allowed to stand and air dry thoroughly before using.

CAUTION: Petroleum solvents, such as kerosene, are not to be used to clean cartridge. They may cause deterioration of the cartridge. DO NOT OIL CARTRIDGE. DO NOT USE PRESSURIZED AIR TO CLEAN OR DRY CARTRIDGE.

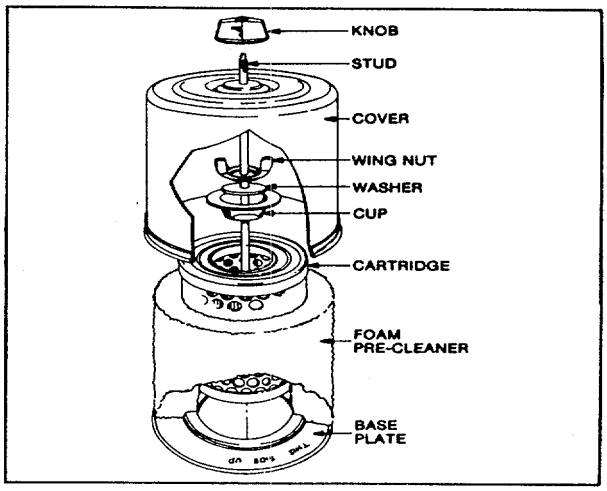


Fig. 4.

CARTRIDGE TYPE

To clean - tap cartridge (top or bottom) on flat surface or wash in non-sudsing detergent and flush from inside until water is clear. After washing, air dry thoroughly before using. DO NOT OIL. Fig. 5.

CAUTION: Petroleum solvents, such as kerosene, are not to be used to clean cartridge. They may cause deterioration of the cartridge. DO NOT OIL CARTRIDGE. DO NOT USE PRESSURIZED AIR TO CLEAN OR DRY CARTRIDGE.

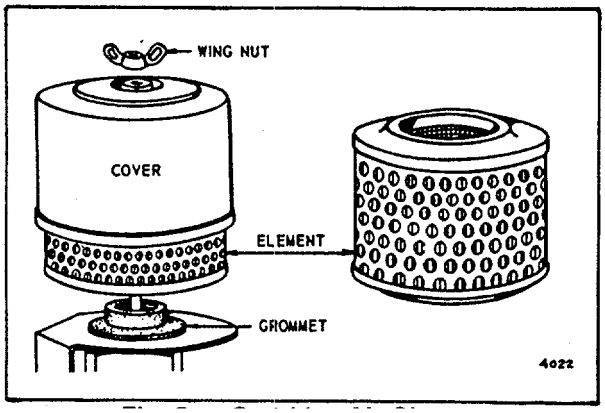


Fig. 5. - Cartridge Air Cleaner

CARTRIDGE AIR CLEANER - REVERSE AIR FLOW

1. Remove air cleaner stud, screw and gasket. Replace gasket if damaged.

2. Remove plate screw, washer and plate.

3. Remove cartridge and clean air cleaner body carefully to prevent dirt from entering carburetor. Brush dirt from body through holes into duct.

4. Clean cartridge by tapping gently on flat surface.

   a. If very dirty, replace cartridge or wash in a low or non-sudsing detergent and warm water solution.

   b. Rinse thoroughly from OUTSIDE IN until water is clear.

   c. Cartridge must be allowed to stand and air dry thoroughly before using.

5. Re-assemble air cleaner. Fig. 6.

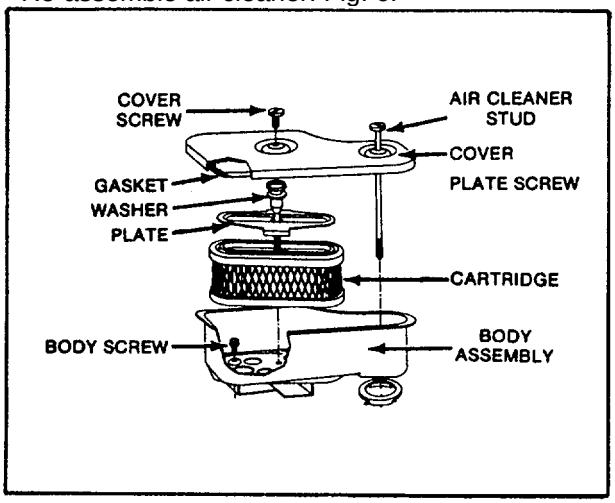


Fig. 6. - Cartridge Air Cleaner

CAUTION: Petroleum solvents, such as kerosene, are not to be used to clean cartridge. They may cause deterioration of the cartridge. DO NOT OIL CARTRIDGE. DO NOT USE PRESSURIZED AIR TO CLEAN OR DRY CARTRIDGE.

SERVICE OIL BATH AIR CLEANER

Pour out old oil from bowl. Wash element thoroughly in solvent and drain dry. Clean bowl and refill with same type of oil used in crankcase. See Fig. 7.

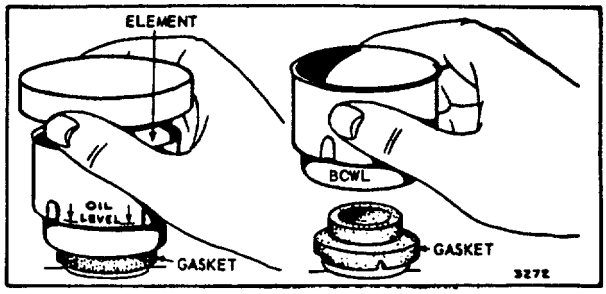


Fig. 7. - Oil Bath Air Cleaner

THREE BASIC CARBURETOR STYLES

There are three styles of carburetors used on Briggs & Stratton engines. Page 3 and 4, Fig. 8. Compare the carburetor to be repaired with the illustrations to determine style of carburetor and refer to that section for repair information.

Before removing any carburetor for repair, look for signs of air leakage, or mounting gaskets that are loose, have deteriorated, or are otherwise damaged.

Note position of governor springs, governor link, remote control or other attachments to facilitate re-assembly. Do not bend the links or stretch the spring. (Section 4 illustrates popular engine models.)

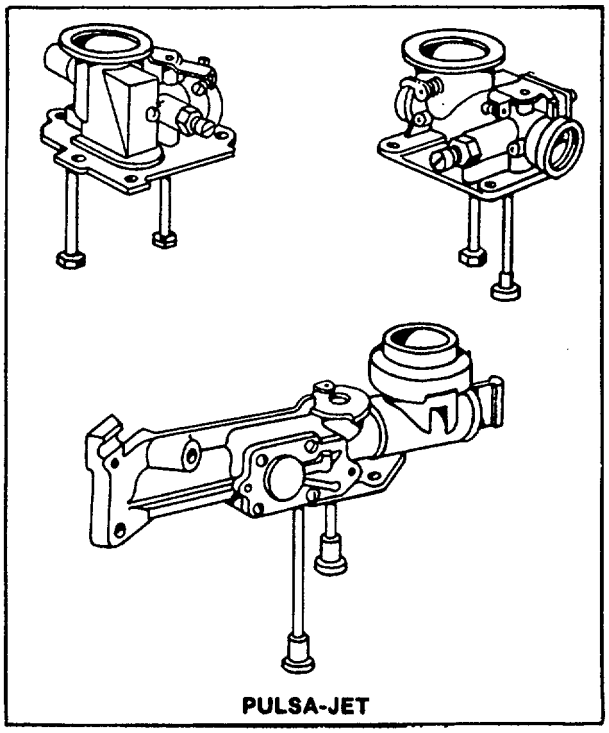
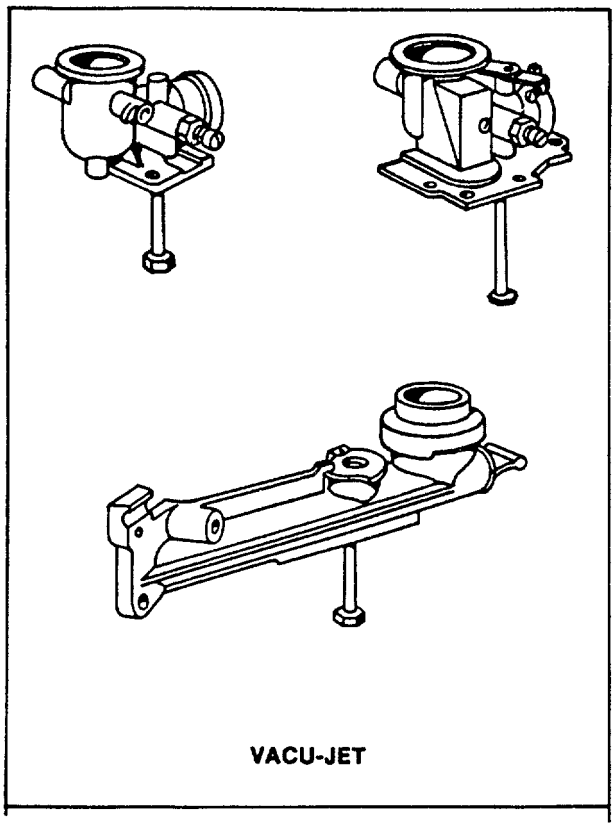


Fig.8. - Style of Carburetors



AUTOMATIC CHOKE
MODEL SERIES 9:2000

The automatic choke operates in conjunction with engine vacuum, similar to the Pulsa-Jet fuel pump.

A diaphragm under the carburetor is connected to the choke shaft by a link. See Fig. 9. A calibrated spring under the diaphragm holds the choke valve closed when the engine is not running.

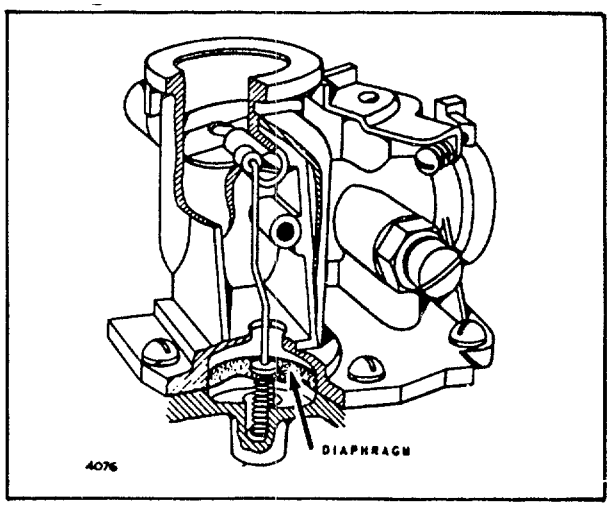


Fig. 9. - Automatic Choke System

Upon starting, vacuum created during the intake stroke is routed to the! bottom of the diaphragm, through a calibrated passage, thereby opening the choke.

This system also has the ability to respond similar to an acceleration pump. As speed decreases during heavy loads, the choke valve partially closes enriching the mixture, thereby improving low speed performance and lugging power.

The automatic choke can easily be checked to determine if it is or is not functioning properly.

1. Remove the air cleaner and replace the stud. Observe the position of the choke valve; it should be fully closed.

2. Move the speed control to the stop position; the governor spring should be holding throttle in a closed position. Pull the starter rope rapidly. The choke valve should alternately open and close.

3. If the engine can be started, run for 2 or 3 minutes, at a normal operating speed. Check to be sure fuel tank is 1/2 full of fuel. Then, open the needle valve to be sure the mixture can be made too rich. Next close the needle valve to be sure the mixture can be made too lean. Adjust needle valve to midpoint between too rich and too lean.

   Allow engine to run at idle speed for 3 to 5 minutes. Again, close needle valve; the mixture should become so lean the engine will stop. If the engine continues to run at idle with the needle valve closed, a fuel leak is occuring at one of the following areas: Check items 2D, 2H, 21, 2J and 2K.

If the choke valve does not react as stated in Steps 1, 2 and 3, the carburetor will have to be disassembled to determine the problem. (See Repair Procedure below).

The following list is given to aid you in checking the performance of the Automatic Choke Carburetion System.

1. Engine Appears to be Under-Choked -

A. Carburetor adjusted too lean
B. Fuel pipe check valve inoperative (Vacu-Jet only)
C. Bent air cleaner stud
D. Sticking choke shaft due to dirt, etc.
E. Choke spring damaged or too short (See Repair Procedure)
F. Diaphragm not preloaded (See Repair Procedure)

2. Engine Appears to be Over-Choked -

A. Carburetor adjusted too rich
B. Bent air cleaner stud
C. Sticking choke shaft due to dirt, etc.
D. Ruptured diaphragm
E. Vacuum passage restricted
F. Choke spring distorted, stretched, etc.
G. Gasoline or oil in vacuum chamber
H. Leak between link and diaphragm
I. Diaphragm folded during assembly, causing vacuum leak
J. Machined surface on tank top not flat (See Repair Procedure)
K. Needle valve seat loose

REPAIR PROCEDURE

Inspect the automatic choke for freeness of operation. Any sticking problems should be corrected, as proper choke operation depends on freedom of the choke to travel as dictated by engine vacuum.

Repair procedures specific to the automatic choke are as follows:

Remove the carburetor and fuel tank assembly from the engine. The choke link cover may now be removed and the choke link disconnected from the choke shaft. Disassemble carburetor from tank top, using care to insure diaphragm is not damaged.

CHECKING DIAPHRAGM AND SPRING

The diaphragm is suitable for further use, provided it has not developed wear spots or punctures. (On Pulsa-Jet models check to insure fuel pump valves are not damaged.) Also check choke spring length. The Pulsa-Jet spring minimum length is 1-1/8" -maximum 1-7/32" and the Vacu-Jet spring minimum length is 15/16" - maximum 1". NOTE: On Model 110900 and 111900 choke spring minimum length is 1-5/16"; maximum 1-3/8". If spring length is shorter or longer than specified, replace diaphragm and spring.

CHECKING TANK TOP

The machined surface on the top of the fuel tank must be flat in order for the diaphragm to provide an adequate seal between the carburetor and tank. If the machined surface on the tank is not flat, it is possible for gasoline to enter the vacuum chamber by passing between the machined surface and diaphragm. Once fuel has entered the vacuum chamber, it can move through the vacuum passage and into the carburetor. The flatness of the machined surface on the tank top can be checked by straight edge and feeler gauge, as shown in Fig. 10. A .002" feeler gauge should not enter between the straight edge and machined surface, when checking at the shaded areas depicted in the drawing. Replace tank if gauge enters. NOTE: STRAIGHT EDGE MUST BE ACCURATE.

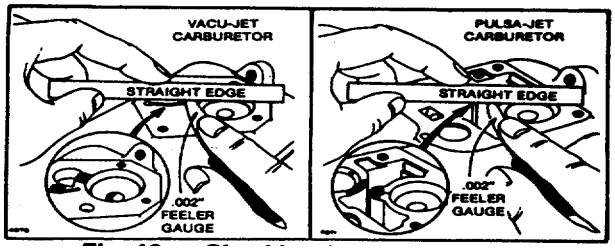


Fig. 10. - Checking Tank Top Flatness

Repair Kit #391413 may be used to repair Pulsa-Jet fuel tanks which are not flat. Install roll pin and teflon washer as shown in Fig. 11.

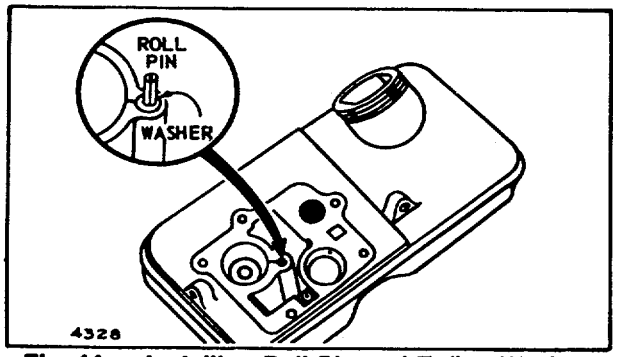


Fig. 11. - Installing Roll Pin and Teflon Washer

If needed, repair of the fuel metering and supply system may now be undertaken as shown on pages 9 and 10.

If a new diaphragm is being installed, assemble choke spring to diaphragm, as shown in Fig. 12. Be careful not to bend or distort the spring.

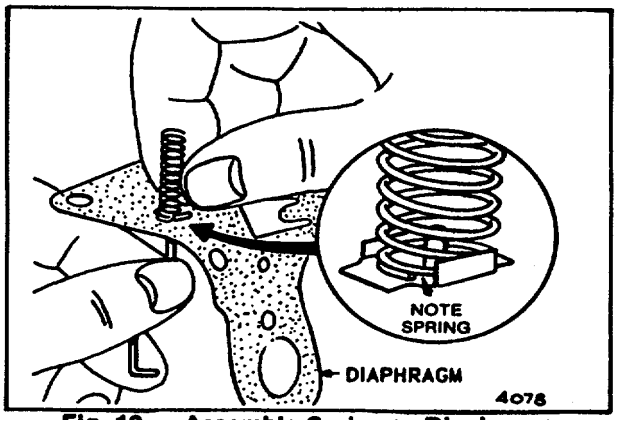


Fig. 12. - Assemble Spring to Diaphram

Holding carburetor body upside down, place diaphragm on body while guiding choke link thru hole for link. On Pulsa-Jet carburetor, have pump spring and cap in fuel pump well, Fig. 13.

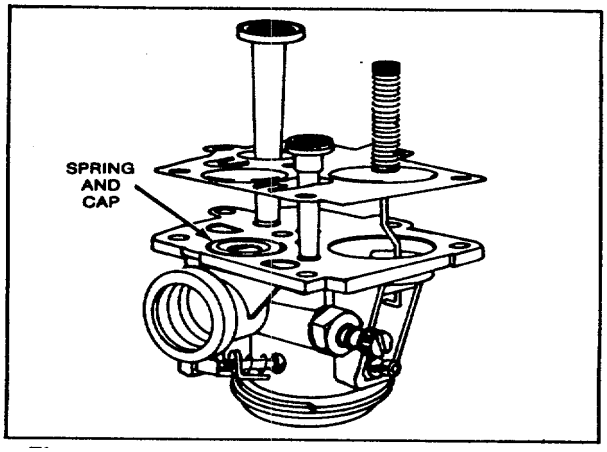


Fig. 13. - Locating Diaphram on Carburetor

Lower tank down onto carburetor, while guiding choke spring into spring well, Fig. 14. Holding carburetor and body together, turn assembly right side up. Thread carburetor mounting screws into tank top about two (2) turns. DO NOT TIGHTEN.

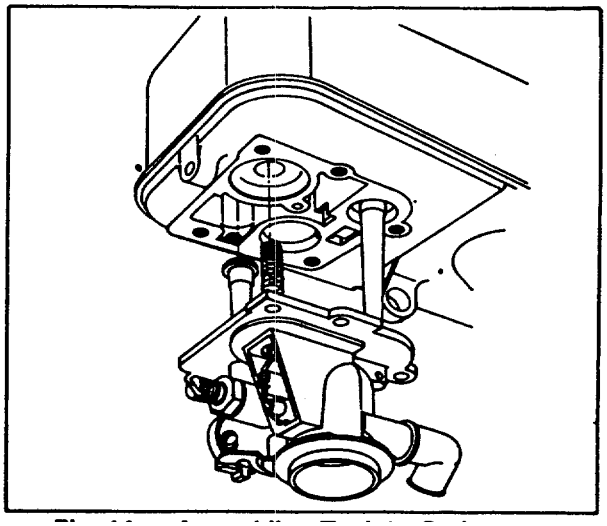


Fig. 14. - Assembly Tank to Carburetor

Close choke valve, insert choke link into choke shaft as shown. Fig. 15.

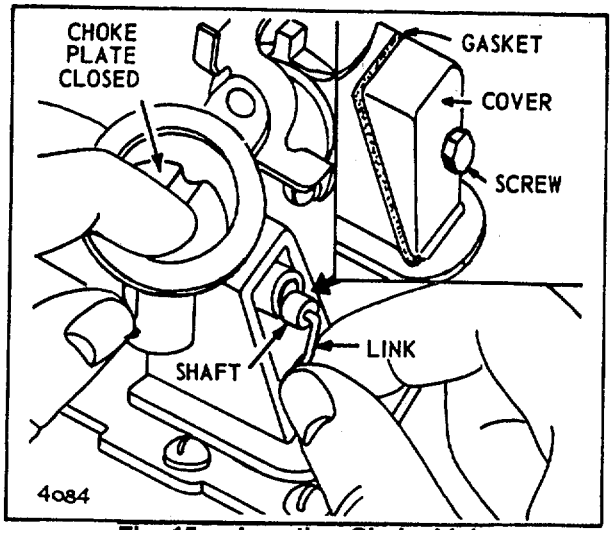


Fig. 15. - Inserting Choke Link

Move choke plate to an over center position as shown in Fig. 16. Tighten carburetor mounting screws in a staggered sequence. Please note-Opening the choke to an over center position places the diaphragm in a preloaded condition.

Move choke plate to a normal position. Choke plate should now fully close, Fig. 16.

If choke valve is not fully closed, check to be sure choke spring is properly assembled to diaphragm, and also properly inserted in its pocket in the tank top. Install choke link cover and gasket.

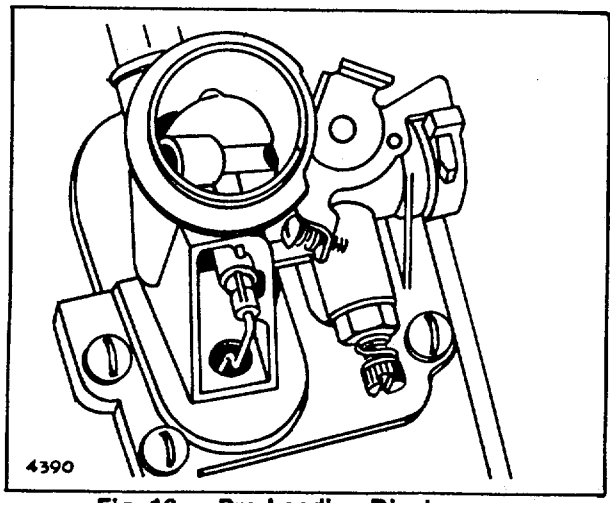


Fig. 16. - Pre-Loading Diaphram

All carburetor adjustment should be made with the air cleaner on engine. Best adjustment is made with a fuel tank half full of gasoline.

To Adjust Carburetor:

1. Start engine and run long enough to warm it to operating temperature.

   NOTE: If engine is out of adjustment so that it will not start, close the needle valve by turning it clockwise. Then open needle valve 1-1/2 turns counterclockwise. Fig. 17.

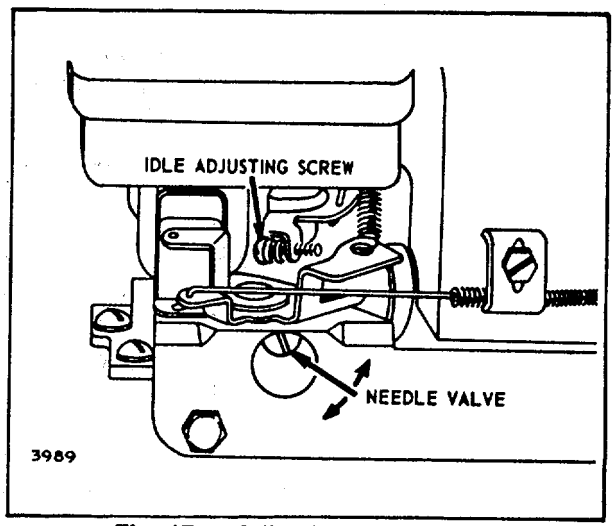


Fig. 17. - Adjusting Carburetor

2. Move speed control lever to run engine at normal operating speed.
   a. Turn needle valve in clockwise until engine starts to lose speed (lean mixture).
   b. Then slowly turn needle valve out counter-clockwise past the point of smoothest operation until engine just begins to run unevenly (rich mixture).
   c. Turn needle back clockwise to midpoint (smoothest operation) between rich and lean mixture.
   d. Final adjustment of the needle valve should be at the midpoint between rich and lean.

3. Move engine to SLOW. Turn idle adjusting screw until a fast idle is obtained - 1750 R.P.M.

   If the engine idles at a speed lower than 1750 R.P.M., it may not accelerate properly. It is not practical to attempt to obtain acceleration from speeds below 1750 R.P.M., since the richer mixture which would be required, would be too rich for normal operating speeds.

4. To check adjustment move engine control from SLOW to FAST speed. Engine should accelerate smoothly. If engine tends to stall or die out, increase idle speed or re-adjust carburetor, usually to a slightly richer mixture.

   NOTE: Flooding can occur if the engine is tipped at an angle for a prolonged period of time, if the engine is cranked repeatedly when the spark plug wire is disconnected or if carburetor mixture is adjusted too rich.

   In case of flooding, move the governor control to the "Stop" position and pull the starter rope at least six times. (Crank electric starter models for at least 5 seconds.)

   When the control is placed in the "Stop" position the governor spring holds the throttle in a closed (idle) position. Cranking the engine with a closed throttle creates a higher vacuum which opens the choke rapidly, permitting the engine to clear itself of excess fuel.

   Then move the control to "Fast" position and start engine. If engine continues to flood, lean carburetor needle valve - 1/8 to 1/4 turn clockwise or see page 5.

If the engine on a mower with a high-inertia disc type cutter blade becomes hard starting when the engine is warm, a leaner carburetor mixture may be required.

A heavy, high-inertia disc type cutter blade rotates for a longer period of time, after the governor control is placed in the STOP position. During this "coasting" period, the engine continues to induct the fuel-air mixture, even when the choke is open. If the carburetor mixture is too rich, the warm engine may flood and become hard starting. If the original carburetor adjustment has not been changed, turn the needle valve clockwise (leaner) approximately 1/8 turn. If the original carburetor adjustment has been changed, follow previous adjustment procedure paragraph No. 2 - A, B and C, then adjust 1/8 turn leaner.

Cleaning Fuel System

Gummy or dirty fuel tanks, lines and carburetors should be cleaned in a carburetor cleaner, such as Bendix. Do not soak diaphragms or nylon parts in cleaner.

MODEL SERIES 92000

Model Series 92900, have a Pulsa-Jet carburetor.

Remove carburetor and fuel tank assembly mounting bolts, Fig. 18.

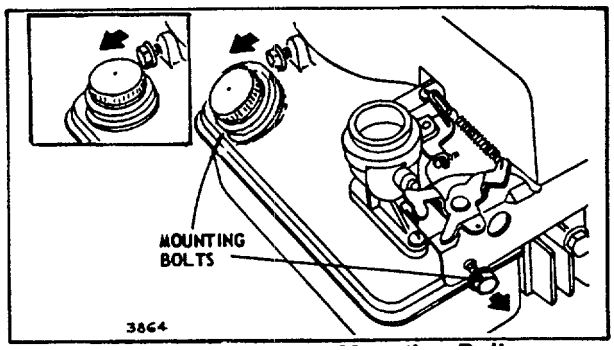


Fig. 18. - Removing Mounting Bolts

Slip carburetor and fuel tank assembly off end of. fuel intake tube and turn assembly to free throttle link from throttle lever. This will leave governor link and governor spring connected to the governor blade and control lever, Fig. 19.

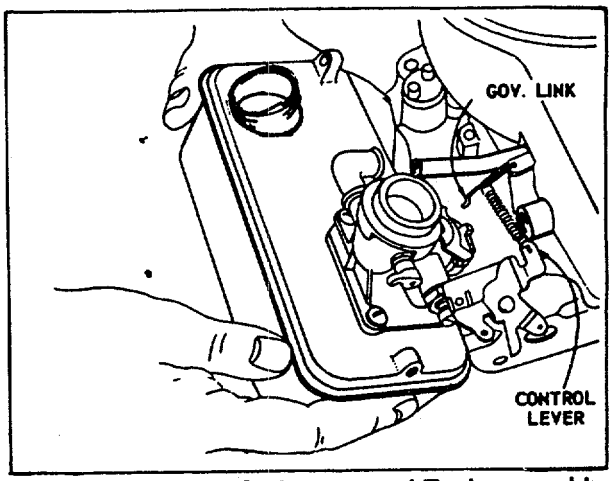


Fig. 19. - Remove Carburetor and Tank Assembly

Carburetor Repair -
Pulsa-Jet,

Removing Carburetor,
Model Series 92000,

Automatic Choke

Remove screws holding carburetor on tank body. On Model Series 110900 and 111900 a mounting screw is located under the choke valve. To gain access to the screw, open the choke valve completely. Use a #2 Phillips head screwdriver to remove the screw, Fig. 21. Then lift carburetor straight' up. Remove pump spring, spring cup and diaphragm.

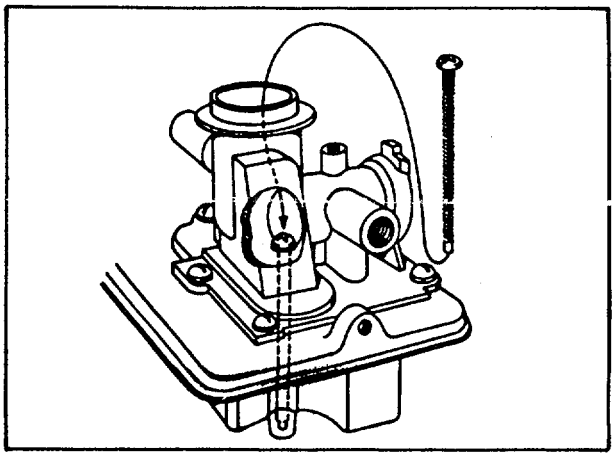


Fig. 21. - Screw Under Choke Valve

Minion Carburetor Body

Remove and discard "O" ring. Remove needle and seat assembly by backing out mixture adjusting needle about 4 to 5 turns counterclockwise. Then pull needle and seat assembly out. Remove inner "0" ring. Metering holes in carburetor body should be cleaned with solvent an'd compressed air. CAUTION: Commercial carburetor cleaners will soften or dissolve Minlon bodies, if left in for long periods of time. DO NOT EXCEED 15 MINUTES. DO NOT ALTER SIZE OF METERING HOLES, Fig. 23.

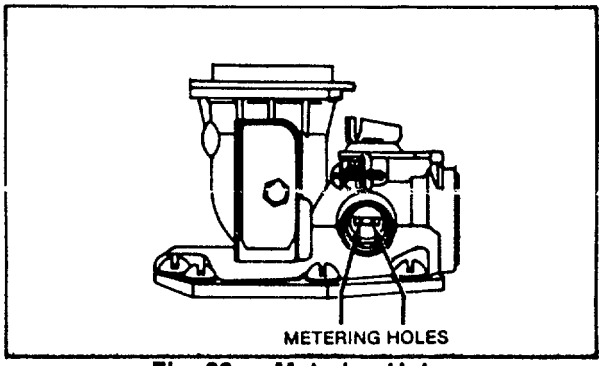


Fig. 23. - Metering Holes

Always remove all nylon and rubber parts if carburetor is cleaned in solvent.

Removing Nylon Choke and Shaft

Automatic Choke, Model Series 92000,

To remove choke parts, first remove automatic choke link cover. Then slide choke link out choke shaft lever. Pull shaft out of valve, Fig. 26.

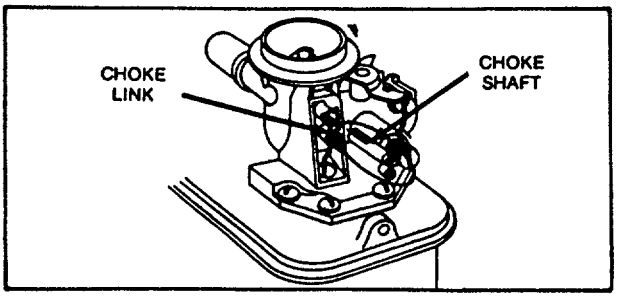


Fig. 26. - Removing Automatic Choke

Replacing Fuel Pipes, Zinc Carburetors
Model Series 92000,

Nylon fuel pipe is threaded into carburetor body. To remove and replace, use socket as shown in Fig. 27. Do not over-torque. No sealer is required.

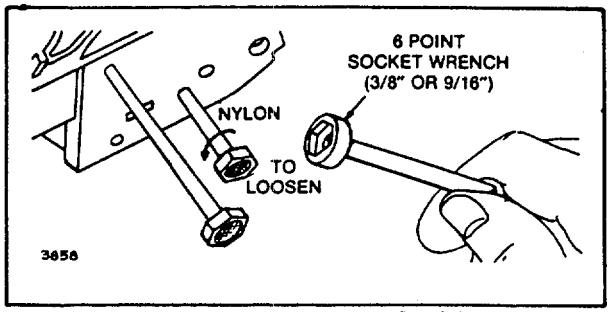


Fig. 27. - Replacing Nylon Fuel Pipes, Zinc Carburetor

Replacing Fuel Pipe, Minion Carburetor

The fuel pipe on Minion carburetors is of the snap-in design. The pipe may snap in and out with considerable force. Fig. 28.

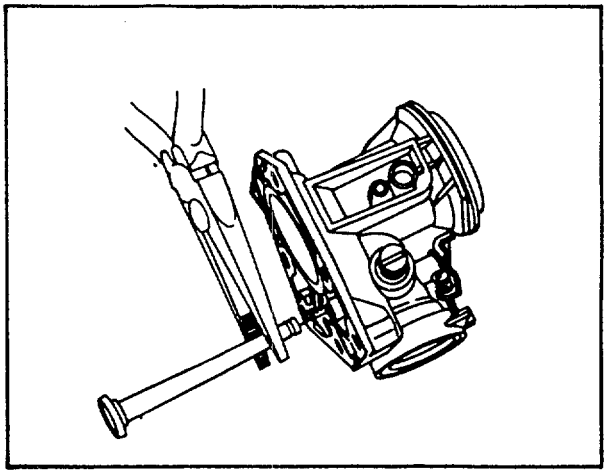


Fig. 28. - Replacing Fuel Pipe, Minlon Carburetor

Inspection and Repair

Check all parts for wear and replace as needed. Examine fuel pipe screens for gum deposits and dirt. Replace if dirty. Replace diaphragm if worn, torn, punctured or stiff. Inspect mixture adjustment needle, Fig. 29, and replace if damaged.

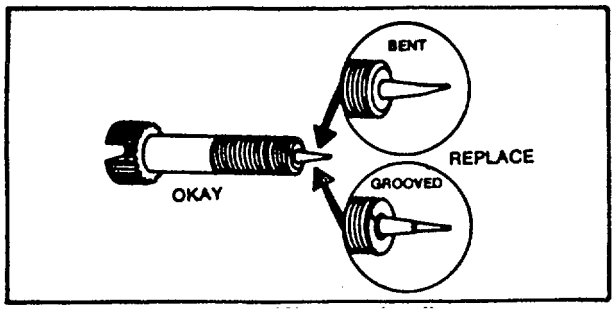


Fig. 29. - Mixture Needle

NOTE: On Vacu-Jet carburetors there is a check ball in the fuel pickup tube. To function properly, the screen must be clean and the check ball free. Replace pipe if screen is clogged or the check ball is not free to move.

Carburetor Assembly, Zinc and "Minion"

When assembling carburetor, use new "O" rings, gaskets and/or diaphragms. Install choke plate and choke shaft. Choke shaft lever should be as shown in Fig. 30, Illus. I, II, III.

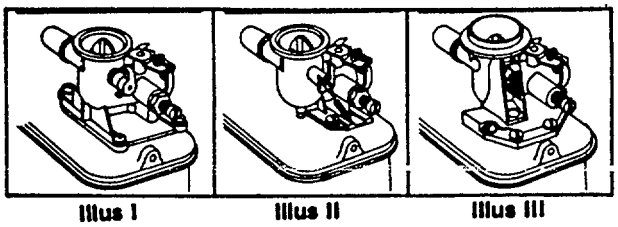


Fig. 30. - Choke Lever

On zinc carburetors, install needle valve seat being sure not to cause burrs in slot. Then install needle valve assembly, Fig. 31 or Fig. 32.

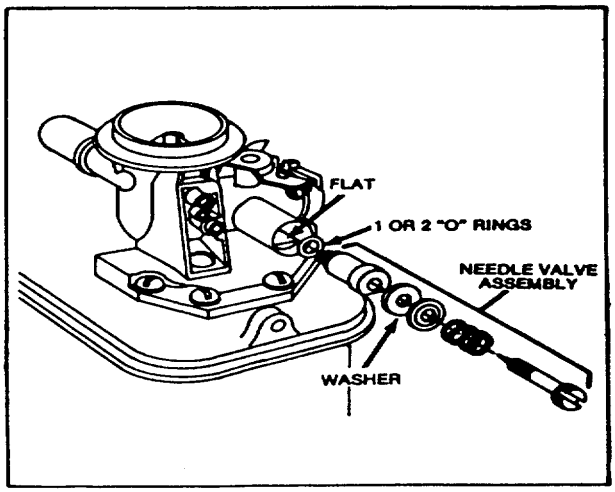


Fig. 32. - Needle Valve Assembly, Minlon Body

Install needle valve as an assembly being sure fiat on valve seat lines up with flat in carburetor body, Fig. 33. Oil fill tube, part no. 280131 will help firmly seat valve assembly.

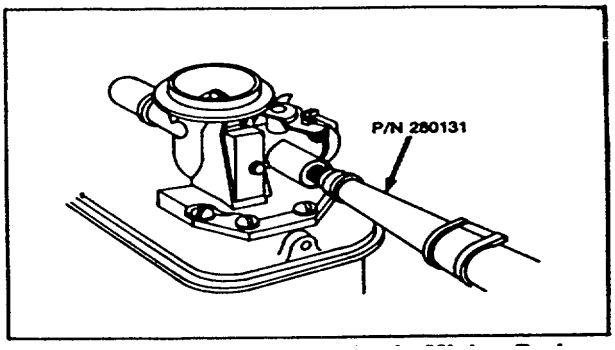


Fig. 33. - Assembling Valve in Minlon Body

Place "O" ring in groove in throttle bore. Early "O" rings had a square cross section. Current "O" rings have a round cross section. Fig. 34.

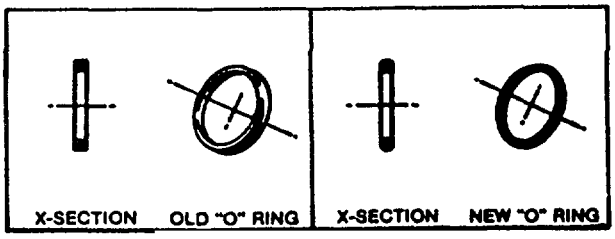


Fig. 34. - "O" Ring

CARBURETION
Pulsa-Jet,

Assembly, Carburetor to Tank,
Choke-A-Matic,
Model Series 92000

To assemble Pulsa-Jet carburetor to tank, first place diaphragm on tank. Then place spring cap and spring on diaphragm. Install carburetor and tighten four (4) screws evenly in staggered sequence to avoid distortion, Fig. 35.

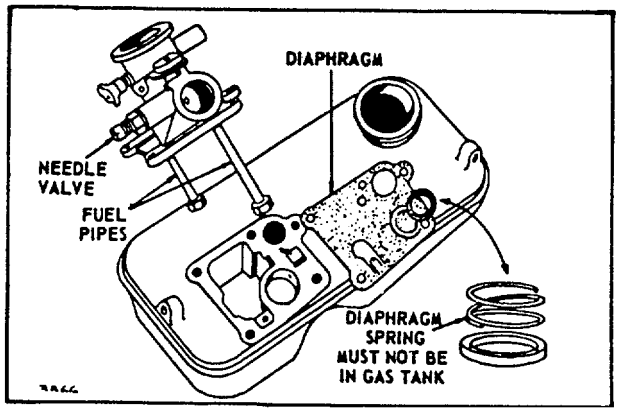


Fig. 35. - Exploded View - Carburetor and Tank Assembly

Assembly, Carburetor to Tank,
Automatic Choke,
Model Series 92000

Assemble carburetor to tank as outlined on pages 6 and 7 of this section.

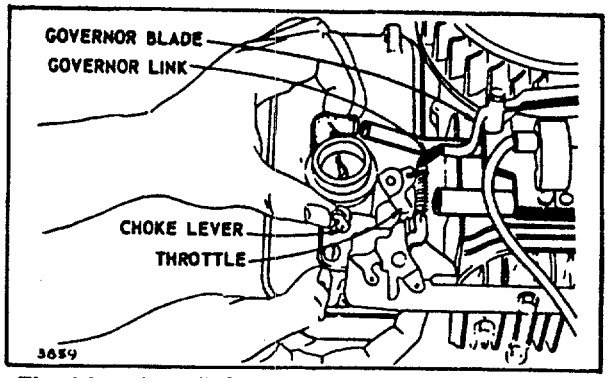


Fig. 36. - Install Carburetor and Tank Assembly

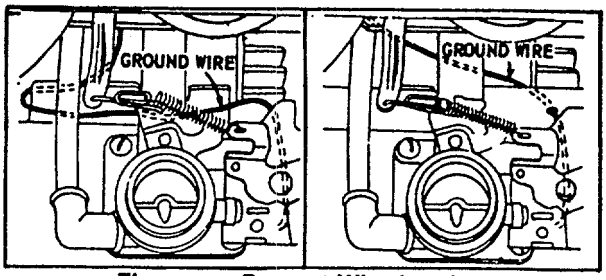


Fig. 37. - Ground Wire Leads

Install Carburetor and Tank Assembly
Automatic Choke, Model Series 92000,

Apply light film of oil to "O" ring in throttle bore. Then hook governor link to governor blade. Align the carburetor with the intake tube and breather tube grommet. Be sure the "0" ring does not distort when fitting the carburetor to the intake tube. Install governor spring as shown in Section 4, Page 7.

Carburetor Adjustment

NOTE: When making carburetor adjustments on Model Series 92000, air cleaner and stud must be Installed on carburetor.

PULSA-JET CARBURETORS

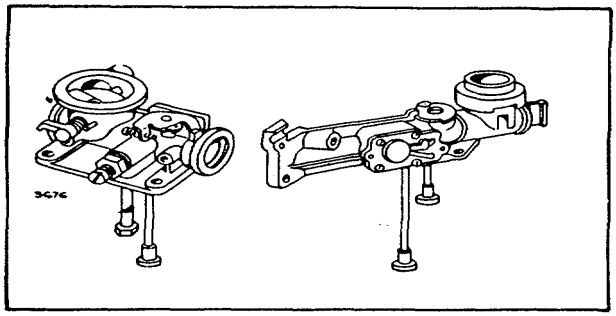


Fig. 41. - Pulsa - Jet Carburetor

Carburetor and Tank Assembly

Remove the carburetor and fuel tank as one unit, being careful not to bend the governor linkage. On models equipped with a stop switch, remove the ground wire. Fig. 42.

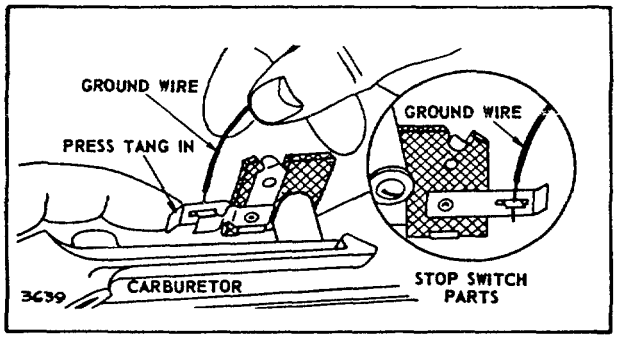


Fig. 42. - Removing Ground Wire

After removal of the carburetor from the fuel tank, inspect the tank for deposits of dirt and/or varnish.

Throttle

Cast throttles, Fig. 43, Illustration 1, are removed by backing off the idle speed adjustment screw until the throttle clears the retaining lug on the carburetor body, Fig. 44.

Stamped throttles, Fig. 43, Illustration 2, are removed by using a Phillips screw driver to remove the throttle valve and screw. After removal of the valve, the throttle may be lifted out, Fig. 45. Reverse procedure to install. Fig. 44.

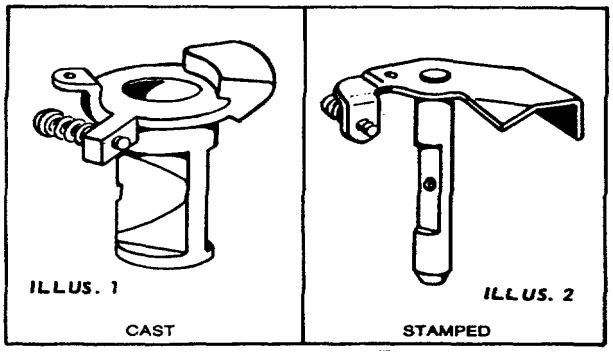


Fig. 43. - Throttle Types

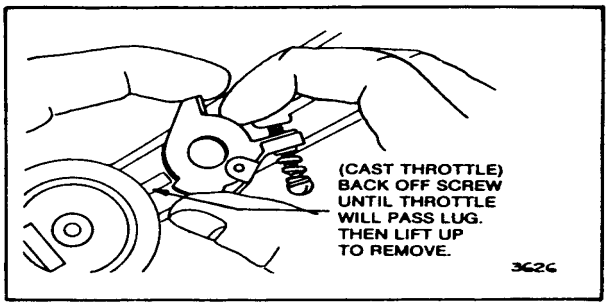


Fig. 44. - Removing Cast Throttle

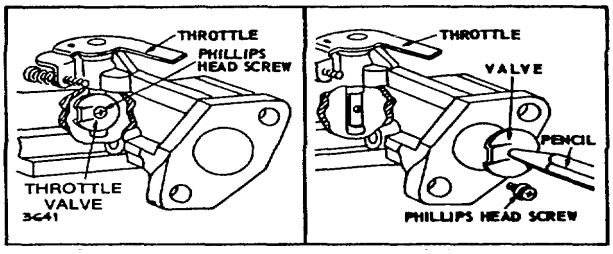


Fig. 45. - Removing Stamped Throttle

Some carburetor models have a spiral in the carburetor bore. To remove, fasten carburetor in a vise with smooth jaws about half an inch below top of jaws. Grasp spiral firmly with a pair of pliers, as shown, Fig. 46. Place a screw driver under ledge of pliers. Using edge of vise, push down on screw driver handle to pry out spiral, Fig. 46. Inspect gasket surface of carburetor. Repair if mounting surface is damaged.

When inserting spiral, top must be flush to 1/32" (.8 mm) below carburetor flange, and spiral parallel with fuel tank mounting surface, Fig. 46.

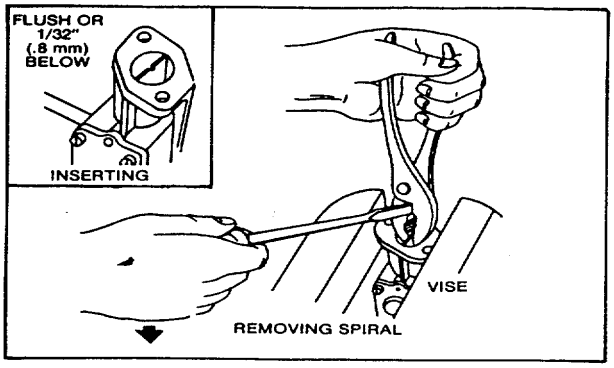


Fig. 46. - Removing and Inserting Spiral

Fuel Pipe

Check balls are not used in these fuel pipes. The screen housing or pipe must be replaced if the screen can not be satisfactorily cleaned. The long pipe supplies fuel from the tank to the pump. The short pipe supplies fuel from the tank cup to the carburetor. Fig. 47. Fuel pipes are nylon or brass. Nylon pipes are removed and replaced by using a 6 point socket, or open end wrench. Fig. 48. WHERE BRASS PIPES ARE USED, THE SCREEN HOUSING ONLY IS REPLACED. Fig. 49. Clamp the fuel pipe in a vise (do not overtighten). Drive off the brass housing with a screw driver. The new housing is installed by tapping it on the pipe with a soft hammer, Fig. 49.

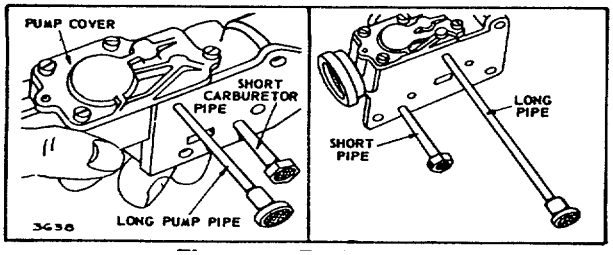


Fig. 47. - Fuel Pipes

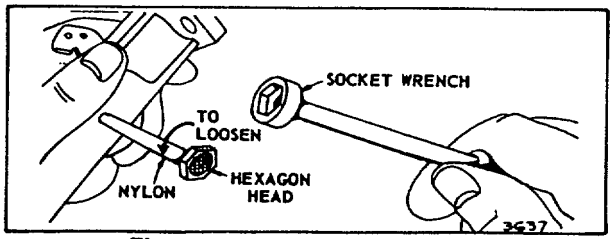


Fig. 48. - Replacing Fuel Pipe

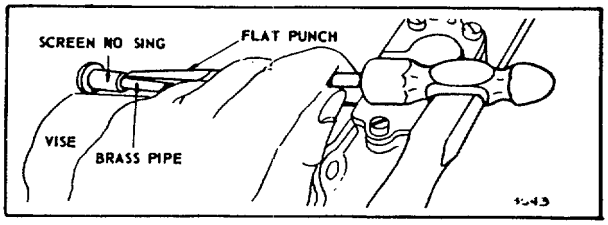


Fig. 49. - Replacing Screen Housing Assembly

Needle Valve and Seat

Remove needle valve to inspect. If carburetor is gummy or dirty, remove seat to allow better cleaning of metering holes. Fig. 50. Do not resize metering holes.

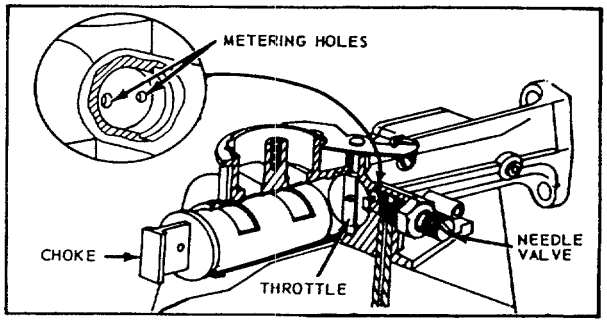


Fig. 50. - Metering Holes

Pump Disassembly and Repair

Remove fuel pump cover, diaphragm, spring and cup. Fig. 51. Inspect diaphragm for punctures, cracks and fatigue. Replace if damaged. Current style supersedes the previous style. When installing the pump cover, tighten the screws evenly in staggered sequence to insure a good seal. Inspect all sealing surfaces for nicks or damaged and repair or replace as required.

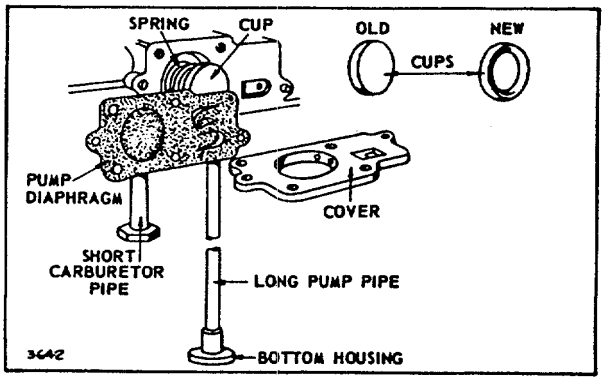


Fig. 51. - Pulsa - Jet Carburetor

Section 4
GOV. CONTROLS & CARB. LINKAGE

REMOTE CONTROLS

In general, there are three types of remote controls: Governor Control, Throttle Control, Choke-A-Matic Control. Fig. 1 to Fig. 6, show the operation of these control systems. See following pages for specific control assemblies and installation hook-up by engine model.

Remote Governor Control

The Remote Governor control regulates the engine speed by changing the governor spring tension, thus allowing the governor to control the carburetor throttle at all times and maintain any desired speed. Fig. 1.

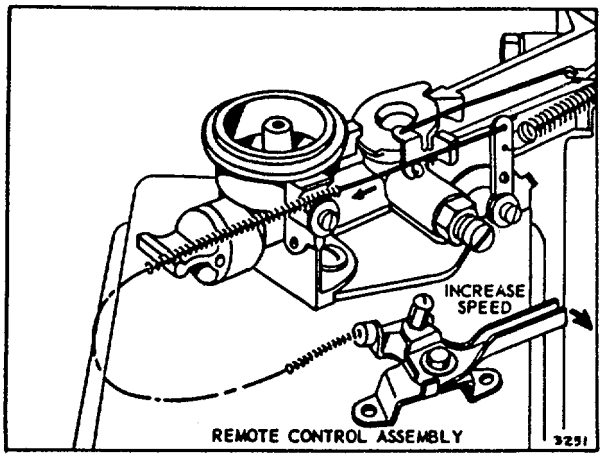


Fig. 1.- Remote Governor Control

Remote Throttle Control

The Remote Throttle control is used on an engine having a fixed no load governed speed setting such as 3600 or 4000 R.P.M.

This control enables an operator to control the speed of an engine, similar to an accelerator used on an automobile. However, when full governed speed is obtained, the governor prevents over speeding and possible damage to the engine. At any point below the governed speed, the throttle is held in a fixed position and the engine speed will vary with the load. See Fig. 2.

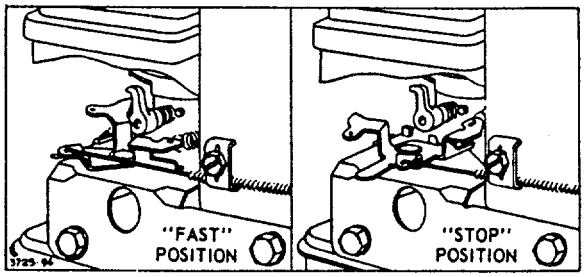


Fig. 50

Fig. 50.

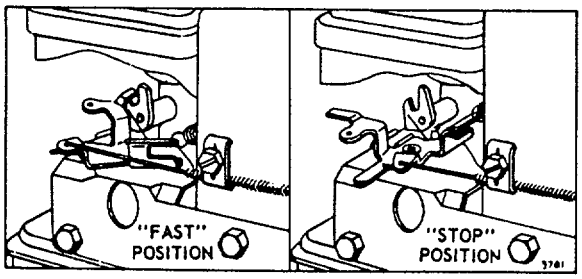


Fig. 51

Fig. 51.

Fig. 52. - Dial Trol Linkage

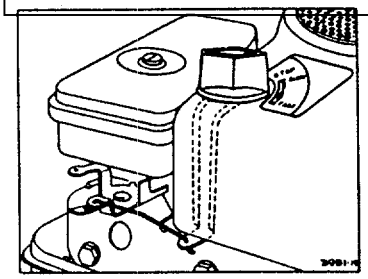


Fig. 52 – Dial-Trol Linkage

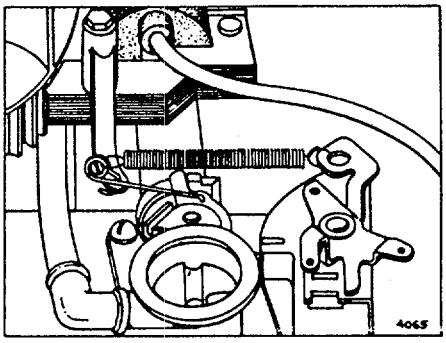


Fig. 53

Fig. 53.

MODELS 92000

REMOVAL AND INSTALLATION OF GOVERNOR SPRING ON MODEL SERIES 92900

The governor springs used on engine Model Series 92900 are made with double end loops for a secure attachment and proper governor regulation. Springs with double end loops are easily removed and installed by following the procedure shown below. Do NOT use a needle-nosed pliers, or the end loops of the governor spring will be deformed. When the governor spring is correctly installed, the spring must be positioned as shown in Figure 54.

CORRECT POSITION OF SPRING

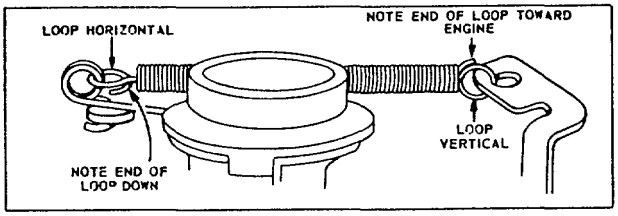


Fig. 54.

REMOVING SPRING

1 REMOVE SPRING FROM CONTROL LEVER

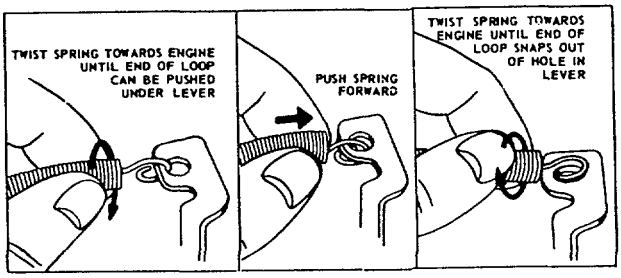


Fig. 55.

2 REMOVE SPRING FROM EYELET IN LINK

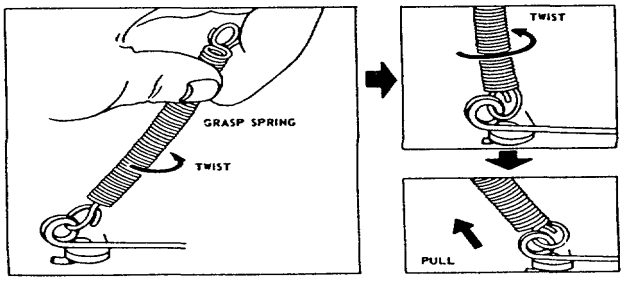


Fig. 56.

INSTALLING SPRING

1 ASSEMBLE SPRING TO LINK EYELET

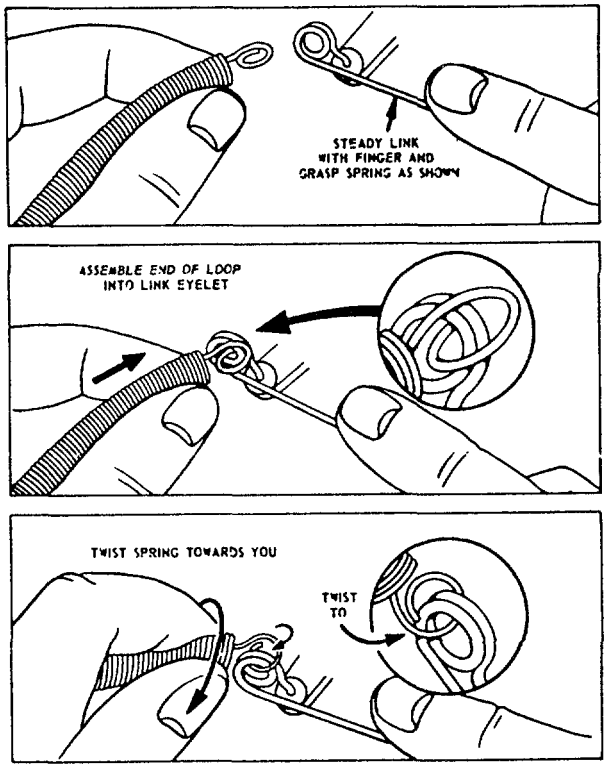


Fig. 57.

2 ASSEMBLE SPRING TO CONTROL LEVER

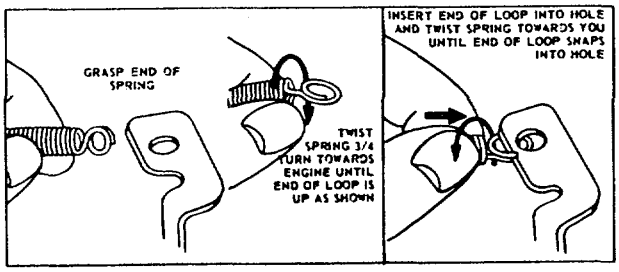


Fig. 58.

Section 5
GOVERNORS

THE PURPOSE OF THE GOVERNOR IS TO MAINTAIN WITHIN CERTAIN LIMITS, A DESIRED ENGINE SPEED, EVEN THOUGH THE LOAD MAY VARY.

AIR VANE GOVERNOR

The governor spring tends to open the throttle. Air pressure against the air vane tends to close the throttle. The engine speed at which these two forces balance is called the governed speed. The governed speed can be varied by changing governor spring tension, Fig. 1, or changing governor spring, Fig. 2.

Checking

Worn linkage or damaged governor springs should be replaced to insure proper governor operation. If spring or linkage is changed, check and adjust TOP NO LOAD R.P.M., Fig. I or check TOP NO LOAD R.P.M., Fig. 2, with engine assembled.

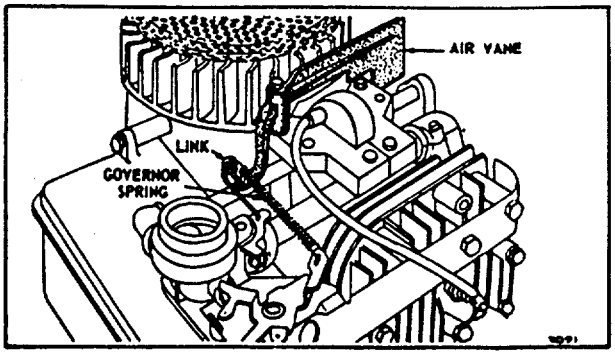


Fig. 2. - Air Vane Governor (Typical)

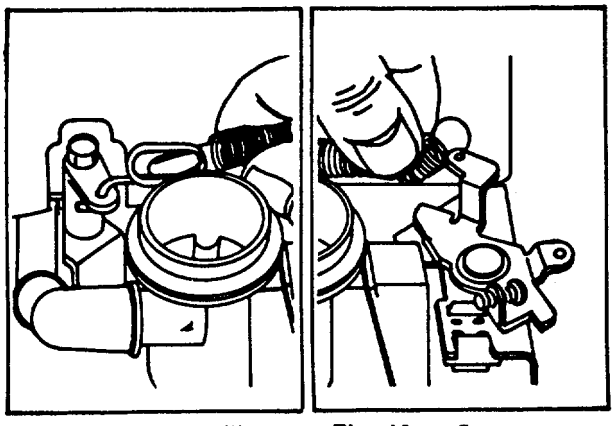


Fig. 12. -- Installing Governor Spring

Fig. 13. - Governor Spring Installed

Adjustment

Loosen lever adjusting screw, Fig. 10. While holding governor lever and governor clamp to the left (counterclockwise), tighten lever adjusting screw to 15 in. lbs. (.17 mkp, 1.7 Nm)

Replacement, Governor Shaft Bushing

When a new governor shaft bushing is pressed in, it should be pressed in until 1/16" (1.58 mm) extends out from crankcase. Finish ream with 19058 reamer using Stanisol or kerosene for lubricant

Installation, Governor Spring

Hold governor spring as shown in Fig. 12 with open end of small loop down. Hook large loop in throttle link loop as shown in Fig. 12 and pull loop toward throttle lever until end of spring loop snaps on. Hook small loop in throttle control lever as shown in Fig. 13

Section 6
COMPRESSION

COMPRESSION

Briggs & Stratton does not publish any compression pressures, as it is extremely difficult to obtain an accurate reading without special equipment

It has been determined through extensive testing, a simple and accurate indication of compression can be made as follows:

Spin the flywheel counterclockwise (flywheel side) against the compression stroke, a sharp rebound indicates satisfactory compression Slight or no rebound indicates poor compression

Loss of compression will usually be the result of the following:

1. The cylinder head gasket blown or leaking.

2. Valves sticking or not seating properly.

3. Piston rings not sealing, which would also cause the engine to consume an excessive amount of oil.

Carbon deposits in the combustion chamber should be removed every 100 to 300 hours of use (more often when run at a steady load), or whenever the cylinder head is removed

Remove Cylinder Head and Shield

Always note the position of the different cylinder head screws so that they may be properly reassembled. If a screw is used in the wrong position, it may be too short and not engage enough threads. It may be too long and bottom on a fin, either breaking the fin, or leaving the cylinder head loose

CYLINDER HEAD TORQUE PROCEDURE

Assemble the cylinder head with a new head gasket, cylinder head shield, screws and washers in their proper places. (A graphite grease or part no. 93963 should be used on aluminum cylinder screws.)

Do not use a sealer of any kind on gasket. Tighten the screws down evenly by hand. Use a torque wrench and tighten head bolts in the sequence shown, Fig. 1, and to the specified torque in Table 1

Do not turn one screw down completely before the others, as it may cause a warped cylinder head.

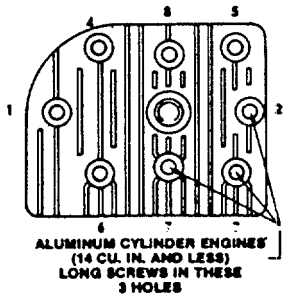


TABLE NO. 1
CYLINDER HEAD TORQUE

BASIC MODEL SERIES ALUMINUM CYLINDER	Inch Pounds	Meter Kilopond	Newton Meter
92000, ➢	140	1.61	15.82

To Remove Valves

Fig. 2 shows the three methods used to hold the valve spring retainers. To remove types shown in Illus. 1 and 2, use 19063 compressor; adjust jaws until they just touch the top and bottom of the valve chamber. This will keep the upper jaw from slipping into the coils of the spring. Push the compressor in until the upper jaw slips over the upper end of the spring. Tighten the jaws to compress the spring. Fig. 3. Remove collars or pin and lift out valve. Pull out compressor and spring. Fig. 4

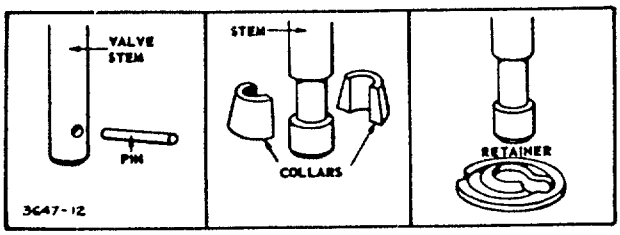


Fig. 2.. - Valve Spring Retainers

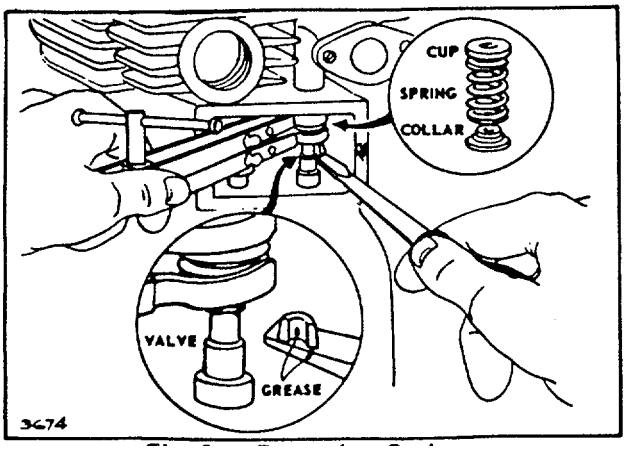


Fig. 3. - Removing Spring

To remove valves using retainers, Fig. 2, Illus. 3, slip the upper jaw of 19063 compressor over the top of the valve chamber and lower jaw between spring and retainer. Compress spring. Remove retainer. Pull out valve. Remove compressor and spring. Fig. 5

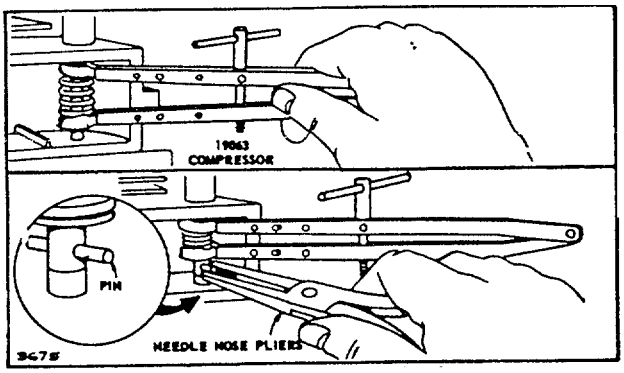


Fig. 4. - Removing Spring

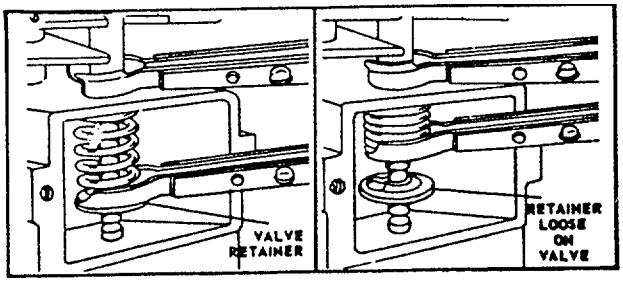


Fig. 5. - Removing Retainer and Spring

Old 19063 valve spring compressors can be modified by grinding as shown in Fig. 6.

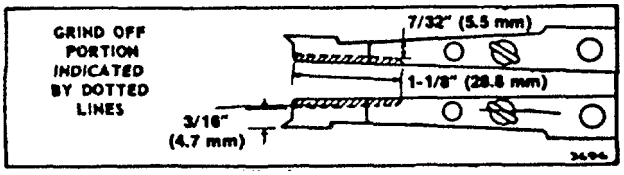


Fig. 6. - Modified #19063 Compressor

TABLE NO. 2
VALVE TAPPET CLEARANCE

MODEL SERIES	INTAKE				EXHAUST			
ALUMINUM CYLINDER	MAX.		MIN.		MAX.		MIN.	
	Inches	Milli-meter	Inches	Milli-meter	Inches	Milli-meter	Inches	Milli-meter
)2000	.007	0.18	.005	0.13	.011	0.28	.009	0.23

To Reface Valves and Seats

Faces on valves and valve seats should be resurfaced with a valve grinder or cutter, to an angle of 45°. NOTE: SOME ENGINE MODELS HAVE A 30° INTAKE VALVE AND SEAT. Valve and seat should then be lapped with a fine lapping compound to remove grinding marks and assure a good seat. Valve seat width should be 3/64" to 1/16" (1.191.58 mm). Fig. 7. If the seat is wider, a narrowing stone or cutter should be used. If either the seat or valve is badly burned, it should be replaced. Replace valve if margin is 1/64" (0.4 mm) or less after refacing. Fig. 7

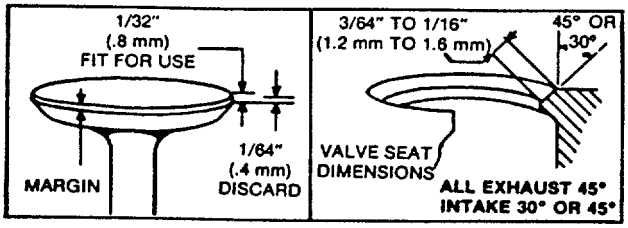


Fig. 7. - Valve and Seat Dimensions

To Check and Adjust Tappet Clearance

Insert the valves in their respective positions in the cylinder. Turn the crankshaft to top dead center, end of compression stroke. Both valves are now closed. Then check clearance on the intake and exhaust valves with feeler gauge. See Table 2. Grind off the end of the valve stem if necessary, to obtain proper clearance

CAUTION: Piston MUST be at top dead center at the end of compression stroke to assure both valves being closed.

NOTE: Check clearance cold.

To Install Valves

Some engines use the same spring for intake and exhaust side, while others use a heavier spring on the exhaust side. Compare' springs before installing

If retainers are held by a pill or collars, Fig. 2, Illus. 1 and 2, place valve spring and retainer (and cup on Model Series 9, 14, 19, 20, 23, 24 and 32) into valve spring compressor 19063. Compress the spring until it is solid. Insert the compressed spring and retainer (and cup when used) into the valve chamber. Then drop the valve into place, pushing the stem through the retainer. Hold the spring up in the chamber, and the valve down insert the retainer pin with a needle nose pliers or place the collars in the groove in the valve stem Lower the spring until the retainer fits around the pins or collars, then pull out the spring compressor. Fig. 3. Be sure pin or collars are in place.

If self-lock retainer, Fig. 2, Illus. 3, is used, compress retainer and spring with compressor 19063. Large diameter of retainer should be toward front of valve chamber. Fig. 8. Insert compressed spring and retainer into valve chamber. Drop the valve stem through larger area of retainer slot and move the compressor so as to center the small area of the valve retainer slot onto the valve stem shoulder. Release the spring tension and remove the compressor

COMPRESSION
Valves & Guides

NOTE: Apply "LED-PLATE" or Part No. 93963 lubricant to valve stems and guides before Installing. Be sure that no "LED-PLATE" or Part No. 93963 is on the ends of the valve stems or tappets

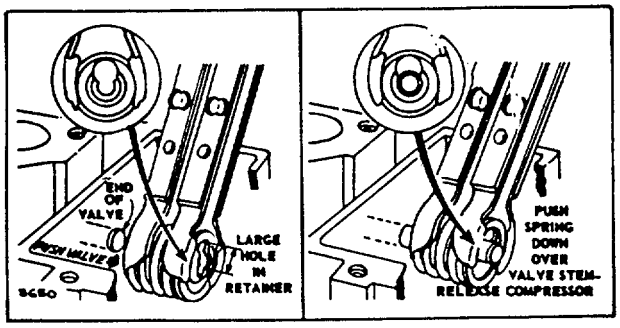


Fig. 8. - Installing Valves

Valve Guides

Models
92000,

If the flat end of valve guide plug gauge 19122 can be inserted into the valve guide for a distance of 5/16" (7.94 mm), the valve guide is worn and should be rebushed in the following manner Fig. 9

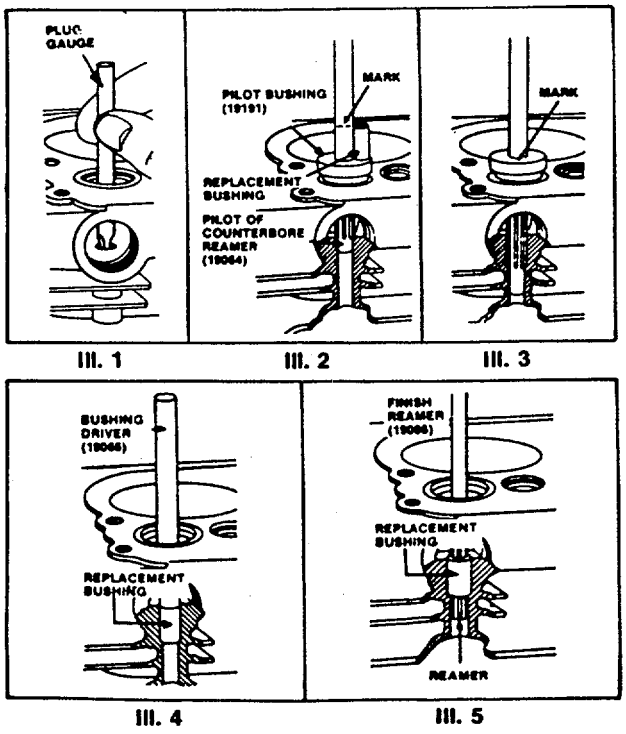


Fig. 9. - Bushing Valve Guides

Place pilot of counterbore reamer no. 19064 in valve guide, Fig. 9, Illus. 1. Install pilot bushing 19191 over counterbore reamer and lower pilot bushing to rest in valve seat. Hold replacement valve guide bushing 63709 on top of pilot bushing next to reamer. Make a mark on reamer 1/16" (1.59 mm) above top of replacement bushing, Fig 9, Illus. 2

Ream out valve guide until mark on counterbore reamer is level with top of pilot, Fig. 9, Illus. 3 (Lubricate reamer with kerosene or equivalent lubricant.)

Place replacement bushing in reamed-out hole, Fig. 19. Press replacement bushing down until it is flush with the top of the hole with valve guide bushing driver 19065, Fig. 9, Illus. 4.

Finish ream the replacement bushing with a valve guide bushing finish reamer 19066, Fig. 9, Illus. 5. (Lubricate reamer with kerosene or equivalent lubricant.)

NOTE: It is usually not necessary to bush factory installed brass valve guides. However, if bushing is required, DO NOT REMOVE ORIGINAL BUSHING follow standard procedure outlined

Removing Valve Guide Bushings Using Kit 19232 (Aluminum Engines)

To remove factory or field installed guide bushings on aluminum engines, rotate nut no 19239 up to head of 19238 puller screw. Center washer on valve seat. (Larger washer may be required on some model intake seats.) Lubricate cutting surface of screw and inside of guide bushings with Stanisol or kerosene. Insert screw 19238 thru washer 19240, centering washer on seat. See Fig. 10. Use 3/4" socket to turn screw clockwise to a depth of 1/4" (6.5 mm) or until bushing starts to turn and -STOP. While holding screw stationary, turn nut down onto washer until bushing is free

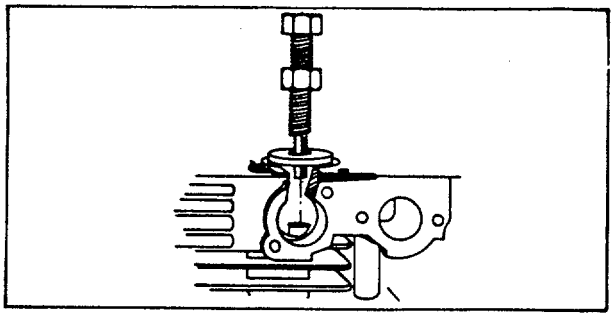


Fig. 10.

Repairing Worn Aluminum or Sintered Iron Guides

Place piloted counterbore reamer, 19231, into worn guide. Slide reamer guide, 19234, down shank of 19231 and center on valve seat, Fig. 9, Illus. 2. Place bushing 231218 next to reamer on reamer guide, Fig. 9, Illus. 2, and mark reamer 1/16" (1.6 mm) above bushing

Use Stanisol or kerosene to lubricate reamer while turning clockwise. Continue reaming until mark on reamer is flush with top of reamer guide bushing, 1-1/32" (26.19 mm), Fig. 9, Illus. 3

Installing Replacement Bushing

Clean out all chips. Place grooved end of service bushing, 231218, into valve guide, Fig. 9, Illus. 4 Use bushing driver, 19204, to press bushing into guide until flush with top of guide or until it bottoms. Place reamer guide bushing, 19234, on valve seat and slide finish reamer, 19233, thru center of bushing. Fig. 9, Illus. 5. Use Stanisol or kerosene as lubricant while turning reamer clockwise. Continue reaming until reamer enters tappet chamber. After reaming is done, continue to turn reamer clockwise while removing. Clean out all chips before reassembling engine

Repairing Worn Valve Guides Using 19183 Reamer and Reamer Guide Bushing 19192

Place piloted counterbore reamer, 19183 into worn guide. Slide reamer guide bushing, 19192, down shank of reamer and center in valve seat, Fig. 9, Illus. 2. Slide replacement bushing, 230655, next to reamer shank on reamer guide bushing Mark reamer 1/16" (1.6 mm) above bushing Fig 9, Illus. 3. Use Stanisol or kerosene to lubricate reamer while turning clockwise. Continue reaming until mark on reamer is flush with top of bushing. DO NOT REAM THROUGH THE WHOLE GUIDE. Continue to turn reamer clockwise while withdrawing reamer

Installing Replacement Bushing 230655

Clean out all chips. Press in valve guide bushing, 230655, using bushing driver, 19204, until flush with top of guide or until it bottoms. Fig. 9, Illus. 4

The bushing 230655 is finish reamed to size at the factory, no further reaming is necessary, and a standard valve can be used.

NOTE: Cast iron engines use sintered (gray colored) valve guide bushings. DO NOT REMOVE THESE BUSHINGS. See reaming valve guide (230655 or 231218 bushing) to install service brass bushings.

CAUTION

Valve seating should be checked after bushing the guide, and corrected if necessary by refacing the seat.

Valve Seat Inserts

Cast iron cylinder engines are equipped with an exhaust valve seat insert which can be removed and a new insert installed. The intake side must be counterbored to allow installation of an intake valve seat insert. Fig. 12, 13 & 14

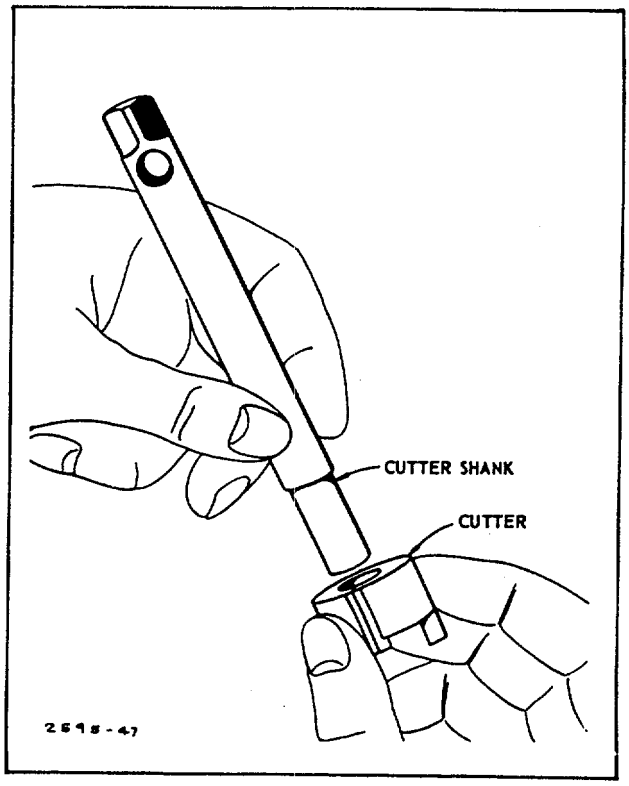


Fig. 12. - Inserting Cutter Shank

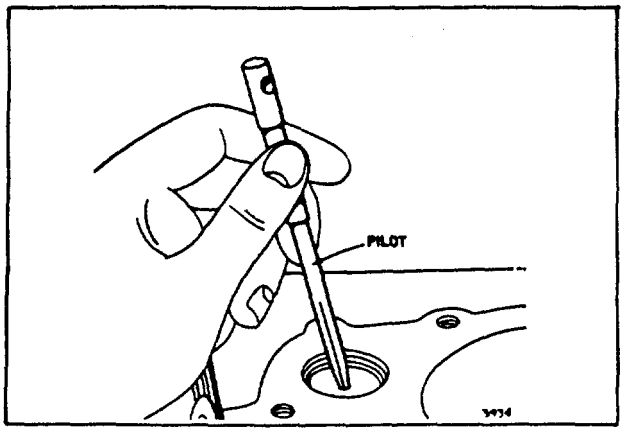


Fig. 13. - Inserting Pilot

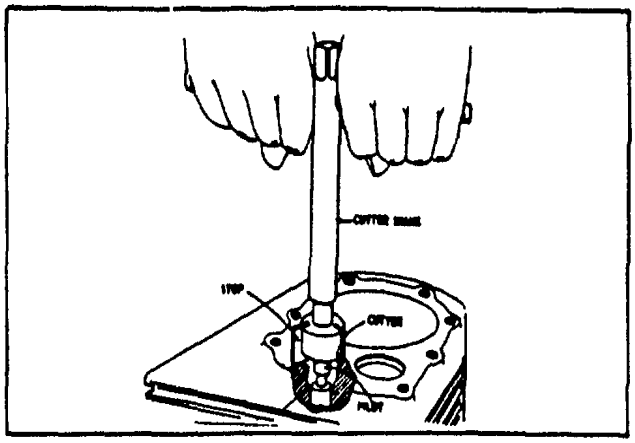


Fig. 14. - Counterboring for Valve Seat

Aluminum alloy cylinder models are equipped with inserts on exhaust and intake side. See Table 3.

TABLE NO. 3
VALVE SEAT INSERTS

BASIC MODEL SERIES	INTAKE STANDARD	EXHAUST STANDARD	EXHAUST STELLITE	INSERT # PULLER ASSEMBLY	PULLER NUT
ALUMINUM CYLINDER					
92000,	210879	211291	210452	19138	19140 Ex. 19182 In.

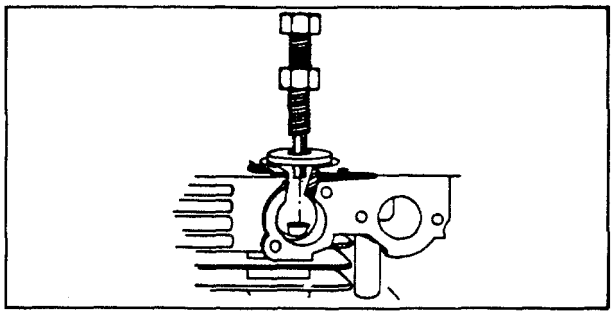


Fig. 10.

Repairing Worn Aluminum or Sintered Iron Guides

Place piloted counterbore reamer, 19231, into worn guide. Slide reamer guide, 19234, down shank of 19231 and center on valve seat, Fig. 9, Illus. 2. Place bushing 231218 next to reamer on reamer guide, Fig. 9, Illus. 2, and mark reamer 1/16" (1.6 mm) above bushing

Use Stanisol or kerosene to lubricate reamer while turning clockwise. Continue reaming until mark on reamer is flush with top of reamer guide bushing, 1-1/32" (26.19 mm), Fig. 9, Illus. 3

Installing Replacement Bushing

Clean out all chips. Place grooved end of service bushing, 231218, into valve guide, Fig. 9, Illus. 4 Use bushing driver, 19204, to press bushing into guide until flush with top of guide or until it bottoms. Place reamer guide bushing, 19234, on valve seat and slide finish reamer, 19233, thru center of bushing. Fig. 9, Illus. 5. Use Stanisol or kerosene as lubricant while turning reamer clockwise. Continue reaming until reamer enters tappet chamber. After reaming is done, continue to turn reamer clockwise while removing. Clean out all chips before reassembling engine

Repairing Worn Valve Guides Using 19183 Reamer and Reamer Guide Bushing 19192

Place piloted counterbore reamer, 19183 into worn guide. Slide reamer guide bushing, 19192, down shank of reamer and center in valve seat, Fig. 9, Illus. 2. Slide replacement bushing, 230655, next to reamer shank on reamer guide bushing Mark reamer 1/16" (1.6 mm) above bushing Fig 9, Illus. 3. Use Stanisol or kerosene to lubricate reamer while turning clockwise. Continue reaming until mark on reamer is flush with top of bushing. DO NOT REAM THROUGH THE WHOLE GUIDE. Continue to turn reamer clockwise while withdrawing reamer

Installing Replacement Bushing 230655

Clean out all chips. Press in valve guide bushing, 230655, using bushing driver, 19204, until flush with top of guide or until it bottoms. Fig. 9, Illus. 4.

The bushing 230655 is finish reamed to size at the factory, no further reaming is necessary, and a standard valve can be used.

NOTE: Cast iron engines use sintered (gray colored) valve guide bushings. DO NOT REMOVE THESE BUSHINGS. See reaming valve guide (230655 or 231218 bushing) to install service brass bushings

CAUTION
Valve seating should be checked after bushing the guide, and corrected if necessary by refacing the seat.

Valve Seat Inserts

Cast iron cylinder engines are equipped with an exhaust valve seat insert which can be removed and a new insert installed. The intake side must be counterbored to allow installation of an intake valve seat insert. Fig. 12, 13 & 14

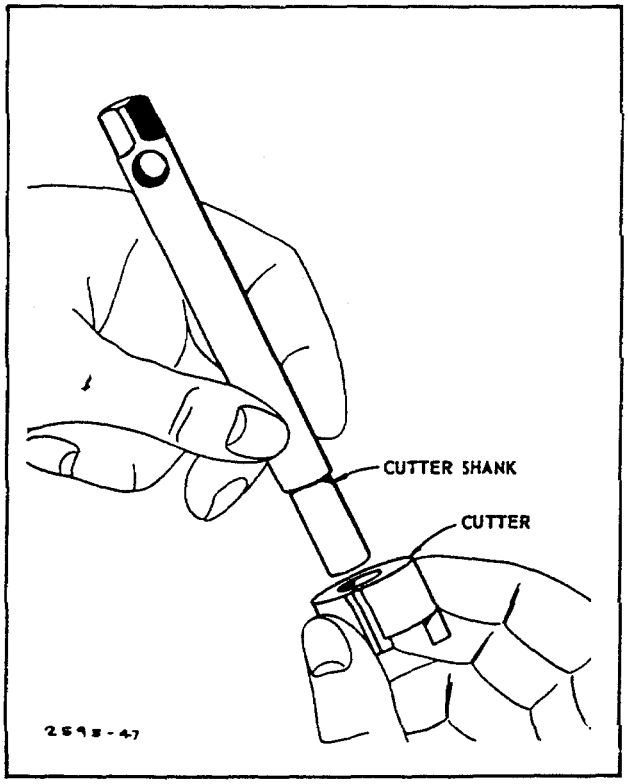


Fig. 12. - Inserting Cutter Shank

To Remove Valve Seat Insert

Use valve seat puller 19138 as shown in Fig. 15, and select the proper puller nut. See Table 3. Be sure the puller body does not rest on the valve seat insert. Fig. 16. Turn the 5/16" bolt with a wrench until insert is pulled out of the cylinder. Fig. 16

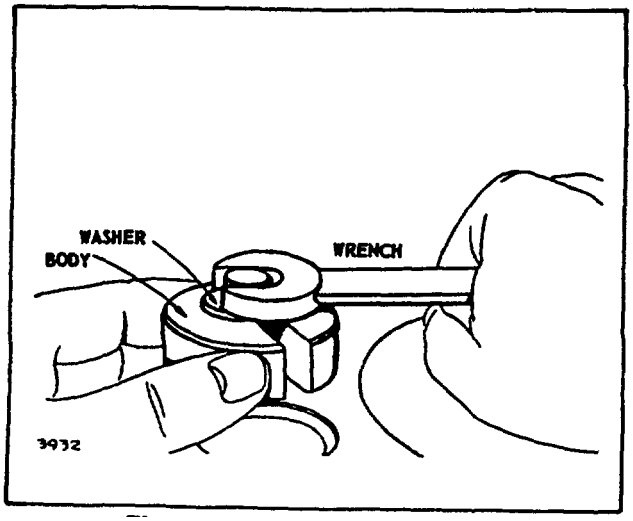


Fig. 15. - Removing Valve Seat

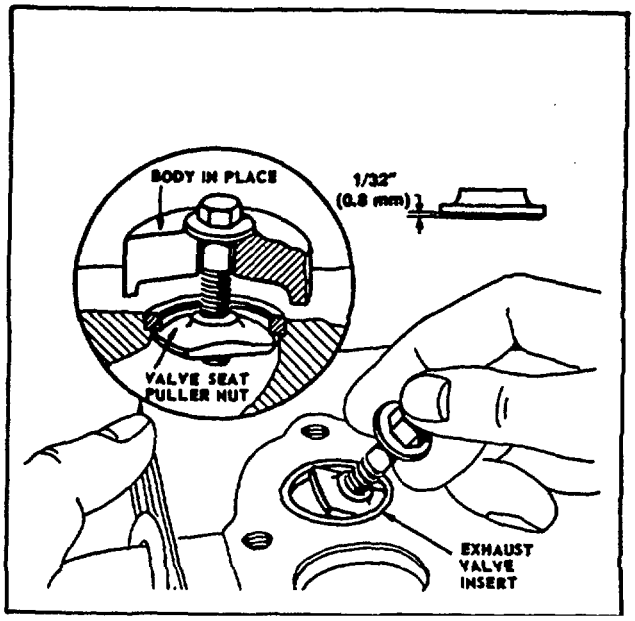


Fig. 16. - Inserting Valve Seat Puller

NOTE: On aluminum alloy cylinder models, it may be necessary to grind the puller nut until the edge is 1/32" (0.8 mm) thick in order to get the puller nut under the valve insert. Fig. 16.

TABLE NO. 4
VALVE SEAT INSERT AND COUNTERBORE TOOLS

BASIC MODEL SERIES	COUNTERBORE CUTTER	SHANK	CUTTER & DRIVER PILOT	INSERT DRIVER
ALUMINUM CYLINDER				
92000,			19126	19136

COMPRESSION
Valve Seat Inserts

To Drive in New Valve Seat Insert

Select the proper valve seat insert and the correct pilot and driver according to Table 3 & 4. You will note that one side of the seat insert is chamfered at the outer edge. This side should go down into the cylinder

Insert the pilot into the valve guide. Then drive the valve insert into place with the driver, as shown in Fig. 17. The seat should then be ground lightly and the valves and seats lapped lightly with grinding compound. Clean thoroughly

NOTE: Aluminum alloy cylinder models. Use the old insert as a spacer between the driver and the new insert. Drive new insert until it bottoms. Top of insert will be slightly below cylinder head gasket surface. Then peen around-the insert as shown in Fig. 18

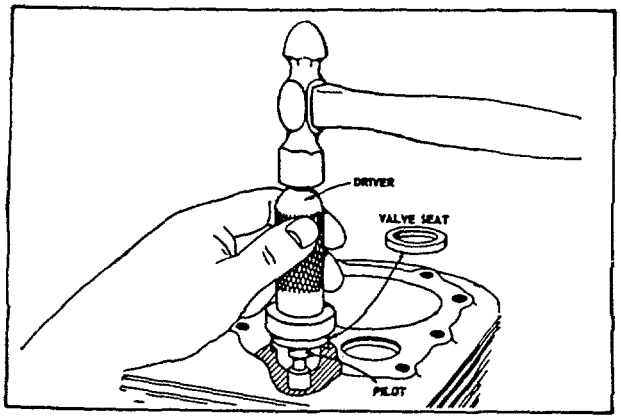


Fig. 17. - Driving In Valve Seat

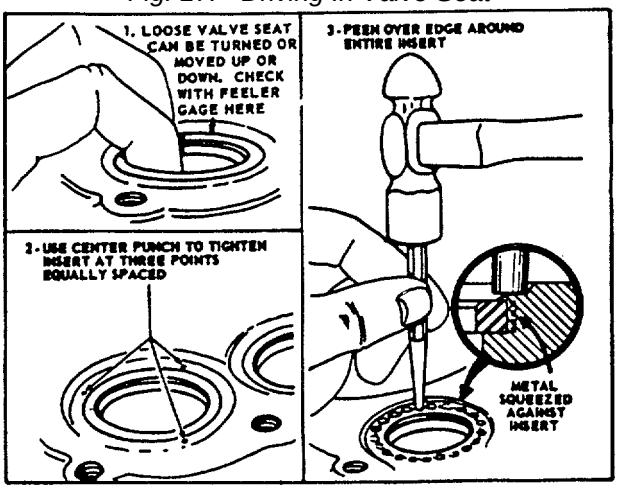


Fig. 18. - Peening Valve Seat

NOTE: Replace Cylinder it a .005" (0.13 mm) Feeler Gauge enters between Valve Seat and Cylinder.

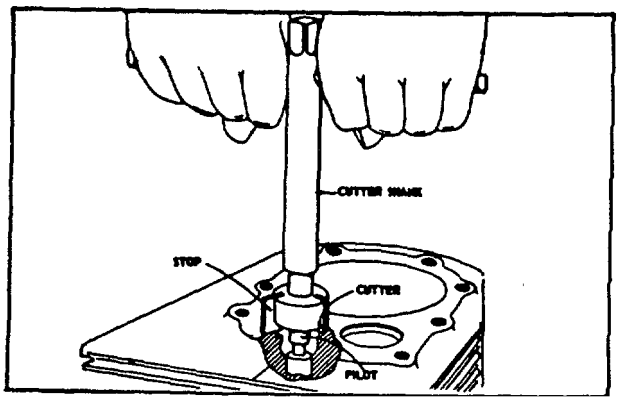


Fig. 21. - Counterboring for Valve Seat

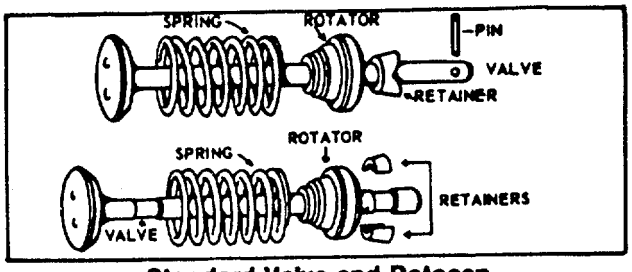
Valves, Valve Conversions

The life of a valve is considered to be the period of time the valve will operate before repair or replacement is necessary. The life of a standard exhaust valve is often shortened because of burning, which occurs when pieces of combustion deposit lodge between the valve seat and valve face, preventing the valve from closing completely. This is most likely to occur on engines which are operated at constant speed and constant load, for long periods of time. Exhaust valve life can be extended by using:

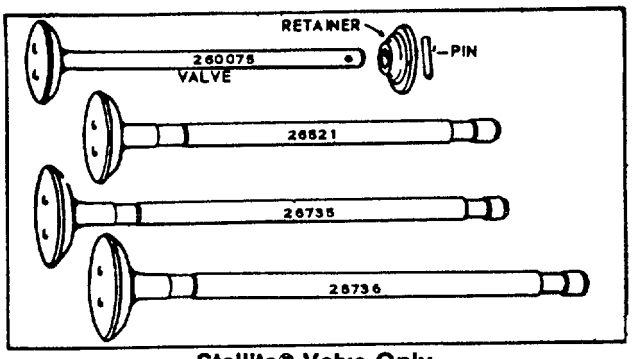
1. A Rotocap (Valve Rotator), which turns the exhaust valve a slight bit on each lift, wiping away any deposits which tend to lodge between the valve face and seat, or,

2. A Stellite Exhaust Valve which has a greater resistance to heat.

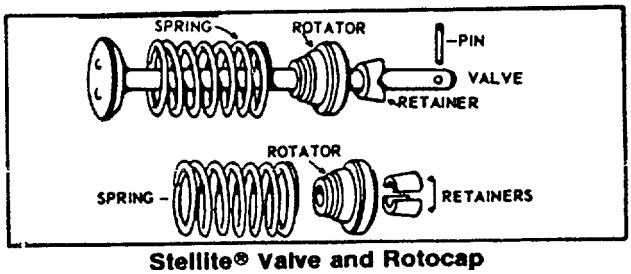
Stellite® Valves & Rotators



Standard Valve and Rotocap



Stellite® Valve Only



Stellite® Valve and Rotocap

Use Table 5 below, Table 6 on page 10 or Table 7 on page 11 for Part Numbers.

TABLE NO. 5

BASIC MODEL SERIES	STELLITE® VALVE AND ROTOCAP CONVERSION				
	STELLITE® VALVE	ROTOCAP ONLY CONVERSION			
		SPRING	ROTOCAP	RETAINER	PIN
ALUMINUM CYLINDER					
92000*,	260443	26826	292259	230127	230126

Section 7
STARTERS & CHARGING SYSTEMS

REWIND STARTERS

Various rewind starter assemblies are illustrated below.

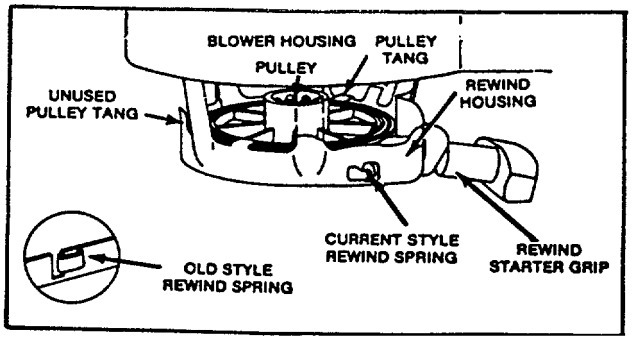


Fig. 2. - Model Series: 92000,

Repair procedure is similar except as indicated.

TO REPLACE A SPRING

Remove Spring

Cut knot at starter pulley to remove rope. With rope removed, grasp outer end of rewind spring with pliers, see Fig. 5, and pull out of housing as far as possible. Turn spring 1/4 turn and remove from pulley or bend one of the tangs up and lift out starter pulley to disconnect spring

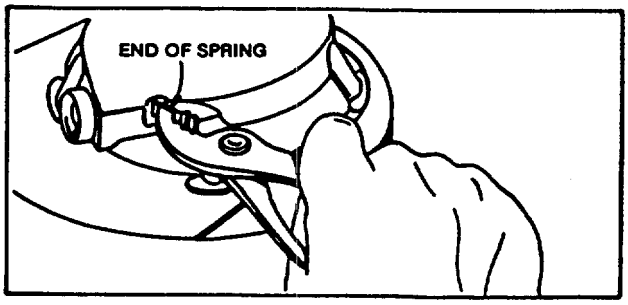


Fig. 5. - Remove Spring

Install Spring

Clean rewind housing. pulley and rewind spring in solvent. Wipe clean with cloth. Straighten spring to allow easier installation and restore tension. Oil spring. Insert either end of spring into blower housing slot and hook into pulley. Fig. 6

STARTERS

Rewind Starters

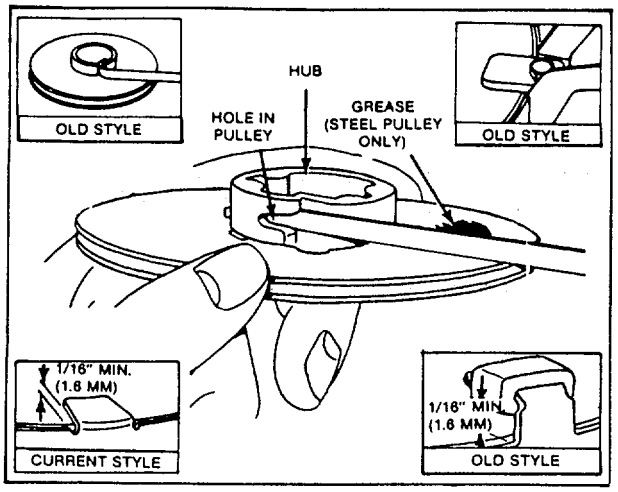


Fig. 6. - Install Spring

Place a dab of grease on pulley. Set pulley into housing and bend tang down. See Fig. 6. Adjust tang gap as shown. Pulley must be depressed fully into rewind housing when measuring tang gap

NOTE: Do not remove nylon bumper from old style tang when replacing metal pulley with nylon pulley. Replace nylon bumpers if worn

Wind Spring

Place a 3/4" square piece of stock into center of pulley hub or make rewind tool similar to one shown in Fig. 7. GRASPING STOCK WITH A WRENCH, WIND PULLEY COUNTERCLOCKWISE UNTIL SPRING IS WOUND TIGHT. Then back off pulley one turn or until hole in pulley for rope knot and eyelet in blower housing are in alignment. See Fig. 11 or 12

Spring should be securely locked in smaller portion of tapered hole. See Fig. 8.

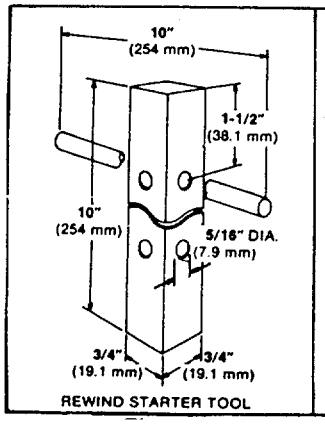


Fig. 7.

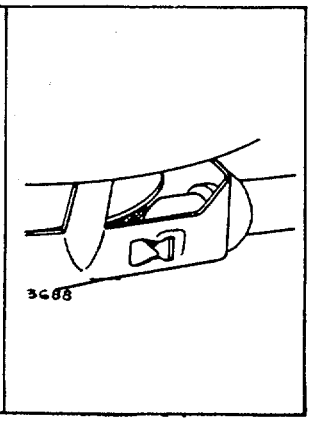


Fig. 8.

Install Rope

Inspect rope. Replace if frayed. Insert rope through handle and tie a figure eight knot. Insert pin through knot and pull tightly into handle. Fig. 9. ALWAYS SEAL BOTH ENDS OF KNOT

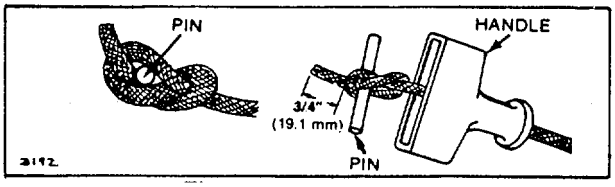


Fig. 9. - Install Rope

If re-using old rope, burn pulley end of rope with a match. Wipe with waste cloth, using caution, while it is still hot. to prevent swelling and unravelling

NOTE: WHEN INSTALLING A NEW ROPE, CHECK PARTS LIST TO BE SURE CORRECT DIAMETER AND LENGTH ROPE IS USED

A rope inserter tool may be made by using a piece of music wire or spring wire, and forming it as shown in Fig. 10

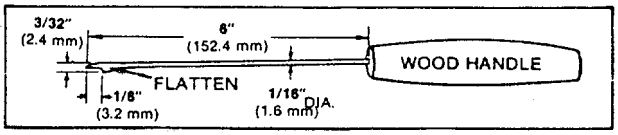


Fig. 10. - Rope Inserter

Thread wire and rope through rope eyelet in housing and out pulley hole. (CAUTION: Rope must pass inside a guide lug on metal pulley.) Fig. 11

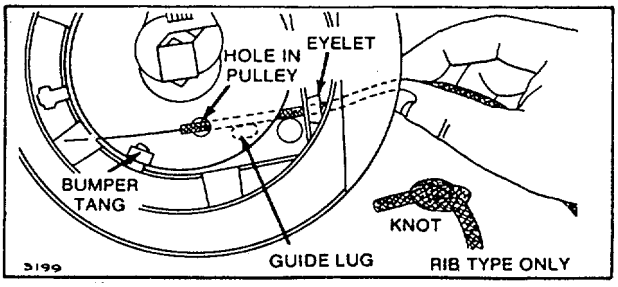


Fig. 11. - Inserting Rope, Old Style

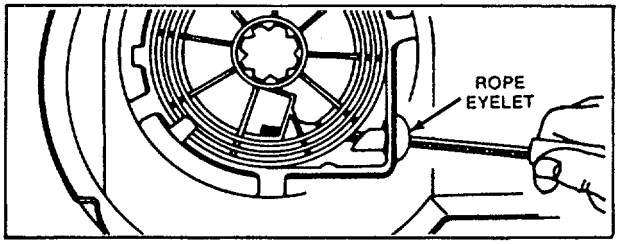


Fig. 12. - Inserting Rope

Current Style without Guide Dug

Tie a knot in rope and pull tight. Manipulate knot so it can be pulled down into knot cavity. Fig. 13.

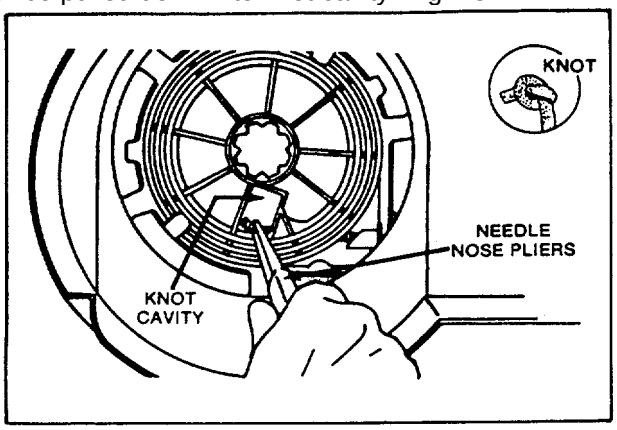


Fig. 13. - Tie Knot

Replace Rewind Assembly

If original starter housing is spot welded to blower housing, drill out spot welds using a 3/16" diameter drill. Drill deep enough to loosen spot welds ONLY. Locate replacement rewind assembly in desired position. Install screws from inside blower housing up through starter housing mounting leg. Fasten securely with nuts as shown in Fig. 14

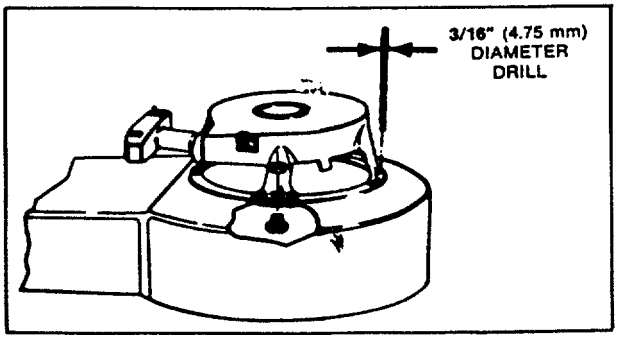


Fig. 14.

Starter Clutch (Sealed)

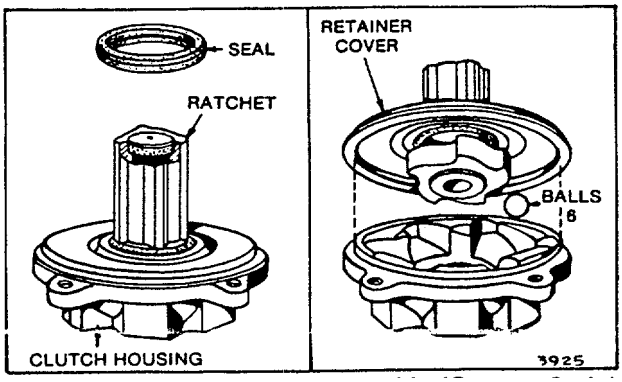


Fig. 16.- Sealed Clutch Assembly (Current Style)

If necessary, the sealed clutch can be disassembled by using a screwdriver or wedge to pry the retainer cover from the housing, as shown in Fig. 17. Place one drop of engine oil on end of crankshaft before replacing clutch assembly on crankshaft. Tighten clutch to torque noted on specification sheet for your model engine. DO NOT run engine without screen screws assembled to clutch

NOTE: Clean ratchet by wiping with cloth only.

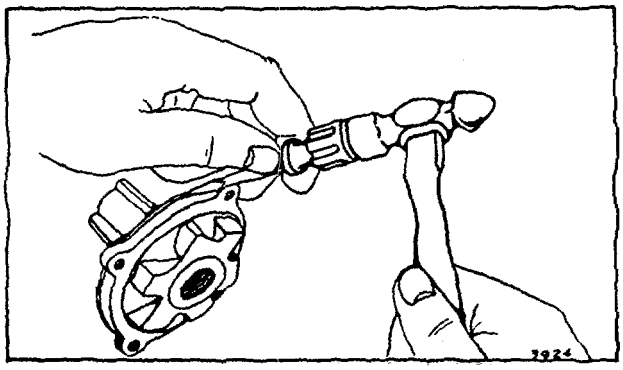


Fig. 17. - Disassembling Sealed Clutch

STARTERS
Windup Starters

NOTE: The sealed clutch may be installed on older model engines, by modifying the starter pulley and crankshaft. The old pulley can be made to fit the new clutch by cutting off the hub to a dimension of 1/2" as shown in Fig. 18

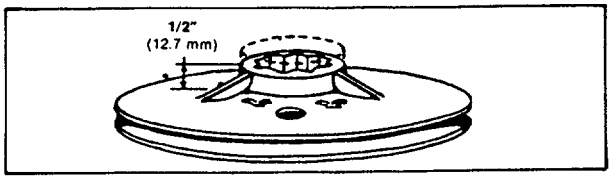


Fig. 18. - Pulley Modification

The crankshaft must be shortened 3/8" and the end chamfered as shown in Fig. 19. A new screen #221661 is required with the new clutch

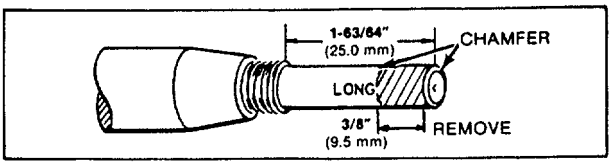


Fig. 19. - Crankshaft Modification

WINDUP STARTER

Windup Starter

Two types of windup starters have been used. The control knob release was used with the unsealed four ball clutch. The control lever release can only be used with a sealed six ball clutch. See Fig. 20 and Fig. 21

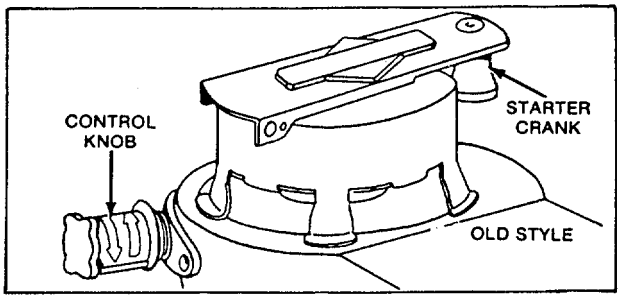


Fig. 20. - Old Style Starter Assembly

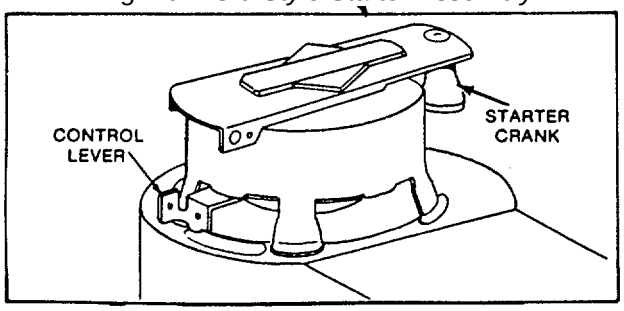


Fig. 21. - Lever Starter Assembly

Before working on equipment, remove spark plug from engine. Make sure starter spring is not wound. This can be determined by attempting to turn starter crank clockwise

If wound tight, release tension by placing control knob or lever to "Start" position. If starter spring does not release, place control at "Crank" position. To prevent injury, hold crank handle with one hand while removing Phillips head screw and handle assembly from starter housing This will release spring. Fig. 22

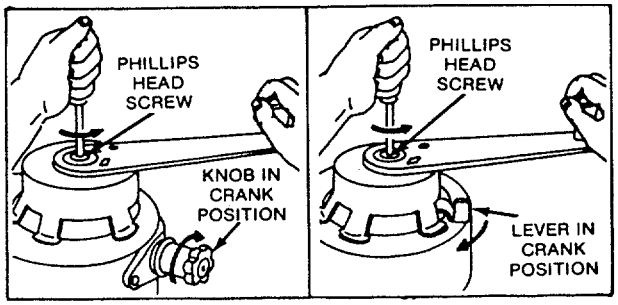


Fig. 22.. - Releasing spring

Broken Spring, Windup Starter

To check starter for a broken spring, while unit is still on engine, place control knob or lever to "Start" position. Turn cranking handle ten turns clockwise. If engine does not turn over, either the spring is broken or the starter clutch balls are not engaged. While turning the cranking handle, watch the starter clutch ratchet; if it does not move the starter spring is probably broken

Disassemble Windup

Remove blower housing. Remove screw holding cranking handle to housing. Fig. 22. Bend tangs holding starter spring and housing assembly upward and lift retainer plate, spring and housing assembly out of blower housing. Fig. 23

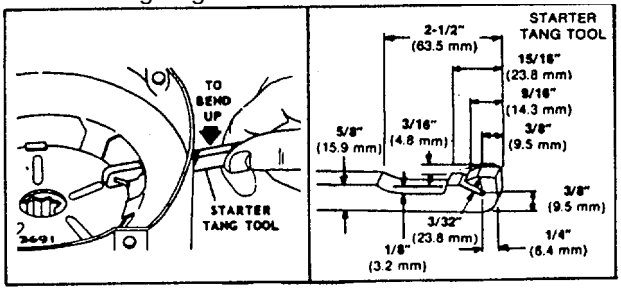


Fig. 23. - Removing Spring Housing

CAUTION: Do not attempt to remove starter spring from its housing.

Section 8
LUBRICATION

Oil has four purposes. It cools, cleans, seals and lubricates. Briggs & Stratton engines are lubricated with a gear driven splash oil slinger or a connecting rod dipper

OIL

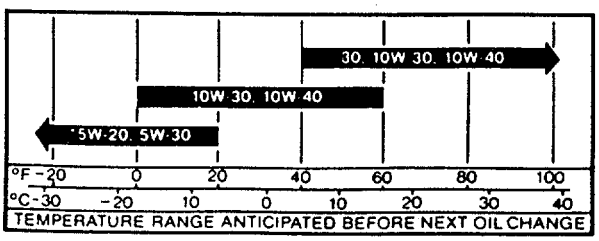
Capacity Chart

BASIC MODEL SERIES	CAPACITY	
ALUMINUM	PINTS	LITERS
9, cu. in. Vert. Crankshaft	1-1/4	.6

Oil Recommendations

Use a high quality detergent oil classified "For Service SC, SD, SE or MS." Detergent oils keep the engine cleaner and retard the formation of gum and varnish deposits. Nothing should be added to the recommended oil.

RECOMMENDED SAE VISCOSITY GRADES

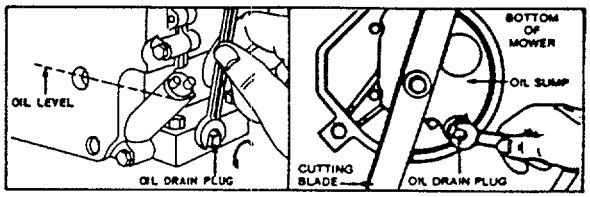


**If not available, a synthetic oil may be used having 5W-20, 5W-30 or 5W-40 viscosity.*

Change Oil (Crankcase)

Change oil after first 5 hours of operation. Thereafter change oil every 25 hours of operation; more often under dirty operating conditions. Remove oil drain plug, Fig. 1, III. I or 2 and drain oil while engine is warm. Replace drain plug. Remove oil fill plug or cap and refill with new oil of proper grade. Replace oil fill plug or cap. Check oil level regularly - at least after five hours of operation.

BE SURE OIL LEVEL IS MAINTAINED.



III. 1 Horizontal **III. 2 Vertical**

Fig. 1.- Change Oil Crankcase

which is used to secure the tube and bracket. When the cap and dipstick assembly is fully depressed or screwed down, it seals the upper end of the tube. See Fig. 5

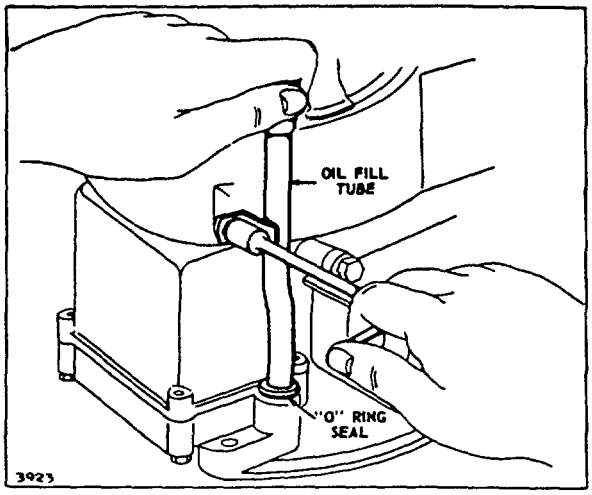


Fig. 5. - Extended 011 Fill and Dipstick

A LEAK AT THE SEAL BETWEEN THE TUBE AND SUMP, OR AT THE SEAL AT THE UPPER END OF THE DIPSTICK CAN RESULT IN A LOSS OF CRANKCASE VACUUM, AND A DISCHARGE OF SMOKE THROUGH THE MUFFLER

Caution owners not to overfill the sump or crankcase with oil when using the extended filler and dipstick The dipstick is marked "DO NOT OVERFILL." Excessive oil will cause a smoking condition, as the engine attempts to discharge the surplus oil

Various styles of extended Oil Fill and Dipsticks are shown in Figs. 6, 7. 8 and 9.

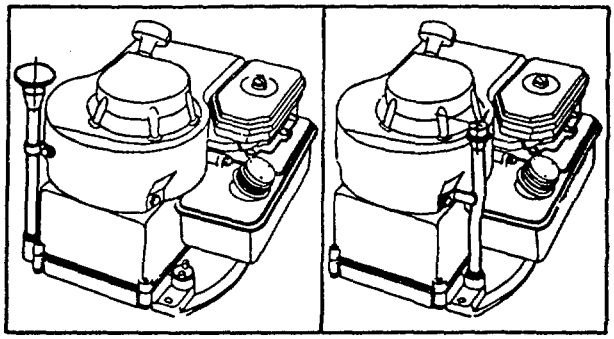


Fig. 6. -- Model Series 92000,

EXTENDED OIL FILL AND DIPSTICKS

When Installing the extended oil fill and dipstick assembly, the tube must be installed so the "0" ring seal is firmly compressed. To do so, push the tube downward toward the sump, then tighten blower housing screw,

It is the breather's function to maintain a vacuum in the crankcase. The breather has a fibre disc valve, which limits the direction of air flow caused by the piston moving back and forth. Air can flow out of the crankcase, but the one way valve blocks the return flow, thus maintaining a vacuum in the crankcase

A partial vacuum must be maintained in the crankcase to prevent oil from being forced out of engine, at the piston rings, oil seals, breaker plunger and gaskets

Checking Breathers

If the fiber disc valve is stuck or binding, the breather cannot function properly and must be replaced. A .045" (1.1 mm) wire gauge should not enter the space between the fiber disc valve and body. (A spark plug wire gauge may be used.) Check as shown in Fig. 10. NOTE: The fiber disc valve is held in place by an internal bracket which will be distorted if pressure is applied to the fiber disc valve. Therefore, do not apply force when checking with wire gauge

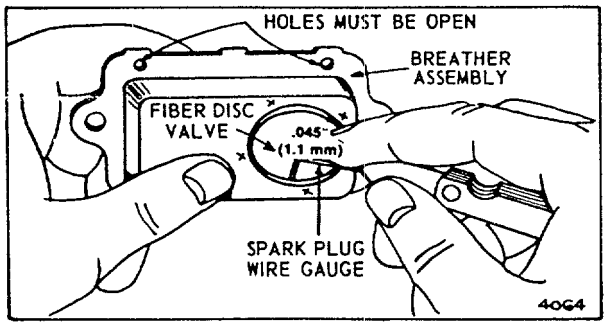


Fig. 10. - Checking Breather

If breather is removed for inspection, or valve repair, a new gasket should be used when replacing breather. Tighten screws securely to prevent oil leakage

Most breathers are now vented through the air cleaner, to prevent dirt from entering the crankcase. Check to be sure venting elbows or tube are not damaged and seal properly

Various breather assemblies are illustrated in Fig. 11.

OIL SLINGER

Aluminum Alloy Engines

The oil slinger is driven by the cam gear. Old style slingers using a die cast bracket assembly have a steel bushing between the slinger and the bracket Replace bracket on which the oil slinger rides if worn to a diameter of .49" (12.4 mm) or less Replace steel bushing if worn. Fig. 13. Illus. 1 Newer style oil slingers have a stamped steel bracket. Unit is one assembly. Fig. 13. Illus. 2 and Fig. 14. Spring washer is used only on Models 100900 130900. Inspect gear teeth, old and new style; replace if worn

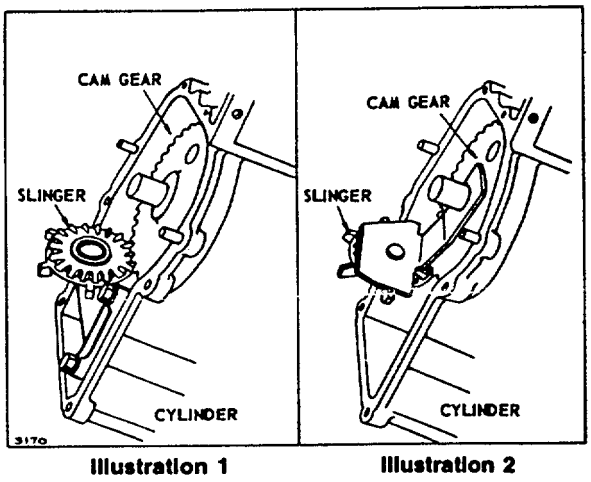


Illustration 1 **Illustration 2**

Fig. 13. - Oil Slinger and Bracket

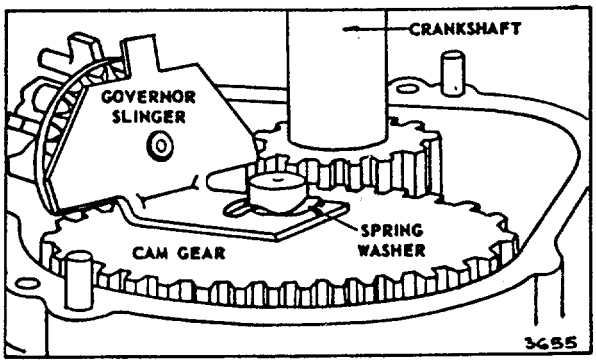


Fig. 14. - Oil Slinger and Bracket
Vertical Crankshaft Engines

Section 9
PISTONS - RINGS - RODS

Remove Piston and Connecting Rod

To remove the piston and connecting rod from the engine, bend down connecting rod lock. Fig. 1. Remove the connecting rod cap. Remove any carbon or ridge at the top of the cylinder bore; this will prevent breaking of the rings. Push the piston and rod out through the top of the cylinder

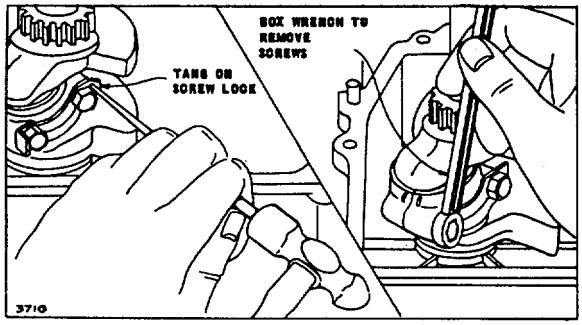


Fig. 1. - Bending Rod Lock

Pistons used in sleeve bore aluminum alloy engines are marked with an "L" on top of the piston. Fig. 2 Illus. 1. These pistons are tin plated. This piston assembly is NOT INTERCHANGEABLE with the piston used in aluminum bore (KOOL BORE) engines

Pistons used in aluminum bore (KOOL BORE) engines are NOT marked on top of the piston

Fig. 2. Illus. 2. The piston is chrome plated and is not to be used in a sleeve bore engine

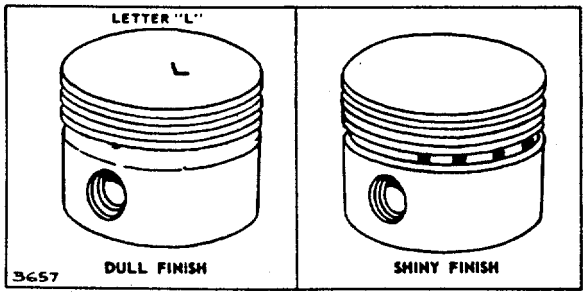


Fig. 2. - Piston Variations

Remove Connecting Rod

To remove connecting rod from piston, remove piston pin lock with thin nose pliers. One end of the pin is drilled to facilitate removal of the lock. Fig. 3

Remove rings one at a time as shown in Fig. 4, slipping them over the ring lands. Use a ring expander to prevent damage to rings and piston

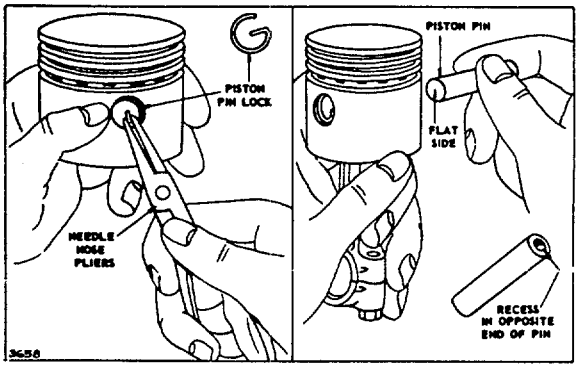


Fig. 3. - Removing Rod

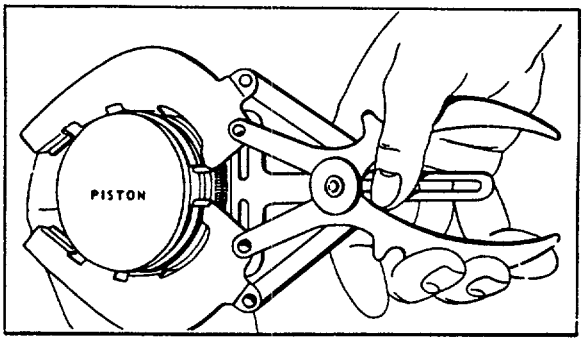


Fig. 4. - Removing Ring

Check Piston

If the cylinder is to be resized, there is no reason to check the piston, since a new oversized piston assembly will be used.

If, however, the cylinder is not to be resized, and the piston shows no signs of wear or scoring, the piston should be checked

PISTONS - RINGS - RODS
Checking

To do so, clean carbon from top ring groove. Place a NEW ring on the groove, check the remaining space in the groove with a feeler gauge. Fig. 5. If a .007" (0.18 mm) feeler gauge can be inserted (all models), the piston is worn and should be replaced.

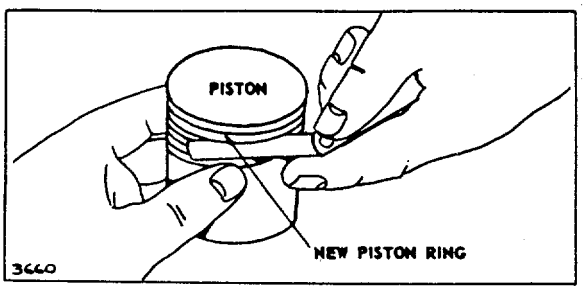


Fig. 5. - Checking Ring Grooves

Check Rings

To check rings, first clean all carbon from the ends of the rings and from the cylinder bore. Insert old rings one at a time one inch down into the cylinder. Check gap with feeler gauge. Fig. 6. If ring gap is greater than shown in Table No. 1, the ring should be rejected.

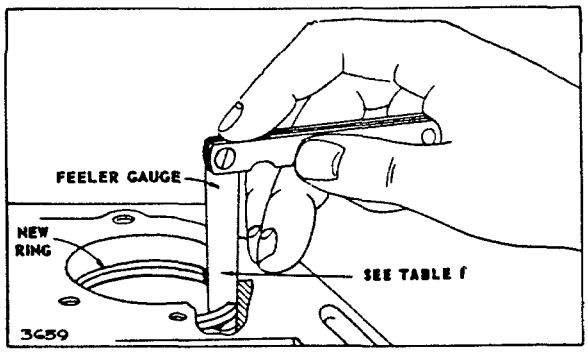


Fig. 6. - Checking Ring Gap

NOTE: Do not deglaze cylinder walls when installing piston rings in aluminum cylinder engines.

Chrome Rings

NOTE: Chrome ring sets are available for all current aluminum and cast iron cylinder models, no honing or deglazing is required. The cylinder bore can be a maximum of .005" (0.13 mm) oversize when using chrome rings. See Service Bulletin 479 or Engine Parts List.

TABLE NO. 1
RING GAP REJECTION SIZE

BASIC MODEL SERIES	COMP. RING		OIL RING	
ALUMINUM CYLINDER	Inches	Milli-meter	Inches	Milli-meter
92000,	.035	0.80	.045	1.14

TABLE NO. 2
CONNECTING ROD REJECT SIZES

BASIC MODEL SERIES	CRANK PIN BEARING		PISTON PIN BEARING	
ALUMINUM CYLINDER	Inches	Milli-meter	Inches	Milli-meter
92000,	1.001	25.43	.492	12.50

Check Connecting Rod

If the crankpin bearing in the rod is scored, the rod must be replaced. Rejection sizes of crankpin bearing hole and piston pin bearing hole are shown in table No. 2. Pistons pins .005" (0.13 mm) oversize are available in case the connecting rod and piston are worn at the piston pin bearing. If, however, the crankpin bearing in the connecting rod is worn, the rod should be replaced. Do not attempt to "file" or "fit" the rod.

Check Piston Pin

If the piston pin is worn .0005" (.01 mm) out of round or below the rejection sizes listed below, it should be replaced. Table No. 3.

TABLE NO. 3
PISTON PIN REJECTION SIZE

BASIC MODEL SERIES	PISTON PIN		PIN BORE	
ALUMINUM CYLINDER	Inches	Milli-meter	Inches	Milli-meter
92000,	.489	12.42	.491	12.47

Assemble Piston and Connecting Rod

The piston pin is a push fit in both piston and connecting rod. On models using a solid piston pin, one end is flat, the other end is recessed. Other models use a hollow pin.

Place a pin lock in the groove at one side of the piston. From the opposite side of the piston, insert the piston pin, flat end first with solid pin, either end with hollow pins, until it stops against the pin lock. Fig. 3. Use a thin nose pliers to assemble the pin lock in the recessed end of the piston. Be sure the locks are firmly set in the grooves.

Assemble Rings to Piston

In Fig. 7, are shown the various rings and the proper position of each. Note especially the center compression ring. The scraper groove should always be down toward the piston skirt. Be sure the oil return holes are clean and carbon is removed from all grooves. NOTE: Install expander under oil ring, when required.

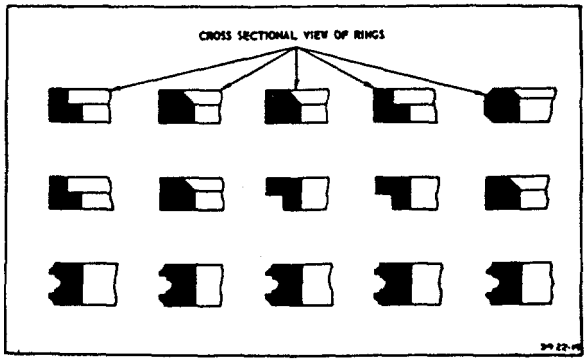


Fig. 7. - Position of Rings

Oil the rings and piston skirt, then compress rings with ring compressor (part 19070 or 19230). On all cast iron models, use ring compressor (19070) as illustrated in Fig. 8. Illustration 1.
On all aluminum engines, use compressor (19070) as illustrated in Fig. 8. Illustration 2.

NOTE: When using 19230 (2 band) ring compressor, use as shown in Fig. 8, Illus. 1 on all engines.

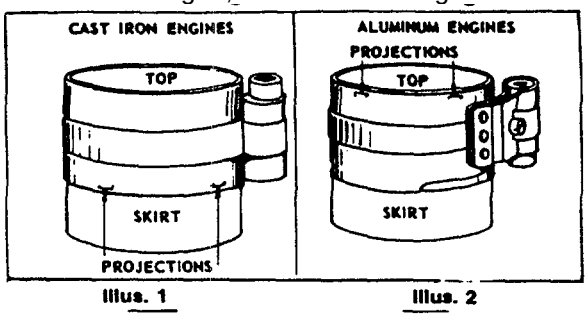


Fig.8. - Compression Rings

Turn the piston and compressor upside down on the bench and push downward, so the piston head and edge of compressor band are even while tightening the compressor. Draw the compressor up tight to fully compress the rings, then loosen the compressor very slightly.

Do not attempt to Install piston and ring assembly without ring compressor.

PISTONS - RINGS- RODS
Assembly

Install piston, connecting rod, and dipper. Piston identification mark "F" and notch at top of piston must be toward flywheel side. Torque connecting rod screw per Table No. 4. Move connecting rod back and forth on crankpin to be sure it is free.

Install Piston and Rod Assembly
All Models

Place the connecting rod and piston assembly with rings compressed into the cylinder bore, Fig. 10. Push piston and rod down into the cylinder. Oil the crankpin of the crankshaft. Pull the connecting rod against the crankpin and assemble the rod cap so assembly marks align. Fig. 11.

NOTE: Some rods do not have assembly marks as rod and cap will fit only in one position. Use care to insure proper installation.

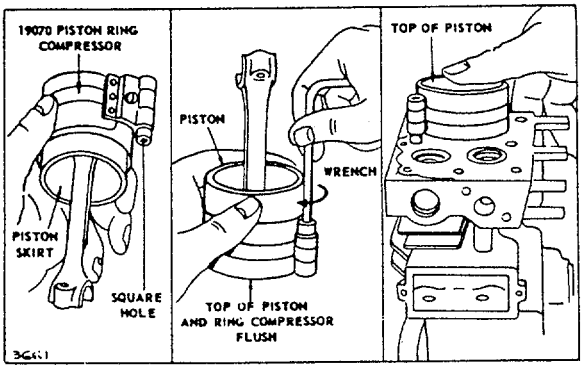


Fig. 10. - Install Piston Assembly

NOTE: Some rods may have flat washers under cap screws; remove and discard prior to installing rod.

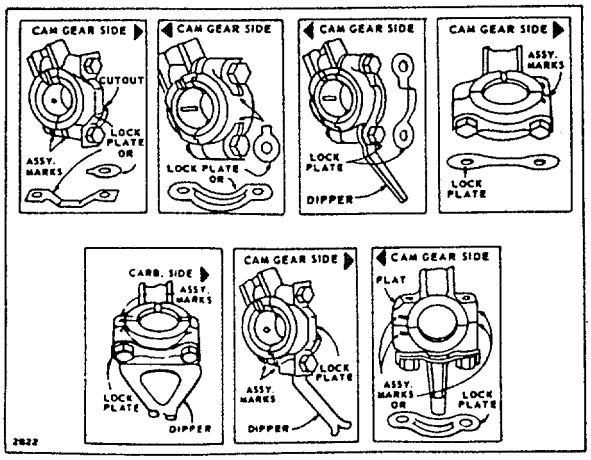


Fig. 11. - Connecting Rod Installation

Assemble the cap screws and screw locks with oil dipper (if used). Tighten cap screws to torque shown in Table No. 4. Fig. 12. Rotate the crankshaft two revolutions to be sure rod is correctly installed. If rod strikes, connecting rod has been installed wrong or cam gear is out of time. If crankshaft operates freely bend screw locks against screw heads. Fig. 12.

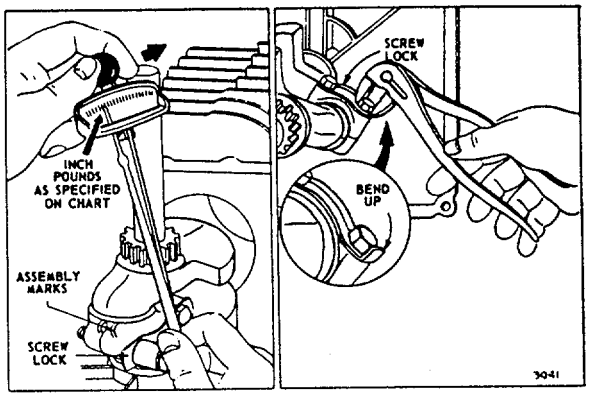


Fig. 12. - Bending Screw Locks

TABLE NO. 4
CONNECTING ROD CAP SCREW TORQUE

BASIC MODEL SERIES	AVERAGE TORQUE		
ALUMINUM CYLINDER	Inch Pounds	Kilo-gram Meter	Newton Meter
92000,	100	1.2	11.3

NOTE: Tighten rod screws securely. After tightening rod screws, rod should be able to move sideways on crankpin of shaft. A torque wrench must be used to prevent loose or overtight cap screws which results in breakage and/or scoring of rod. Fig. 12.

Section 10
CRANKSHAFTS & CAM GEARS

REMOVAL

Aluminum Cylinder Engines

To remove the crankshaft from aluminum alloy engines, remove rust or burrs from the power take-off end of the crankshaft. Remove crankcase cover or sump. If sump or cover sticks, tap lightly with soft hammer on alternate sides near dowel. Turn crankshaft to align the crankshaft and cam gear timing marks, lift out the cam gear, then remove the crankshaft. On ball bearing models, the crankshaft and cam gear must be removed together. Fig. 1.

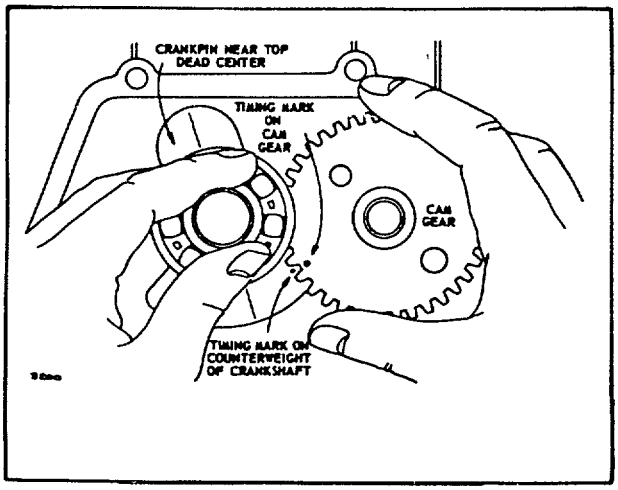


Fig. 1. - Ball Bearing Engines

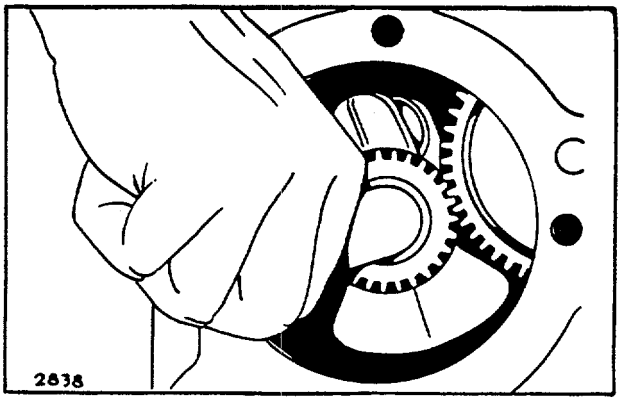


Fig. 2. - Remove or Install Crankshaft

CHECKING CRANKSHAFT
All Engines

Table No. I shows the rejection sizes of the various wear points of the crankshaft. Discard crankshaft if worn smaller than the size shown. Keyways should be checked to be sure they are not worn or spread. Remove burrs from keyway edges to prevent scratching the bearing. Fig. 8 shows the various points to be checked on the crankshaft.

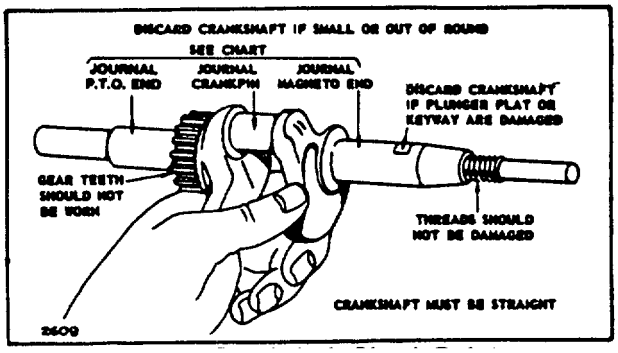


Fig. 8. - Crankshaft Check Points

NOTE: .020" undersize connecting rods may be obtained for use on reground crankpin bearings. Complete instructions are induced with the undersize rod. (See Service Bulletin #480 or Illustrated Parts List to find appropriate undersize rod.)

TABLE NO. 1
CRANKSHAFT REJECT SIZES

MODEL SERIES	P.T.O. JOURNAL		MAGNETO JOURNAL		CRANKPIN JOURNAL	
ALUMINUM CYLINDER	Inches	Millimeter	Inches	Millimeter	Inches	Millimeter
92000*,	.873	22.17	.873	22.17	.996	25.30

CHECKING CAM GEAR
All Engines

Inspect gear teeth for wear and nicks. Cam shaft and cam gear journals and lobe rejection sizes are shown in Table No. 2.

Check automatic spark advance on models equipped with "Magna-Matic." Fig. 9. Place cam gear in normal operating position with the movable weight down. Press the weight down. Release. The spring should lift the weight. If not, the spring is stretched or the weight is binding. Repair or replace.

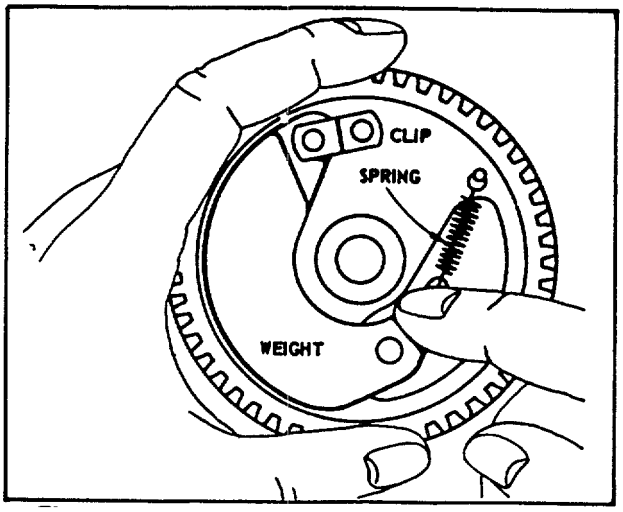


Fig. 9.- Checking Automatic Spark Advance

TABLE NO. 2
CAM GEAR REJECT SIZES

MODEL SERIES	CAM GEAR OR SHAFT JOURNAL		CAM LOBE	
ALUMINUM CYLINDER	Inches	Millimeter	Inches	Millimeter
92000,	.498	12.65	.883	22.43

CRANKCASE COVER and CRANKSHAFT END PLAY

All Models

The crankshaft end play on all models, plain and ball bearing, should be .002" (.05 mm) to .008" (.20 mm). The method of obtaining the correct end play varies, however, between cast iron, aluminum, plain and ball bearing models. New gasket sets include three crankcase cover or bearing support gaskets .005" (.13 mm), .009" (.23 mm) and .015" (.38 mm).

Aluminum Engines - Plain Bearing

The end play should be .002" (.05 mm) to .008" (.20 mm) with one .015" (.38 mm) gasket in place. If the end play is less than .002" (.05 mm), which would be the case if a new *crankcase* or sump cover is used, additional gaskets of .005" (.13 mm) .009" (.23 mm) or .015" (.38 mm) may be added in various combinations to attain the proper end play.

If the end play is more than .008" (.20 mm) with one .015" (.38 mm) gasket in place, a thrust washer is available and to be placed on the crankshaft power take-off end, between the gear and crankcase cover or sump. Additional gaskets .005" (.13 mm) or .009" (.23 mm) will then have to be added to the .015" (.38 mm) gasket for proper end play. NOTE: On aluminum models never use less than .015" (.38 mm) gasket. Fig. 16.

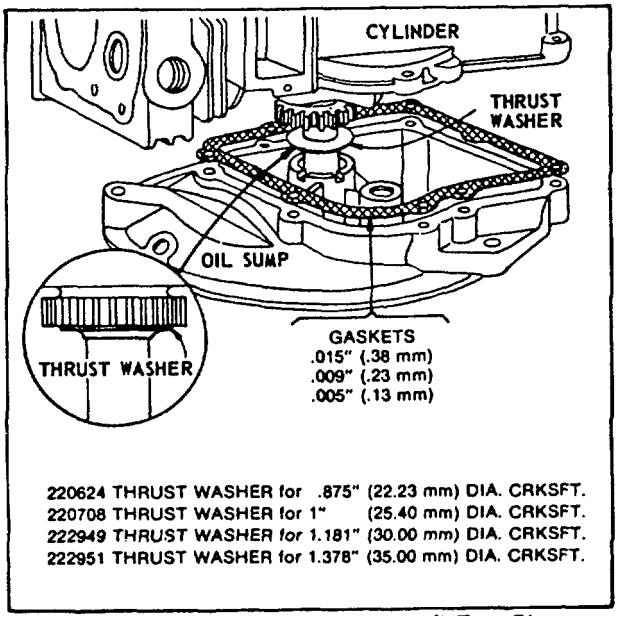


Fig. 16. - Correcting Crankshaft End Play

CRANKSHAFTS & CAM GEARS
End Play

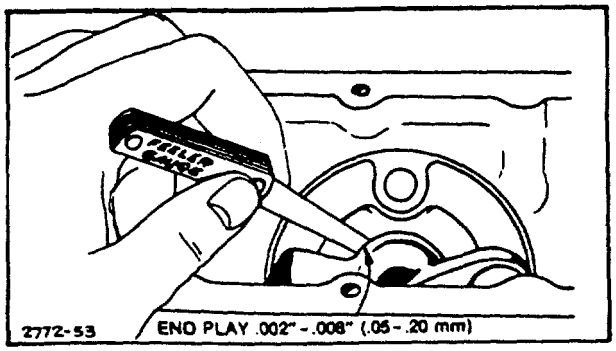


Fig. 20. - Checking Crankshaft End Play

If the end play is more than .008" (.20 mm) with one .015" (.38 mm) gasket in place, a .009" (.23 mm) or .005" (.13 mm) gasket may be used. Fig. 20.

If the end play is more than .008" (.20 mm) with one .005" (.13 mm) gasket in place, a thrust washer is available and is placed on the crankshaft power take-off end. Fig. 20.

222949 Thrust Washer for 1.181" (30 mm) diameter crankshaft.

222951 Thrust Washer for 1.378" (35 mm) diameter crankshaft.

NOTE: Thrust washer cannot be used on ball bearing engines.

Checking End Play

On models with a removable base, the end play can be checked with a feeler gauge between the crankshaft thrust face and the bearing support on plain bearing engines. Fig. 20.

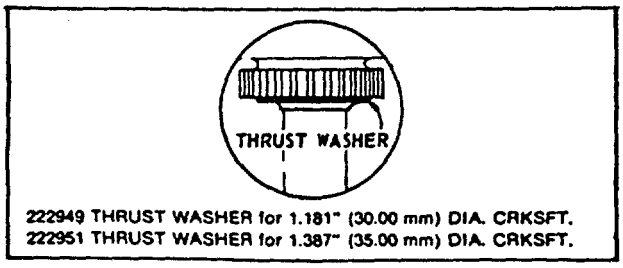


Fig. 21. - Correcting Crankshaft End Play

CHECKING AND CORRECTING
CAM GEAR END PLAY

Cam gear end play tolerance is machined at the factory and normally requires no adjustment, unless the magneto side cam gear bearing or cam gear is replaced.

Cam gear end play is checked in the same manner as crankshaft end play.

Cam shaft end play must be .002" (.05 mm) to .008" (.20 mm). If end play is less than .002" (.05 mm), add service shims (#270516-.009" (.23 mm); #270517-.007" (.18 mm); or #270518-.005" (.13 mm) to obtain proper end play. If end play is more than .008" (.20 mm), use service bearing assembly kit #299706, which includes above shims to obtain proper end play.

Use chalk or crayon to mark the top of crankshaft gear tooth, whose inner end is directly in line with the notch of the timing mark. See Fig. 25.

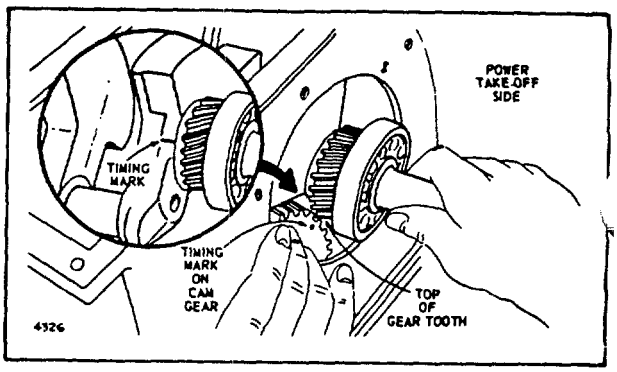


Fig. 25. - Aligning Timing Marks

Align timing marks on crankshaft and cam gear, and install crankshaft. Install crankshaft carefully so crankpin is not damaged.

Section 11
CYLINDERS & BEARINGS

INSPECTION

All Models

Always inspect the cylinder after the engine has been disassembled. Visual inspection will show if there are any cracks, stripped bolt holes, broken fins or if the cylinder wall is damaged. Use a telescoping gauge and dial indicator or inside micrometer to determine the size of the cylinder bore. Measure at right angles. See Fig. 1. Table No. 1 lists the standard cylinder bore sizes.

If the cylinder bore is more than .003" (.08 mm) oversize, or .0015" (.04 mm) out of round on cast iron cylinders, or .0025" (.06 mm) out of round on lightweight cylinders, it must be resized.

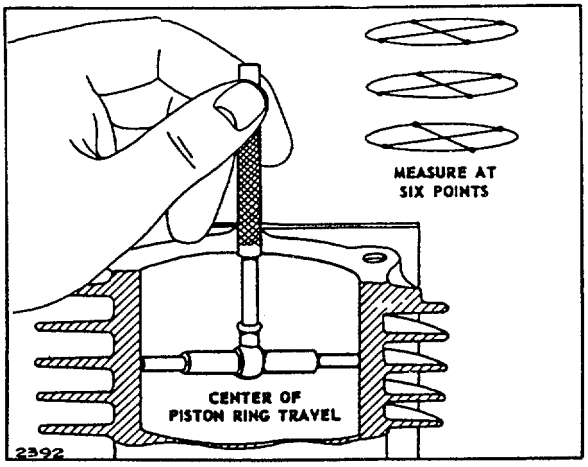


Fig. 1. - Check Cylinder Bore

NOTE: Do not deglaze cylinder walls when installing piston rings in aluminum cylinder engines.

NOTE: Chrome ring sets are available for most models. See Bulletin #479 or Illustrated Parts List. They are used to control oil consumption in bores worn to .005" (.13 mm) over standard and do not require honing or glaze breaking the bore to seat.

RESIZING

Resize Cylinder Bore to Next Oversize

All Models

ALWAYS RESIZE TO EXACTLY .010" (.25 mm) or .020" (.51 mm), or .030" (.76 mm) OVER STANDARD SIZE AS SHOWN IN TABLE NO. 1. IF THIS IS DONE ACCURATELY, THE STOCK OVERSIZE RINGS AND PISTONS WILL FIT PERFECTLY AND PROPER CLEARANCES WILL BE MAINTAINED. Cylinders, either cast iron or aluminum, can be quickly resized with a good hone such as Briggs & Stratton part #19205 for aluminum cylinders or part #19211 for cast iron cylinders. Contact your Briggs & Stratton source of supply. Use the stones and lubrication recommended by the hone manufacturers for the various engine models, to produce the correct cylinder wall finish.

TABLE NO. 1

BASIC ENGINE MODEL OR SERIES	STANDARD BORE SIZE DIAMETER			
	MAX.		MIN.	
ALUMINUM CYLINDER	Inches	Milli-meters	Inches	Milli-meters
92000	2.5625	65.09	2.5615	65.06

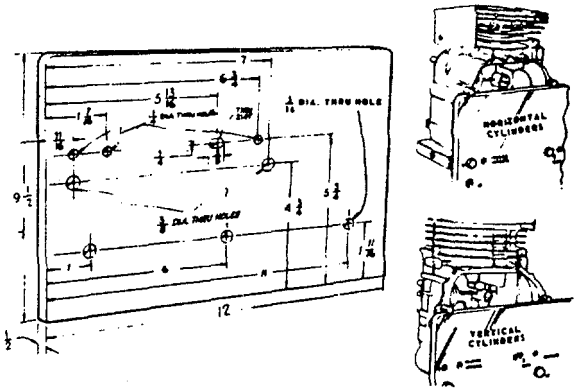


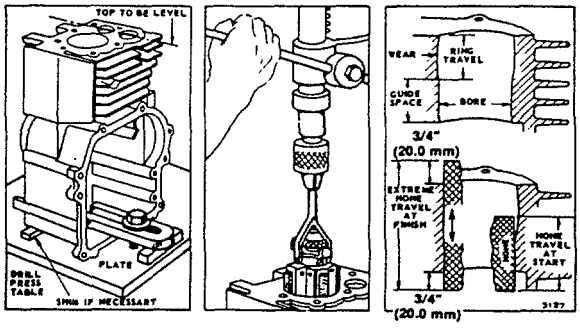
Fig. 2. -- Honing Cylinder
(See page 8 for enlarged drawing.)

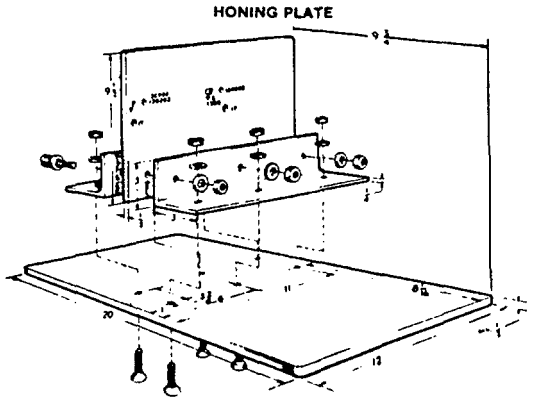
If a boring bar is used, a hone must be used after the boring operation to produce the proper cylinder wall finish.

Honing can be done with a portable electric drill, but it is easier to use a drill press.

To Set Up For Honing

Clean cylinder at top and bottom to remove burrs and pieces of base and head gaskets.





Fasten cylinder to a heavy iron bracket or use honing plate. Fig. 2. Some cylinders require shims. Use a level to align drill press spindle with bore.

Oil surface of drill press table liberally. Set plate and cylinder on drill press table. (Do not anchor to drill press table.) If using portable drill, set plate and cylinder on floor. Place hone drive shaft in chuck of drill or portable drill.

Slip hone into cylinder; Fig. 2, Illus. 2. Connect drive shaft to hone and set stop on drill press so hone can only extend 3/4" (20.0 mm) to I" (25.0 mm) from top or bottom of cylinder. If using a portable drill, cut a wood block to place inside of cylinder as a stop for home.

To Hone Cylinder

Place hone in middle of cylinder bore. Tighten adjusting knob with finger or small screwdriver until :stones fit snugly against cylinder wall. DO NOT FORCE. Hone should operate at 300 to 700 RPM. Lubricate hone as recommended by manufacturer.

Connect drive shaft to hone. Be sure that cylinder and hone are centered and aligned with drive shaft and drill spindle. Start drill and, as hone spins, move it up and down at lower end of cylinder. Fig. 2, Illus. 3. The cylinder is not worn at the bottom but is round so it will guide the hone to straighten cylinder bore. As the bottom of the cylinder increases diameter, gradually increase strokes until hole travels full length of bore. Do not extend hone more than 3/4" (20.0 mm) to 1" (25.0 mm) at either end of cylinder bore.

As cutting tension decreases, stop hone and tighten adjusting knob. Check cylinder bore frequently with an accurate micrometer. Hone about .0005" (.01 mm) large to allow for shrinkage when cylinder cools.

CYLINDER FINISH AND CLEANING

The finish resized cylinder should have a crosshatch appearance, Fig. 3. Proper stones, lubrication and spindle speed along with rapid movement of hone within the cylinder during the last few strokes, will produce this finish. Cross-hatching will allow proper lubrication and ring break-in.

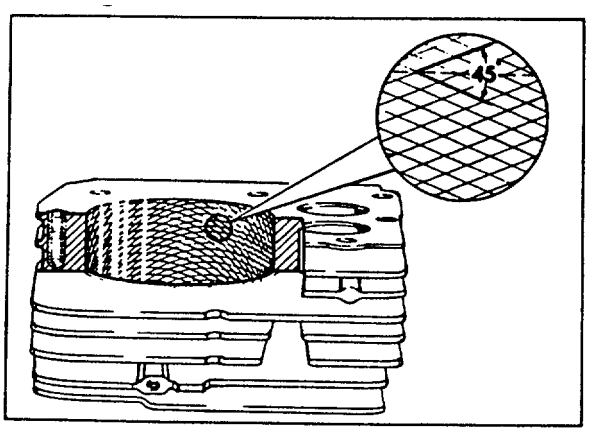


Fig. 3. - Cross Hatch

IT IS MOST IMPORTANT THAT THE ENTIRE CYLINDER BE THOROUGHLY CLEANED AFTER HONING. WASH THE CYLINDER CAREFULLY IN A SOLVENT SUCH AS KEROSENE OR COMMERCIAL SOLVENT. THE CYLINDER BORE SHOULD THEN BE CLEANED WITH A BRUSH, SOAP AND HOT WATER.

PLAIN BEARINGS

Checking

Bearings should be replaced if scored or if plug gauge will enter. Try gauge at several locations in bearing. Fig. 6. See gauge listing in Table No. 3.

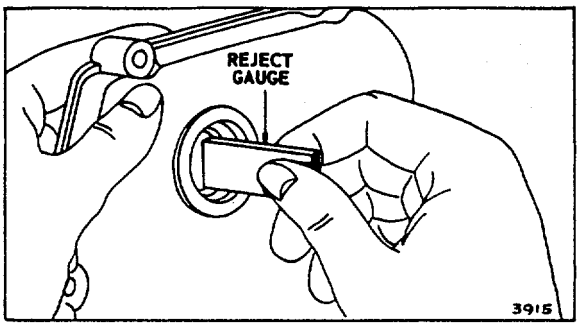


Fig. 6. - Checking Bearing

TABLE NO. 2
CYLINDER BEARING REJECT SIZE CHART

BASIC ENGINE MODEL OR SERIES	PTO BEARING		BEARING MAGNETO	
ALUMINUM CYLINDER	Inches	Milli-meter	Inches	Milli-meter
92000*	.878	22.30	.878	22.30

REPLACING MAGNETO BEARING
Aluminum Cylinder Engines

There is no removable bearing in these models: the cylinder must be reamed out so a replacement bushing can be installed. Place pilot guide bushing in the sump bearing, with flange of pilot guide bushing toward inside of sump.

Assemble sump on cylinder. Be careful that pilot guide bushing does not fall out of place. Place reamer guide bushing into the oil seal recess in the cylinder. The reamer guide bushing, along with the pilot guide bushing, will center the counterbore reamer with the opposite bearing even though old bearing might be badly worn.

Place counterbore reamer on pilot and insert into cylinder until the tip of the pilot enters the pilot guide bushing in the sump. Fig. 7.

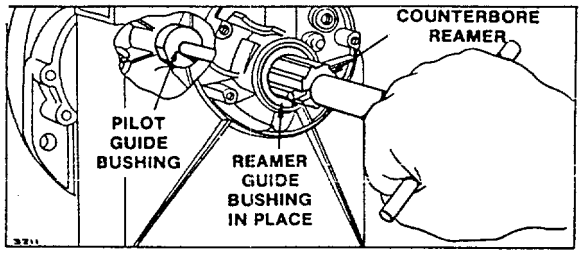


Fig. 7. - Counterbore Reaming

Turn reamer clockwise with a steady even pressure until it is completely through the bearing. Lubricate reamer with kerosene or Stoddard Solvent.

NOTE: Counterbore reaming may be undertaken without any lubricant. However, as aluminum material builds up on reamer flutes, eventual damage to the reamer and oversize counterbores will be experienced.

Remove sump and pull reamer out without backing it through the bearing. Clean out reaming chips. Remove reamer guide bushing from oil seal recess.

Hold new bushing, with notch toward cylinder and in line with notch on inside of cylinder, (Fig. 8, insert), against reamed out bearing. Note position of split in bushing. At a point opposite to the split in the bushing, using a chisel or screwdriver and hammer. make a notch in the reamed out cylinder bearing at a 45° angle. Fig. 8.

TABLE NO. 3
MAIN BEARING TOOL CHART

BASIC ENGINE MODEL SERIES	CYLINDER SUPPORT	PILOT	COUNTER-BORE REAMER	REAMER GUIDE BUSHING MAG.	REAMER GUIDE BUSHING PTO	BUSHING DRIVER	PILOT GUIDE BUSHING MAG.	PILOT GUIDE BUSHING PTO	FINISH REAMER	PLUG GAUGE
92000,	19123	19096	19099	19101	19100	19124	19094	19094	19095	19166

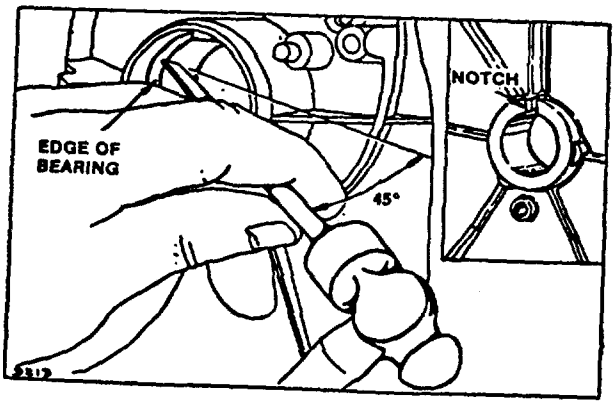


Fig. 8. - Notching Cylinder Hub

Press in the new bushing, being careful to align the oil notches, *with driver and* support until the outer end of the bushing is flush with the end of the reamed out cylinder hub. Fig. 9. If oil notches do not line up, bushing can be pressed through *into recess* in cylinder support and then reinstalled.

With a blunt chisel or screwdriver, drive a portion of the bushing into the notch previously made in the cylinder. See Fig. 8. *This* is called staking and is done to prevent the bushing *from* turning.

Reassemble sump to cylinder with pilot guide bushing in the sump bearing.

Place finish reamer on pilot and insert the *pilot* into the cylinder bearing until the tip of the pilot enters the pilot guide bushings in the sump bearing. Fig. 10.

Lubricate the reamer with kerosene. fuel oil or Stoddard Solvent. then ream the bushing turning the reamer clockwise with a steady even pressure until reamer is completely' through the bearing. Improper lubricants will produce a rough bearing surface. Remove sump and pull reamer out without backing it through the bearing. Remove pilot guide bushing: clean out all reaming chips.

On most cylinders. the breaker point plunger hole enters the reamed out main bearing and i1 burr is formed by the counterbore reaming operation. Burr can be removed using 1905O finish reamer. Clean out dirt and reaming chips.

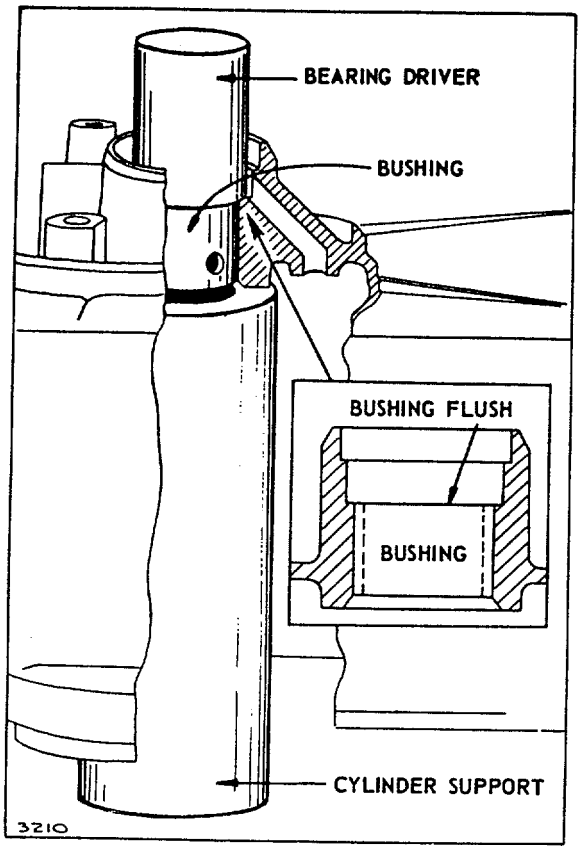


Fig. 9. - Pressing in New Bushing

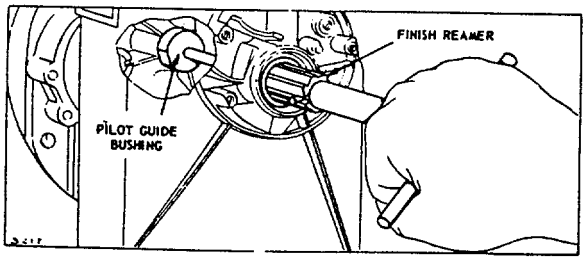


Fig. 10. - Shell Reaming

REPLACING OIL SEAL

The oil seal is assembled with the sharp edge of the leather or rubber toward the inside of the engine. Lubricate inside diameter of oil seals with "Lubriplate." or equivalent, before assembling engines.

Most oil seals are pressed in. flush with the hub. However, models 60000, 80000, 100000 and 130000 using a ball bearing with mounting flange have the seal pressed 3/16" below crankcase mounting flange. Fig. 13.

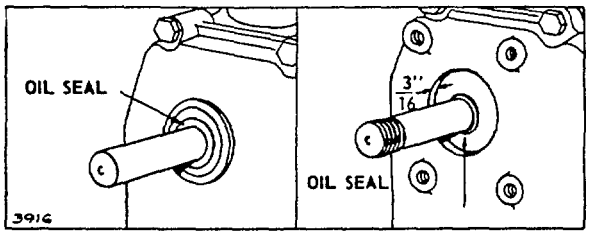


Fig. 13. - Replacing Oil Seal

CHECKING CAM GEAR BEARINGS

Check cam gear bushing using 19164 plug gauge as shown. Fig. 14. If 1/4" or more of gauge enters bearing bore, bearing is worn beyond reject and the cylinder. sump or crankcase cover must be replaced.

NOTE: On Model Series 111200, *111900, plug* gauge 19164 is used on the sump or crankcase cover cam gear bearing bore. Reject size of the cylinder cam bearing is .443 or larger.

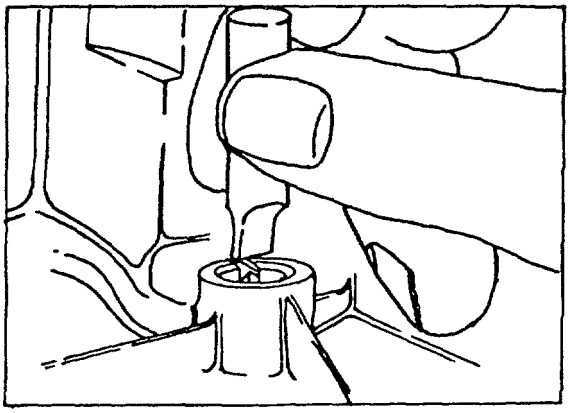
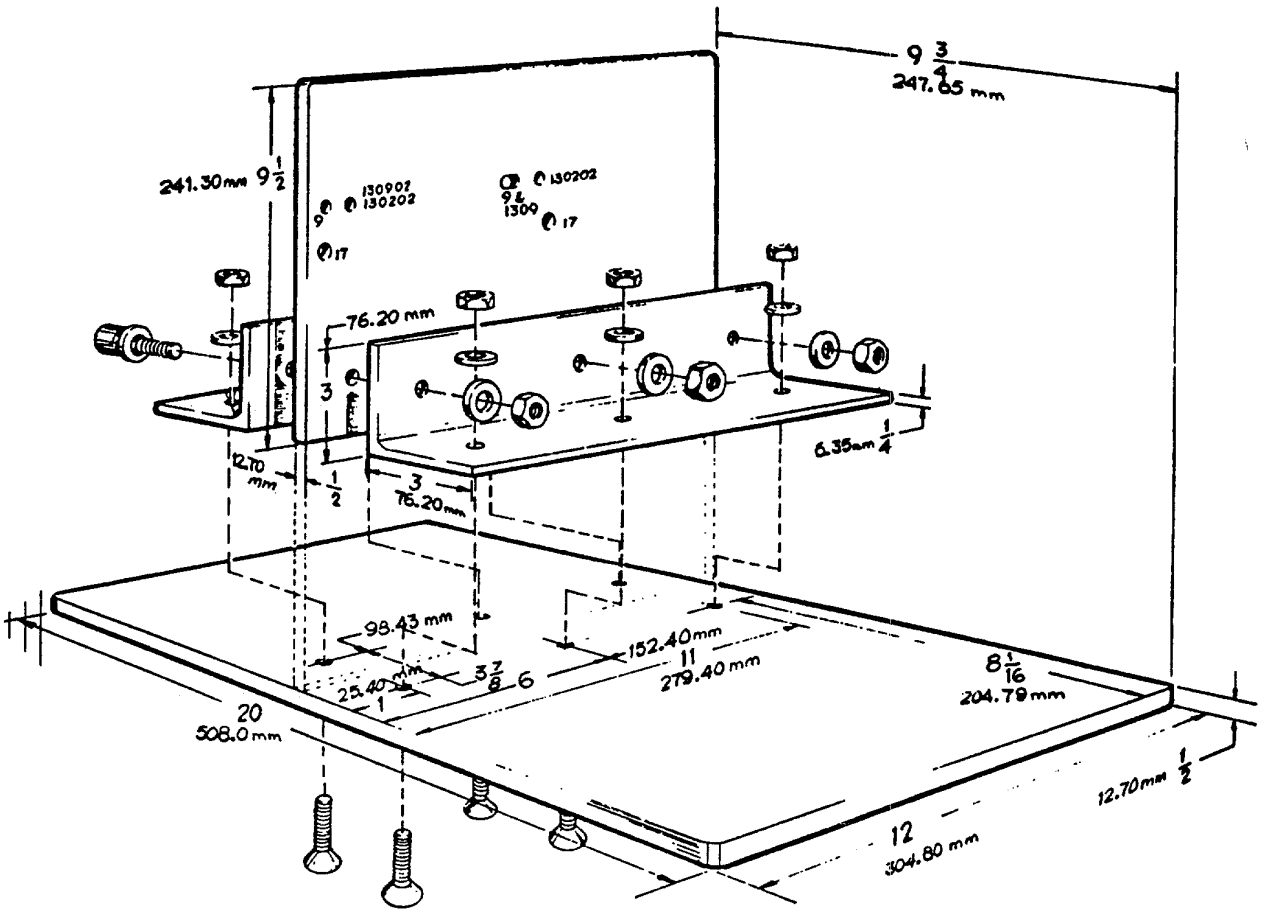
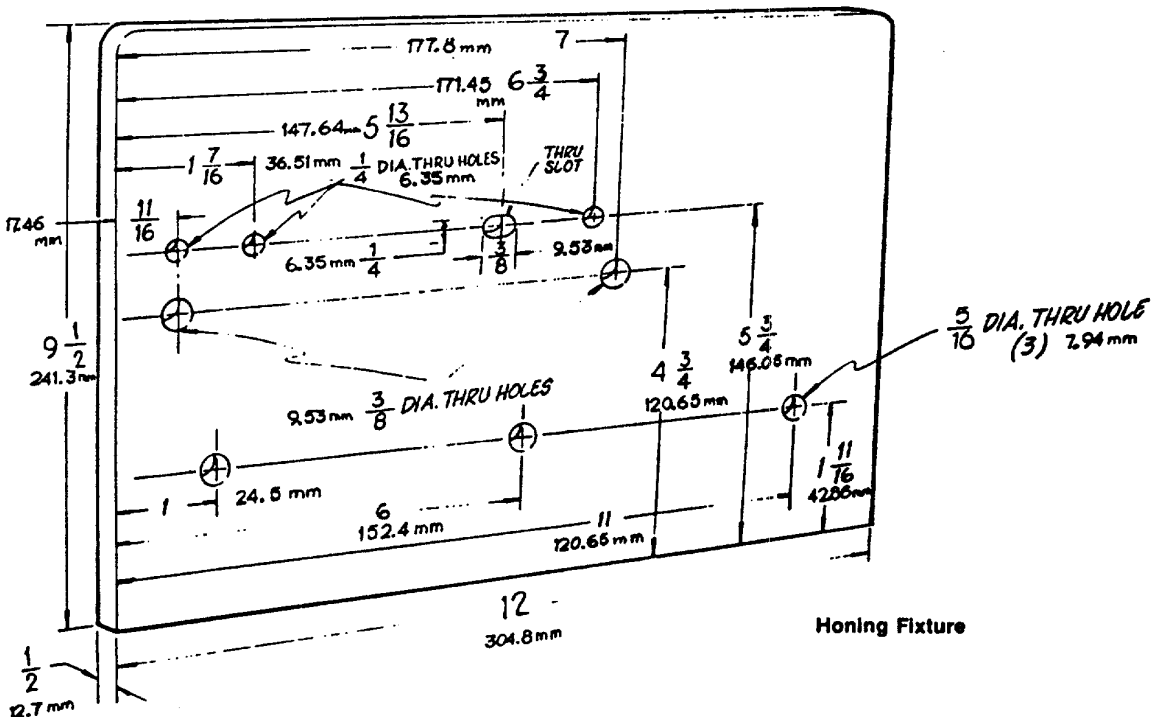


Fig. 14. - Checking Cam Gear Bearing

CYLINDERS





Honing Fixture

Section 13
TOOLS

It is assumed that Authorized Briggs & Stratton Service Centers have all common tools needed to repair engines.

Specialized tools in addition to the Briggs & Stratton #291661 Tool Kit, are required to analyze, repair and restore engines to proper operating condition.

The following tachometers have been found to work well on Briggs & Stratton engines:

TYPE	NAME	RPM RANGE	SOURCE
Vibration	Trysit Sirometer	800-25000	Order from your Briggs & Stratton Source of Supply - Part No. 19200.
Vibration	Frahm #2516	1000-4000	James G. Biddle Company Plymouth Meeting, PA 19462
Electronic	Merc-O-Tronic	1000-5000	Merc-O-Tronic Instruments Corp.
Model 67- 100T		1000-10000	215 Branch Street Almont, MI 48003

Note: Product brand names are given in some instances. However, any tool or test instrument of equivalent accuracy is acceptable in the following list.

DESCRIPTION	RANGE OR TYPE	SOURCE
Torque Wrench	0-200 in. lbs. - Part No. 19197	Briggs & Stratton Source
Valve Guide Tool Guide	Part No. #19191	Briggs & Stratton Source
Valve Seat Refacer	Part No. #19237	Briggs & Stratton Source
Valve Lapper	Woods Powr-Grip	Woods Powr-Grip Manufacturer 233 Cascade Wolf Point, MT 59201
Dial Caliper	0-4 in. - Part No. 19199	Briggs & Stratton Source
Telescope Gauge	2-1/8-3-9/16" - Part No. 19198	Briggs & Stratton Source
VOA Meter	Part No. 19236 Volts Scale - Reads 0 to 400 AC or DC volts. Ohms Scale - Reads 0 to 500, 000 ohms. Amps Scale - Reads 0 to 40 and 400 DC amps amps with shunt. Reads 0 to 16'AC amps.	Briggs & Stratton Source
Ignition Timing Light or Continuity Tester	Merc-O-Tronic Model 701FCT	Briggs & Stratton Source123

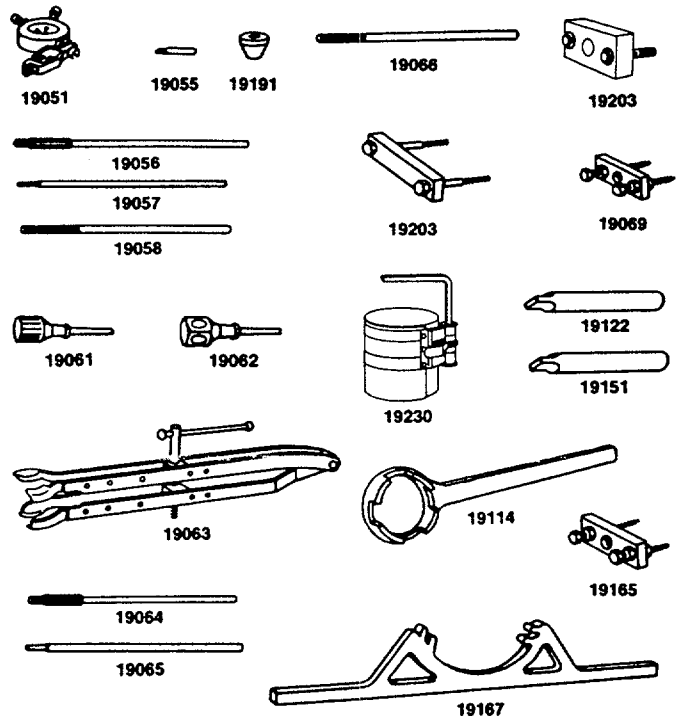
BRIGGS & STRATTON REPAIR TOOLS
See Price List MS-6636 In Section One of the Master Parts Manual

Tools are listed by description and by kits. Kit 291661 is a requirement of the Authorized Registered Service Dealer. An Authorized Service Distributor is required to have the 291661 Kit and the 19158 Kit. Other additional tools should be obtained, as required to provide efficient service. Order through your Briggs & Stratton source of supply.

NOTE: 291661 Tool Kit is recommended for Public Schools conducting air-cooled engine courses.

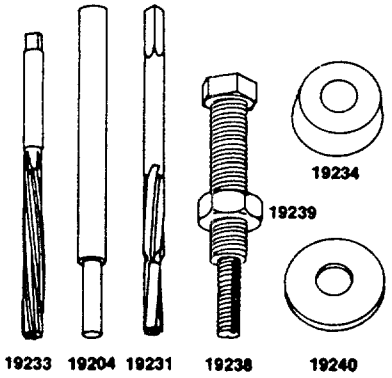
291661 TOOL KIT

PART NO.	DESCRIPTION
19051	Spark Tester
19055	Breaker Plunger Gauge
19056	Plunger Bushing Counterbore Reamer
19057	Plunger Bushing Driver
19058	Plunger Bushing Finish Reamer
19061	Screwdriver, Carburetor
19062	Screwdriver, Carburetor
19063	Valve Spring Compressor
19064	Valve Guide Bushing Counterbore Reamer
19065	Valve Guide Bushing Driver
19066	Valve Guide Bushing Finish Reamer
19069	Flywheel Puller
19114	Starter Clutch Wrench
19122	Valve Guide Reject Gauge
19151	Valve Guide Reject Gauge
19165	Flywheel Puller
19167	Flywheel Holder
19191	Reamer Guide Bushing
19203	Flywheel Puller
19230	Ring Compressor



19232 VALVE GUIDE PULLER KIT*

PART NO.	DESCRIPTION
19204	Bushing Driver
19231	Piloted Reamer
19233	Finish Reamer
19234	Guide Bushing
19238	Bushing Puller
19239	Nut
19240	Washer



*Model Series: 140000, 170000, 190000, 220000, 233000, 243000, 250000, 300000, 326000.

BRIGGS & STRATTON REPAIR TOOLS (Continued)

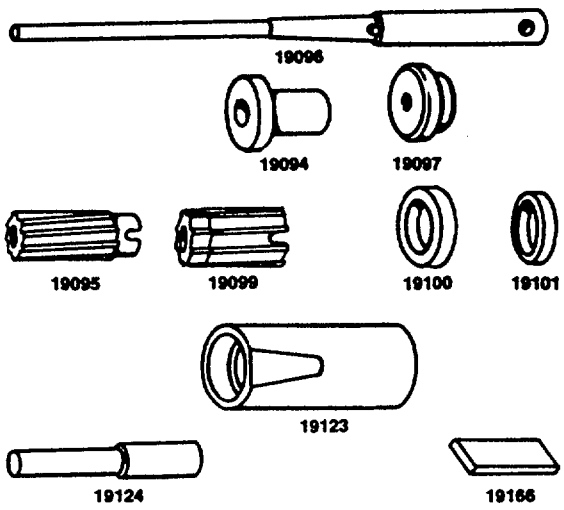
19158 TOOL KIT

MAIN BEARING TOOL KIT

Model Series ▪ 92000,

PART NO.	DESCRIPTION
19094	Pilot Guide Bushing
19095	Finish Reamer
19096*	Pilot
19097	Pilot Guide Bushing, Ball Bearing Cover
19099	Counterbore Reamer
19100	Reamer Guide Bushing
19101	Reamer Guide Bushing
19123	Support Jack
19124	Bushing Driver
19166	Plug Gauge

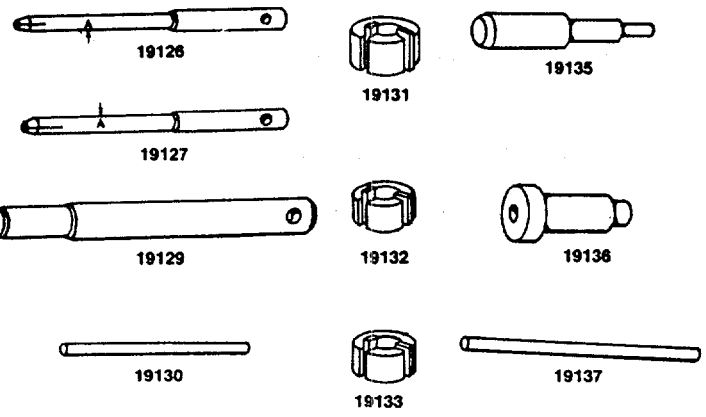
*Included in Tool Kit 19184.



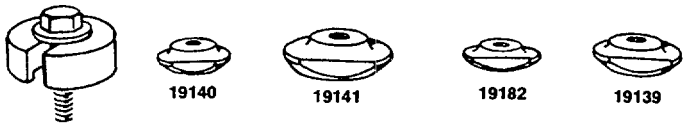
BRIGGS & STRATTON REPAIR TOOLS (Continued)

VALVE SEAT REPAIR TOOLS

PART NO.	DESCRIPTION
19126	Pilot, Valve Seat Counterbore
19127	Pilot, Valve Seat Counterbore
19129	Driver Shank, Counterbore Cutter
19130	T Handle, Driver Shank
19131	Counterbore Cutter, Valve Seats
19132	Counterbore Cutter, Valve Seats
19133	Counterbore Cutter, Valve Seats
19135	Knockout Pin, Remove Driver Shank from Counterbore Cutter
19136	Insert Driver, Install Valve Seats
19137	T Handle for Pilots
19138	Insert Puller, To Pull Valve Seats
19139	Puller Nut, Remove Valve Seats
19140	Puller Nut, Remove Valve Seats
19141	Puller Nut, Remove Valve Seats



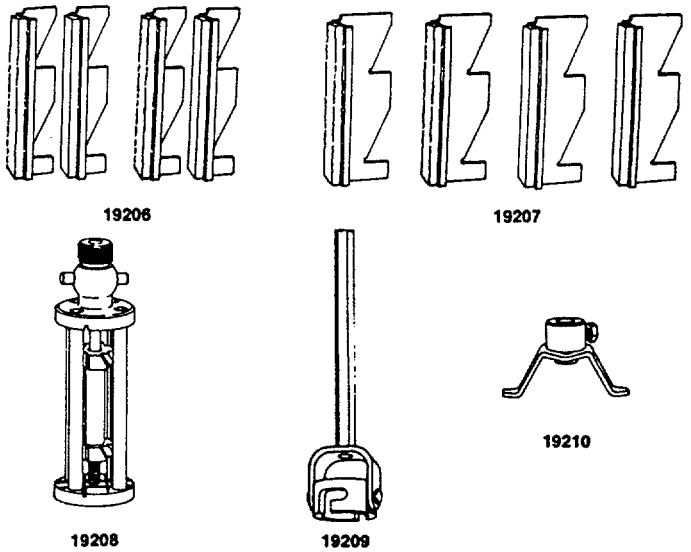
19138 VALVE SEAT PULLER KIT



19205 HONE SET

All Aluminum Cylinder Engines

PART NO.	DESCRIPTION
19206	Stone Set (Range 1-7/8" to 2-3/4")
19207	Stone Set (Range 2-5/8" to 3-1/2")
19208	Stone Retainer Springs
19209	Drive Shank
19210	Stop



Each cylinder hone set contains instructions covering cylinder honing procedures. We also suggest you review your Briggs & Stratton Repair Instructions IV for all standard cylinder bore sizes. Contact your source of supply for pricing information.

PART NO.	DESCRIPTION	MODELS OR SERIES USED ON
	DRIVERS	
*19057	Install Plunger Bushing	92000,
*19065	Install Valve Guide Bushing	92000,
**19124	Install Main Bearing Bushings	92000.

BRIGGS & STRATTON REPAIR TOOLS (Continued)

PART NO.	DESCRIPTION	MODELS OR SERIES USED ON
	REAMERS	
*19056	Breaker Plunger Bushing Reamer	92000,
*19058	Finish Reamer, Breaker Plunger Bushing	92000,
*19064	Valve Guide Bushing Counterbore Reamer	92000,
*19066	Finish Reamer, Valve Guide Bushing	92000,
**19095	Finish Reamer, Main Bearing	92000.
**19099	Counterbore Reamer, Main Bearings	92000,
	PILOTS	
†**19096	Main Bearing Reamer Pilot	92000,
19126	Expansion Pilot for Valve Seat Counterbore Cutter	92000,
	REAMER GUIDE BUSHINGS	
**19100	Reamer Guide Bushing, Main Bearing Reaming	92000,
**19101	Reamer Guide Bushing, Main Bearing Reaming	92000,

*Included in No. 291661 Tool Kit
**Included in No. 19158 Tool Kit
Included in No. 19184 Tool Kit
†††† Included in No. 19232 Kit

BRIGGS & STRATTON REPAIR TOOLS (Continued)

PART NO.	DESCRIPTION	MODELS OR SERIES USED ON
	REAMER GUIDE BUSHINGS (Continued)	
*19191	Reamer Guide Bushing, Valve Guide Reaming	92000,
	PLUG GAUGES	
*19055	Check Breaker Plunger Hole	, 92000,
*19122	Check Valve Guide	, 92000,
	PILOT GUIDE BUSHINGS	
**19094	Pilot Guide Bushing, Main Bearing Reaming	92000,
	COUNTERBORE CUTTERS	
19115	Counterbore Valve Guide Hole	, 92000,

*Included in No. 291661 Tool Kit
**Included in No. 19158 Tool Kit
† Included in No. 19184 Tool Kit
†††† Included in No. 19232 Kit

BRIGGS & STRATTON REPAIR TOOLS (Continued)

PART NO.	DESCRIPTION	MODELS OR SERIES USED ON
	CRANKCASE SUPPORT JACK	
**19123	To Support Crankcase to Remove and Install Main Bearings	92000,
	FLYWHEEL PULLERS	
*19069	Removal of Flywheel	, 92000,
	STARTER CLUTCH WRENCH	
*19114	For Removal and Installation of Starter Clutch	All Models with Rewind Starters
	VALVE SPRING COMPRESSOR	
*19063	To Compress Valve Springs	All Models and Series
	PISTON RING COMPRESSOR	
19230	To Compress Rings on Piston	92000,
	SPARK TESTER	
*19051	For Testing Ignition Spark	All Models and Series
	FLYWHEEL HOLDER	
*19167	To hold Flywheel while loosening or tightening nut	92000,

*Included in No. 291661 Tool Kit
**Included in No. 19158 Tool Kit

Section 14
THEORIES OF OPERATION

COMPRESSION

The general subject of compression is a familiar one to most mechanics. It has been discussed in detail by valve manufacturers, ring manufacturers, piston manufacturers, and by makers of valve grinding equipment. The home mechanic, or handy-man, thinks nothing of getting out his grinding compound, lapping in the valves and putting a new set of rings on the piston all without knowledge of proper fit or tolerance Whether he does the job right or not, he thinks it is easy. And, it is easy. There is nothing difficult or mysterious about compression, and the nice part is that a good job that will create lasting customer satisfaction is about as easy to do as a poor job

We must keep in mind, however, that the Briggs & Stratton engine is an air-cooled, single cylinder engine. The rules that hold true on liquid cooled, multi-cylinder engines do not always apply to Briggs & Stratton engines. For example:

The operating temperature of a liquid-cooled engine is quite constant. The operating temperature of an air-cooled engine, however, may vary greatly with changes in air temperature, the load, and the speed. This necessitates differences in tolerances and clearances of parts like pistons, which must be fitted to Briggs & Stratton's established clearances. These can differ from those used in most automotive engines.

The advantages of an air-cooled engine are many. There is no need for a complicated cooling system. The engine is lighter in weight and occupies less space than its liquid-cooled counterpart, and is comparatively easy to repair

Before we get into the mechanics of the subject, let us clarify some of the terms iii common use.

On single cylinder engines we think of good compression, not in terms of pounds of pressure per square inch, but in terms of horsepower output. If the engine produces the power for which it was designed, we believe the compression must be good. It is extremely difficult to make an accurate compression test on a small, one cylinder engine without expensive machinery The reasons for this are the lack of a starter to crank the engine at a constant speed and the small displacement of the cylinder. Therefore, we do not publish any compression pressure figures. As a simple compression test, give the flywheel a quick spin. If the flywheel rebounds on the compression stroke, the compression is at least good enough to start the engine

We talk about "compression" stroke and "power stroke". What are they? The Briggs & Stratton engine is a four stroke cycle engine, or as it is commonly called, a four cycle engine. It operates on the same principle as an automobile engine. The crankshaft makes two complete revolutions to each power stroke of the piston

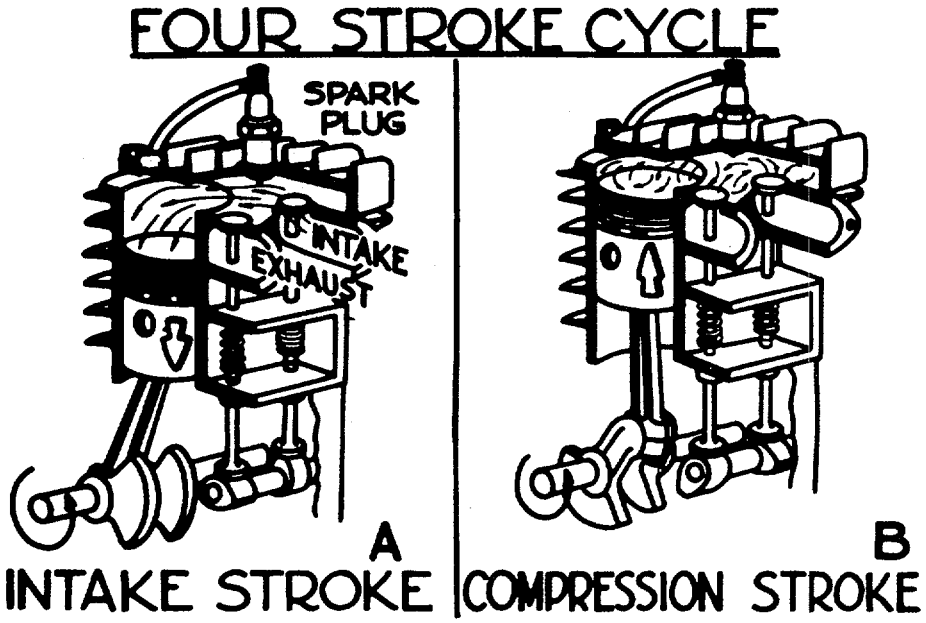


Figure 1.

First is the intake stroke. With the exhaust valve closed and the intake valve open, the ton moves downward and the air-fuel mixture drawn into the cylinder. (A - Fig. 1)

Then, the intake valve closes, and the piston moves upward on the compression stroke. The air-fuel mixture becomes greatly compressed in the small space between the top of the piston and the cylinder head. (B - Fig. 1)

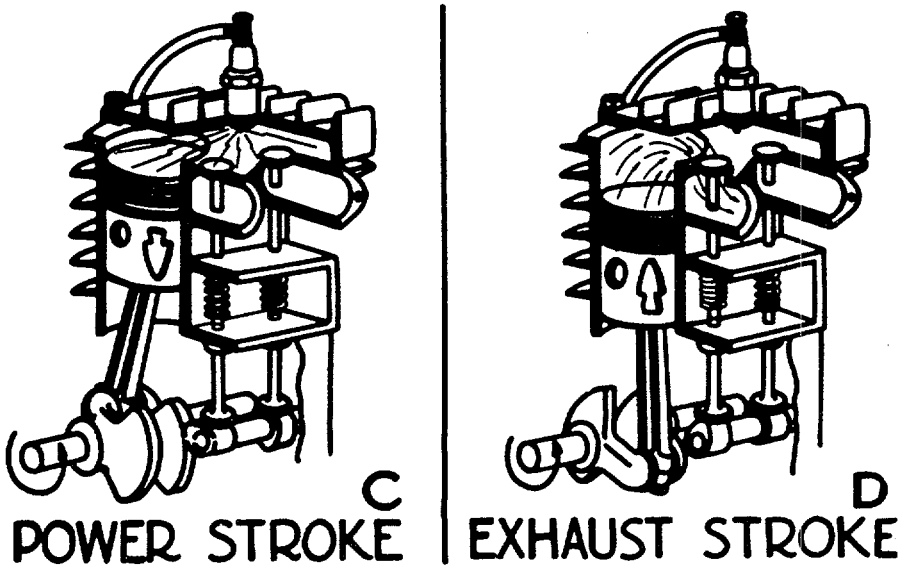
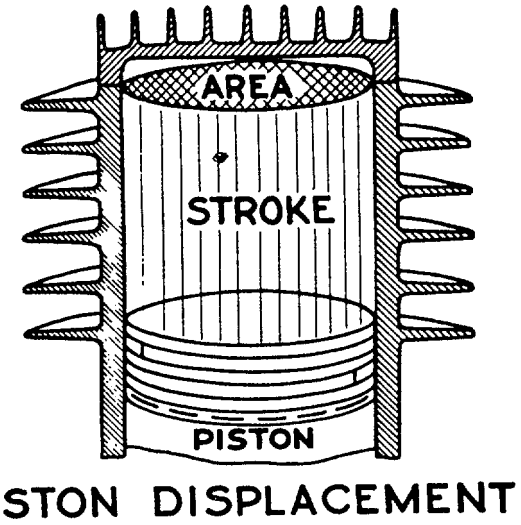


Figure 2.

The spark occurs, igniting the mixture, and the force of the expanding gases push the piston down. This is the power stroke. (C Fig. 2)

The exhaust valve opens, and the upward movement of the piston on the exhaust stroke forces the, burnt gases out of the cylinder. (D-Fig. 2) Then the exhaust valve closes, the intake valve opens, and the engine is ready to repeat the cycle just described. Thus four strokes complete the cycle



PISTON DISPLACEMENT

Figure 3.

What is "piston displacement"? It is the space displaced by the piston in its up and down movement or the volume shown above the piston in Figure 3. The bigger the bore and the longer the stroke, the greater the piston displacement Displacement is computed by the following formula:

$$\text{Displacement} = \frac{(\text{Bore})^2 \times \Pi \times \text{Stroke}}{4}$$

Let us compute the displacement of a Model 6 engine which has a 2" bore and a 2" stroke Using the above formula:

$$\text{Displacement} = \frac{2 \times 2}{4} \times 3.1416 \times 2$$

Displacement = 6.2832 cubic inches

Our specification sheets show 6.28 cubic inches as the displacement for the Model 6 engine.

The model numbers of the current engines indicate the approximate piston displacement Model 60000 has 6.65 cubic inches; Model 14 has 14.21 cubic inches, etc

Piston displacement indicates the relative size of the engine, and usually horsepower is in direct proportion to size.

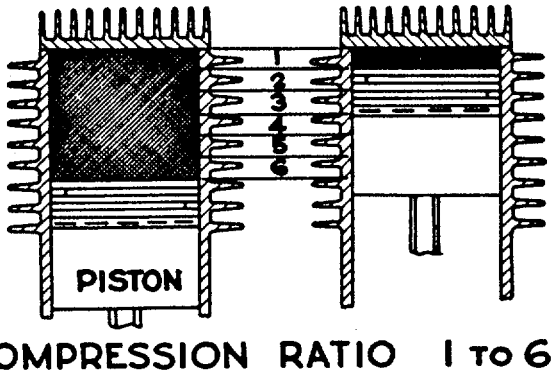


Figure 4.

What do we mean when we say an engine has a 6 to 1 compression ratio? We mean that the space in the cylinder when the piston is at the top of the stroke is only one-sixth as great as when the piston is at the bottom of the stroke

Compression ratios do not tell us the horsepower of an engine. They do have a meaning as regards the efficiency of an engine

Generally, the higher the compression ratio, the greater the efficiency. However, as compression ratios are increased, the loads and stresses upon engine parts become more severe. Premium fuels may be required with high compression ratios. Experience has proven that compression ratios in the range of 5 -1 to 6 -1, currently used in Briggs & Stratton engines, are the best for the work and the conditions under which these engines must operate. Therefore premium fuel is not needed and "regular" is recommended

It is generally conceded that the valves are the most important factor in good compression They operate under more severe conditions than any other parts of the engine. This is particularly true of the exhaust valve

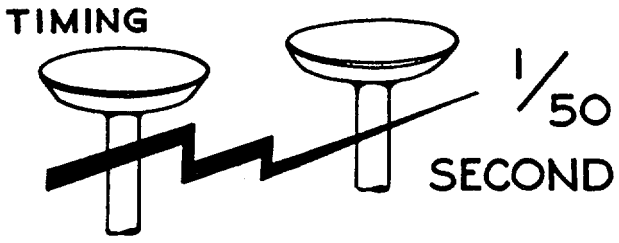


Figure 5.

The valves open and close in a little less than one revolution. When the engine is operating at 3000 RPM, each valve opens and closes in about 1/50 of a second.

THEORIES OF OPERATION
Compression

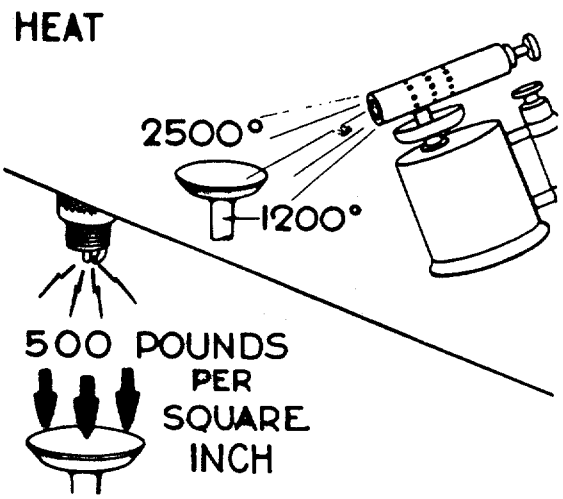


Figure 6.

Valves have to seal well enough to stand pressures up to 500 pounds per square inch. Under full load, the exhaust valve is exposed to temperatures high enough to cause it to operate at a red heat. The temperature of the valve under these conditions may be 12000 F. or more. The intake valve is cooled by the incoming mixture The exhaust valve is subjected to high temperature exhaust gases passing over it on their way out of the cylinder. It is, therefore, very difficult to cool the head of the exhaust valve The cylinder head, the cylinder, and the top of the piston are exposed to this same heat, but these parts are cooled by air from the flywheel fan and oil from the crankcase. Very special steel is required in the exhaust valve to enable it to withstand the corrosive action of the high temperature exhaust gases.

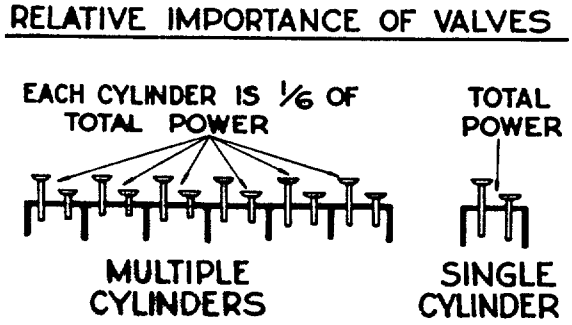


Figure 7.

Remember again that the Briggs & Stratton engine is a single cylinder engine with two (2) valves as compared to the customary 12 or 16 valves in an automotive engine. The fewer the valves, the more important they become

In a 1 cylinder engine one bad valve can cause a great drop in horsepower or cause the engine to stop entirely. In a multicylinder engine, one valve may fail and only 1/6th or 1/8th of the power is affected as the bad cylinder may be motorized by the other good cylinders. Hence, good valve condition is even more important in 1 cylinder engines than it is in multicylinder engines

Now if the valves and seats are so important, how do we do a good valve job on a Briggs & Stratton engine?

The first requirement is good equipment. A valve refacer and valve seat grinders are necessary. If you do not have them, arrangement should be made with your local Briggs & Stratton dealer

After the valves are removed, they should be thoroughly cleaned on a wire ;.brush wheel to remove all carbon deposits. You will find sometimes it is easier to polish carbon than to remove it, but it must come off. Also, remove carbon from valve guides. When the valves are clean, they should be visually inspected

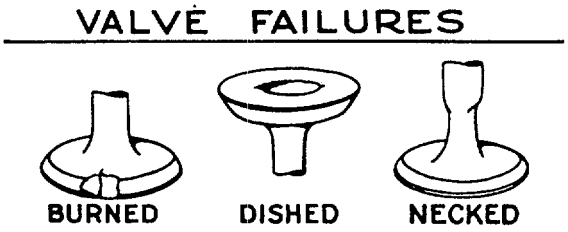


Figure 8.

As mentioned above, when a valve becomes defective in a multicylinder engine, the bad cylinder is motorized by the other cylinders. This may cause serious damage to the valve and seat. Briggs & Stratton engine valves are seldom subjected to the extremes of abuse that automotive valves are. While valves may burn to some extent, it is very seldom that a valve seat or face is very badly burned. Dished or necked valves are almost never found

Valve seat burning is usually caused by an accumulation of carbon or fuel lead either on the valve stem or on the valve face, or from insufficient tappet clearance. These deposits on the valve stem or on the face will hold the valve open, allowing the hot flames of the burning fuel to eat away the valve face and seat. A dished valve is one that has a sunken head This is caused by operating at too high a temperature with too strong a spring, or the head can be eroded away by highly leaded fuels. A necked valve is one that has the stem directly beneath the head eaten away badly by heat or where the stem has been stretched .

Valve sticking is caused by fuel lead, gum or varnish forming on the valve stem and in the valve guide. We believe that most of the deposits formed are caused by carbon, fuel lead, or gum. Since the amount of lead in different fuels varies, the rate of deposit build-up naturally will vary. When an exhaust valve no longer closes properly, due to excess deposits, the hot gases escaping from the combustion chamber heat up the valve stem and guide excessively. This causes the oil on the valve stem to oxidize into varnish which holds the valve partially open and causes burning. Intake valve sticking may be caused by the use of fuels having an excessively high gum content Fuels that are stored for too long a period of time may contain high amounts of gum

If burning occurs in a rather limited area on the valve face, it indicates that something may have caused the valve to tip. This could be due to a bent valve stem or a deposit on one side of the valve seat or stem .

Such a condition would leave an opening for the passage of hot exhaust gases which could burn the valve so badly that it could not be refaced These valves must be discarded.

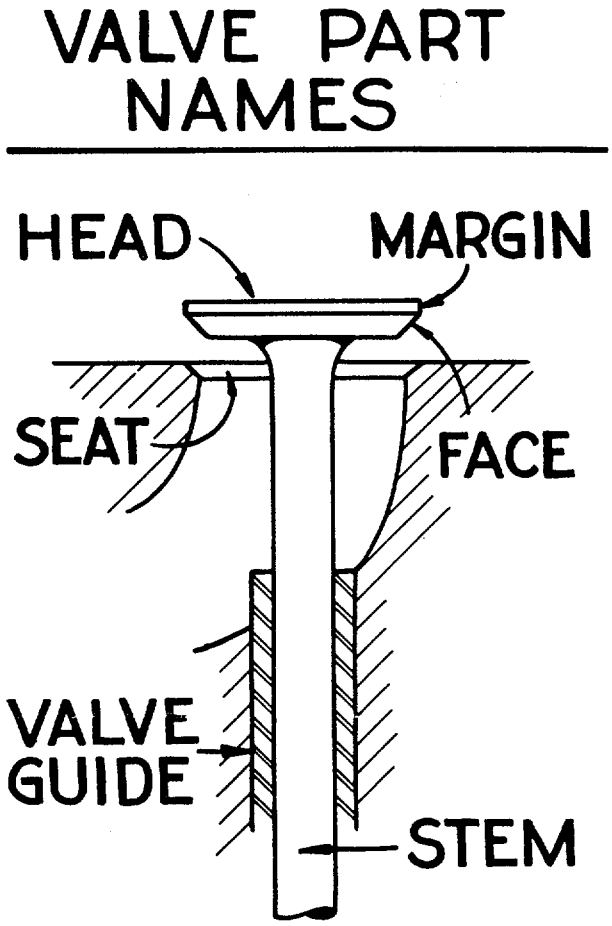


Figure 9.

The important parts of a valve are the head, the margin, face, and stem. They make contact with the seat and the valve guide in the cylinder. The margin is the edge of the valve head. As a general rule, the valve should be discarded when the margin becomes less than one-half of the original thickness .

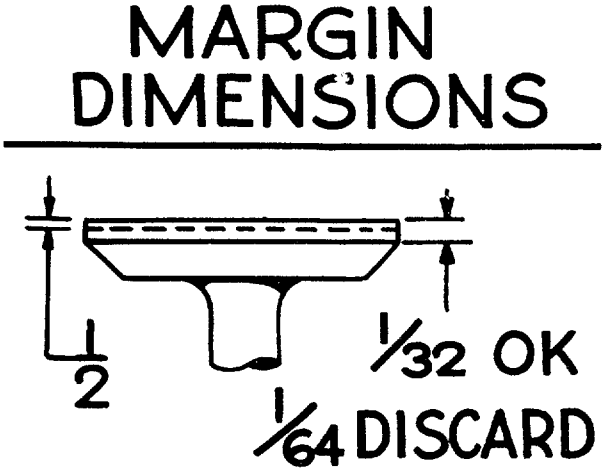


Figure 10.

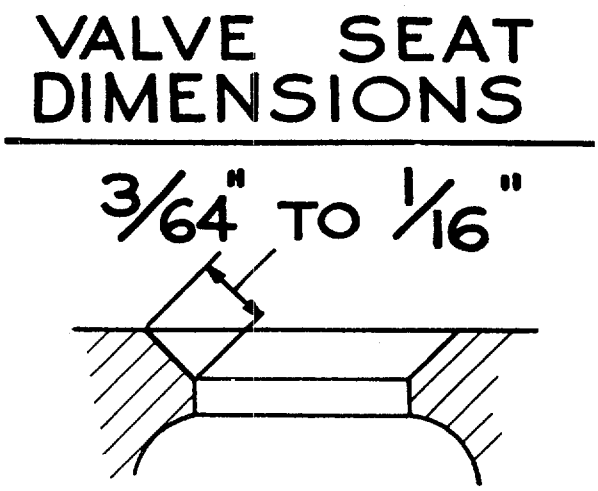


Figure 11.

The margin on a new Briggs & Stratton valve is 1/32 of an inch, so that when it becomes less than 1/64 of an inch the valve should be discarded. Remember, this is after all pit marks and burn marks have been removed from the valve face. If the valve is bent, the face will be ground unevenly, and if the margin becomes too thin on one side the valve should also be discarded. A valve with too thin a margin will not be able to withstand the heat and will quickly crack and burn. After facing the valves and the valve seats to a 450 angle, place a little fine grinding compound on the valve face, and very lightly lap the valve to the seat. Use of fine grinding compound removes any grinding marks and gives a clear picture of the valve seat width. Be sure to remove all grinding compound from seat and valve

The valve seat width is usable up to 5/64 of an inch, but a new seat should be between 3/64 and 1/16 of an inch, and it should be in the center of the valve face. After the valve seat and faces are ground, the valve should be installed in the guide, the cam gear turned to the proper position, and the tappet clearance checked. Refer to Repair Instructions for tappet clearance. Usually the clearance will be too small, and the end of the valve stem will have to be ground off to obtain the proper clearance. Care should be taken not to overheat the end of the valve stem while this grinding is taking place; be sure the end is square with the stem. It is recommended that the valve springs and retainers be assembled immediately after setting the tappet clearance to prevent chances of dirt getting under the valve seat

CARBURETION

The basic purpose of a carburetor is to produce a mixture of fuel and air on which an engine will operate; to do so Is relatively easy. However, producing economical fuel consumption and smooth engine operation over a wide range of speeds creates the need for a more complicated mechanism than a mere mixing valve There is an additional problem in that the price of such a carburetor must be held in proportion to the price of the engine. The price of a Briggs & Stratton engine is not much greater than the price of the carburetor on an automobile

Atmospheric Pressure

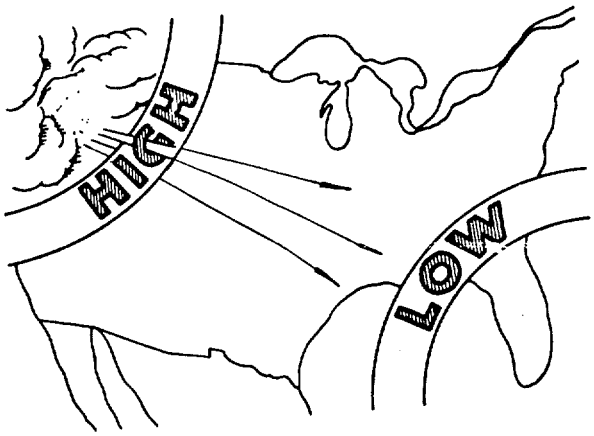


Figure 12.

Keeping this in mind, we must utilize the force of atmospheric pressure and the principles of the venturi and the airfoil

Atmospheric pressure, while it may vary slightly due to altitude or temperature, is a constant potent force which tends to equalize itself in any given area. It is the weight of the air in the atmosphere pushing down and outward in all directions and is commonly figured as between 13 and 15 pounds per square inch. We know that air moves from a high pressure area to a low pressure area

To use this force of atmospheric pressure in a carburetor, we artificially create low pressure areas and thus obtain movement either of air or of intervening fuel. We will show you how a little later.

The greater the difference in pressure between the two areas the greater the velocity or the greater the distance we can raise the fuel

In the interest of brevity we often use the terms vacuum or suction when we actually mean the difference in pressures

Venturi

What is a venturi? Have you ever noticed that the wind blowing through a narrow space between two buildings always seems to be much stronger than in the open? In other words, the velocity is greater. The same thing can be seen in a river. The current is always faster in a narrow, shallow place than in the deep wide pools

In a fashion, these narrow places are venturi's. The great bulk of air or water suddenly forced through a constricted space has to accelerate in order to maintain the volume of flow.

This is the way a venturi is placed in a carburetor. Fig. 13. The shape is carefully designed to produce certain air flow patterns

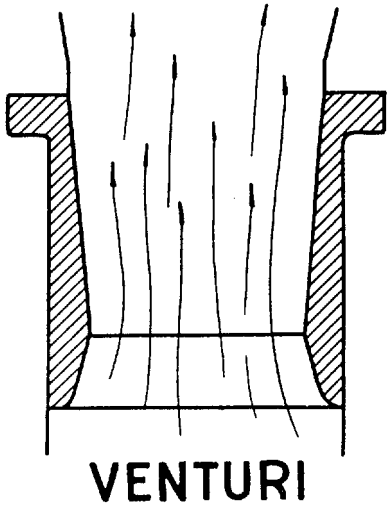


Figure 13.

THEORIES OF OPERATION
Carburetion

Airfoil

Now, what is an airfoil ? Here is a picture of a tube in an air stream. When still, the pressure is equal on all sides. Under movement, an air pattern is formed, Fig. 14, so that we have a high pressure area and a very low pressure area

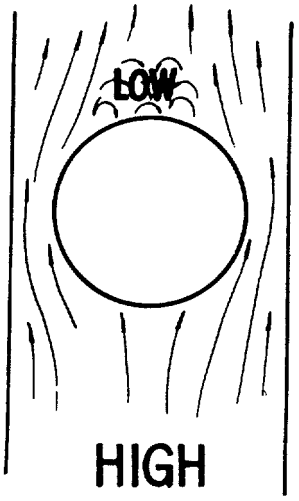


Figure 14.

Now how does all this apply to Briggs & Stratton engines that employe three types of carburetors, the Flo-jet (gravity feed or float type), the Vacu-jet (suction feed) and the newer Pulsa-jet (fuel pump) type?

FLOW-JET CARBURETORS OR GRAVITY FEED

First, lit us consider the gravity feed system The tank is above the carburetor and fuel flows by gravity. Notice an air vent hole in the tank cap so that air can flow in as fuel flows out and a vent hole in the carburetor bowl so that air can flow out as fuel flows in. If one or both of these holes were plugged, the flow of fuel would cease and stop the engine. See Fig. 15 and 16

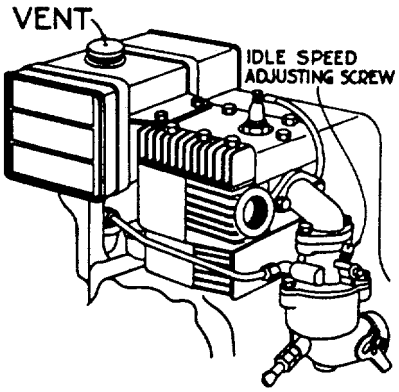


Figure 15.

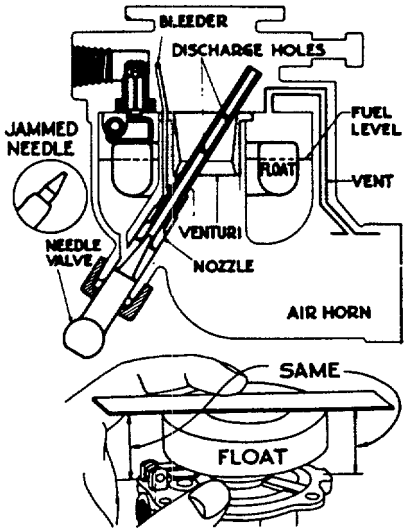


Figure 16.

As the fuel enters the bowl, it raises the float The float in turn raises the needle in the float valve. When the needle touches the seat, it shuts off the fuel flow, and the position of the float at this time is called the float level

Float Level

The float level in general should be high enough to afford an ample supply of fuel at full throttle and low enough to prevent flooding or leaking

To set the level on the carburetor, invert the upper body as shown. See Fig. 16. The float and the body cover should be parallel. If not, bend the tang on the float to obtain this position. The actual distance on the small carburetors is 5/16 of an inch between the float and the gasket. On the larger models it is 3/16 of an inch. It is seldom necessary to measure this distance. The float level is not as critical as on some carburetors. Remember, however, that there should be one gasket between the float valve seat and the carburetor. No gasket or two gaskets will change the float level

Now, the fuel is down into the bowl but how does it get into the cylinder?

Here is shown the position of the nozzle and the fuel level. See Fig. 16. The fuel in the bowl seeks its own level, which is well below the discharge holes. Notice that the discharge holes are in the venturi, the place of greatest air velocity. As the piston in the cylinder moves down with the intake valve open, it creates a low pressure area that extends down into the carburetor throat and venturi. Two things start to happen

The air pressure above the fuel in the bowl pushes the fuel down in the bowl and up in the nozzle to the discharge holes. At the same time the air rushes into the carburetor air horn and through the venturi where its velocity is greatly increased

The nozzle extending through this air stream acts as an air foil, creating a still lower pressure area on the upper side. This allows the fuel to stream out of the nozzle through the discharge holes into the venturi where it mixes with the air and becomes a combustible mixture ready for firing in the cylinder

A small amount of air is allowed to enter the nozzle through the bleeder. This air compensates for the difference in engine speed and prevents too rich a mixture at high speed

The story of carburetion could end right here if the engine were to run at only one speed and under ideal conditions. However, since smooth economical operation is desired at varying speeds, some additions must be made to the carburetor

The ideal combustion mixture is about 14 or 15 pounds of air, in weight, to one (1) pound of gasoline. Remember that an engine operating under heavy load requires a richer mixture than under light load. In order to regulate the mixture, we place in the carburetor a threaded needle valve with a tapered point which projects into the end of the nozzle. See Fig. 16

To adjust the carburetor for maximum power, run the engine at the desired operating speed, then turn in the needle valve until the engine slows down, which indicates a lean mixture Note the position of the needle valve, then turn the needle valve out until the engine speeds up and then slows down, which indicates a rich mixture, Note the position of the needle valve, then turn the needle valve to midway between the lean and rich position. Adjust the mixture to the requirement for each engine. Remember that too lean a mixture is not economical. It causes overheating, detonation, and short valve life. Also, since there is no accelerator pump, the mixture must be rich enough so that the engine will not stop when the throttle is suddenly opened. Engines which run at constant speeds can be slightly leaner than those whose use requires changes in speed

The inset of Fig. 16 shows what happens when the needle valve is turned too far. A square shoulder is produced on the taper. It is possible, of course, to adjust the carburetor with the needle valve in this condition, but it is quite difficult, because a small movement of the needle makes a big difference in the amount of fuel that can enter the nozzle. And, if you do get it adjusted, the vibration can soon throw it off

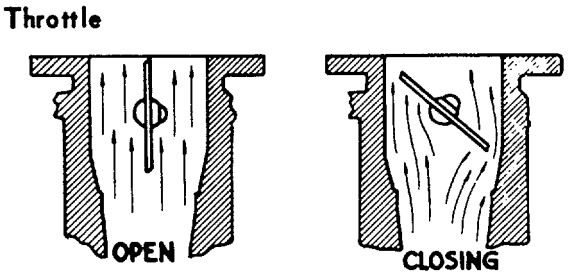


Figure 17.

To allow for different speeds, a flat disc called a butterfly, mounted on a shaft, is placed in the carburetor throat above the venturi. This is called the throttle. See Fig. 17

The throttle in the wide open position does not affect the air flow to any extent. However, as the throttle starts to close, it restricts the flow of air to the cylinder and this decreases the power and speed of the engine. At the same time it allows the pressure in the area below the butterfly to increase. This means that the difference between the air pressure in the carburetor bowl and the air pressure in the venturi is decreased, the movement of the fuel through the nozzle is slowed down; thus the proportion of fuel and air remain approximately the same As the engine speed slows down to idle, this situation changes. See Fig. 18

At idle speed the throttle is practically closed, very little air is passing through the venturi and the pressure in the venturi and in the float bowl are about the same. The fuel is not forced through the discharge holes, and the mixture tends to become too lean

Idle Valve

To supply fuel for the idle, the nozzle is extended up into the idle valve chamber. It fits snugly in the upper body to prevent leaks. Because of this tight fit, the nozzle must be removed before upper and lower bodies are separated, or the nozzle will be bent

THEORIES OF OPERATION
Carburetion

The idle valve chamber leads into the carburetor throat above the throttle. Here the pressure is low, and the fuel rises in the nozzle past the idle valve and into the carburetor throat through the discharge slot. The amount of fuel is metered by turning the idle valve in or out until the proper mixture is obtained. Here again we see what happens if the needle is screwed in too far. A damaged idle valve can result

Adjustment of the idle valve is similar to that of the needle valve but should be made after the needle valve has been adjusted. The idle speed is not the slowest speed at which the engine will run. On small engines it is 1750 RPM On larger engines the idle speed may be as low as 1200 RPM. Use a tachometer to set the speed

Turn the idle speed adjusting screw (located on throttle shaft) until the desired idle speed is obtained and hold throttle closed. Turn the idle valve in until speed decreases, then out until speed increases and again decreases. Then turn the idle valve to a point midway between these two settings. Usually the idle speed adjusting screw will have to be reset to the desired idle speed

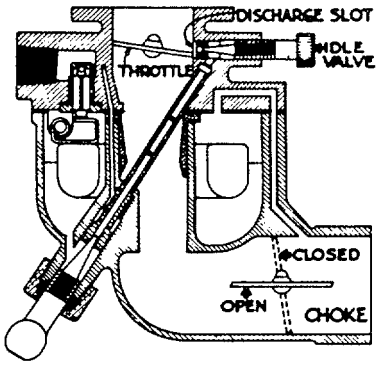


Figure 18.

The next problem is starting the engine in different temperatures and with different fuels. A butterfly, mounted on a shaft, is placed in the air horn. With this choke we can close, or almost close, the air horn and get a low pressure area in the venturi and throat. See Fig. 18

Thus, a rush of fuel is obtained from the nozzle with a relatively small amount of air. Even with low vaporization this extra rich mixture will give easy starting. Only a portion of the fuel will be consumed while choking, and a large portion will remain in the cylinder. This raw gasoline will dilute the crankcase oil and may even cause scuffing due to washing away of the oil film from between the piston rings and the cylinder wall. For this reason, prolonged choking should be avoided

This now is our complete carburetor.

VACU-JET CARBURETORS OR SUCTION FEED

Now let us take a look at the Vacu-jet or suction feed system. Here the fuel tank is below the carburetor, so obviously the fuel will not flow by means of gravity. Therefore, the force of atmospheric pressure must be employed

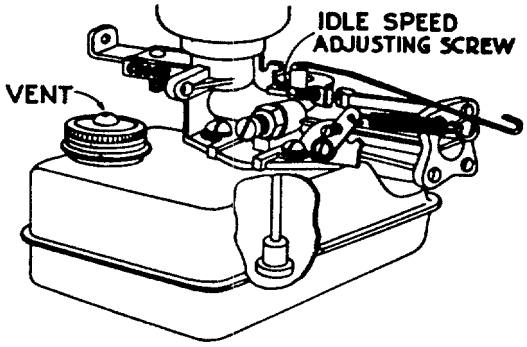


Figure 19.

Again we have a vent hole in the fuel tank cap to allow the pressure in the tank to remain constant. Now here is something important. Before adjusting the carburetor pour in enough fuel to HALF fill the tank. The distance the fuel has to be lifted will affect the adjustment. At half full we have an average operating condition, and the adjustment will be satisfactory if the engine is run with the tank full or nearly empty

As the piston goes down in the cylinder with both the intake valve and the throttle open, a low pressure area is created in the carburetor throat. A slight restriction is placed between the air horn and the carburetor throat at the choke. This helps to maintain the low pressure

The difference in pressure between the tank and the carburetor throat forces the fuel up the fuel pipe, past the needle valve, through the two discharge holes. The throttle is relatively thick, so we have, in effect, a venturi at this point, thus aiding vaporization. A spiral is placed in the throat to help acceleration and also to help keep the engine from dying when the throttle is opened suddenly

The amount of fuel at operating speed is metered by the needle valve and seat. Turning the needle valve in or out changes the setting until the proper mixture is obtained. This adjustment must always be done while the engine is running at operating speed, not at idle speed. While the needle valve may look like an idle valve due to its position, it is a true high speed mixture adjusting valve

Since no accelerator pump is used on this carburetor and since many of these engines are used on lawn mowers where rapid acceleration is needed, the mixture should be rich. Turn the needle valve in until the engine begins to lose speed, indicating a lean mixture. Then, open the needle valve past the point of smooth operation until the engine just begins to run unevenly. Since this setting is made without load, the mixture should operate the engine satisfactorily under load

These carburetors do not have an idle valve, but the mixture at idle speed is controlled in a different way. As the throttle closes to idle, the leading edge takes a position between the two discharge holes. The larger of the discharge holes is now in the high pressure area, and the flow of fuel through it will cease. The small hole will continue to discharge fuel but the amount will be metered by the hole size and will be in proportion to the reduced air flow. For this reason it is important that the small discharge hole be of the proper size. The needle valve will allow much more fuel to pass than should go through the small discharge hole. A number 68 drill can be used as a plug gauge to check the small hole. A number 56 drill can be used to check the larger hole. This can be done with the needle valve and seat removed. See Fig. 20

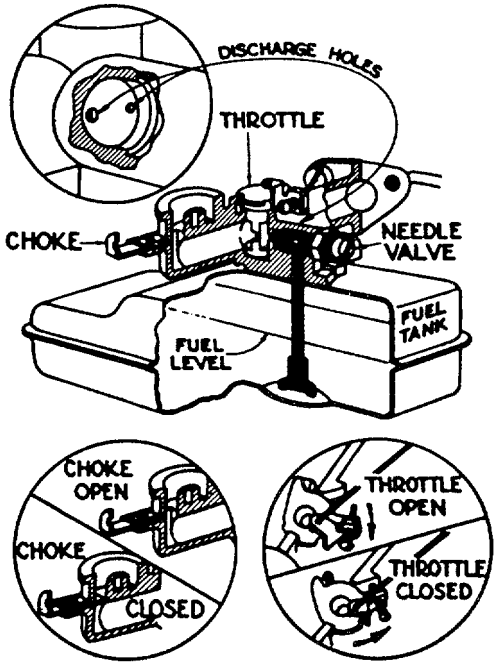


Figure 20.

You will notice a small section is milled out of the throttle where it meets the discharge hole This concentrates the flow of air past the hole and assures good vaporization

The idle speed adjusting screw should be set to obtain an idle speed of 1750 RPM. This may seem fast to people accustomed to auto engines, but it is necessary in order to have fast acceleration. It also helps cooling and lubrication A slight unevenness may be noticed at idle speed, but this is normal and no readjustments of the needle valve should be made The choke is the sliding plate mounted at the outer end of the carburetor. Fig. 20 and 21

The choke is pushed in to close the air intake for starting but should be pulled out as soon as the engine starts. The use of this choke should be understood clearly. Many complaints of engine trouble, upon investigation prove to be nothing more than failure to properly use the choke, especially where the choke is operated by a remote control. The choke must close fully

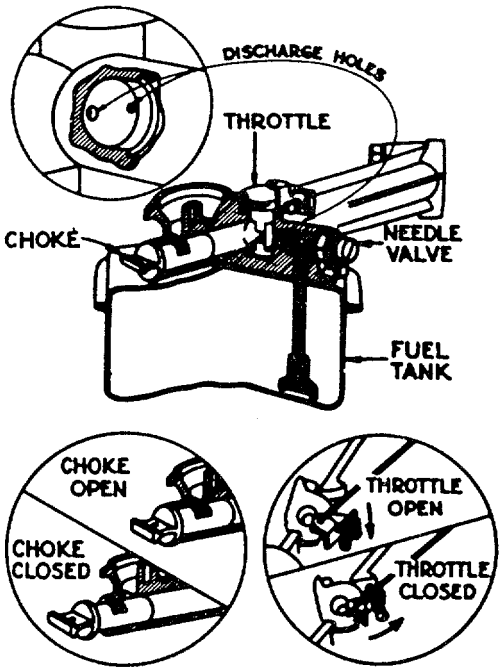


Figure 21.

The latest engines with Vacu-Jet carburetors incorporate a ball check in the fuel pipe which assures a steady flow of fuel to the needle valve and discharge holes

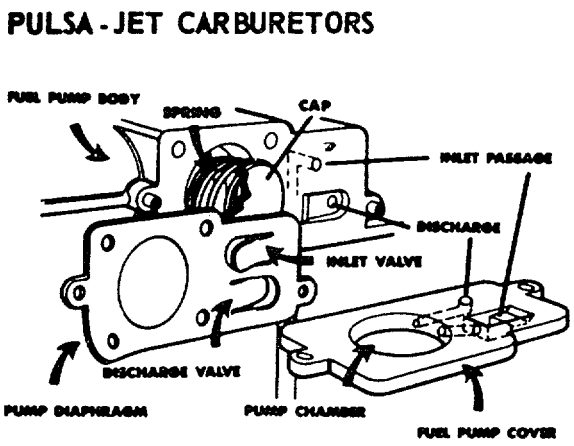


Figure 22.

The Pulsa-Jet is a full carburetor incorporating a diaphragm type fuel pump and a constant level fuel chamber

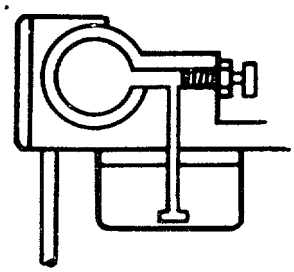


Figure 23.

The fuel tank, the fuel pump and the constant level fuel chamber serve the same functions as the gravity feed tank, the float and the float chamber of conventional "float type" carburetors

This new design makes it possible to obtain just as much horsepower from the Pulsa-Jet carburetor as is obtained from more complex "float type" carburetors. This is due to the fact that the Pulsa-Jet provides a constant fuel level directly below the venturi as illustrated in Fig 23. With this design, very little fuel "lift" is required to draw gasoline into the venturi. The venturi can be made larger, permitting a greater volume of fuel-air mixture to flow into the engine with a consequent increase in horsepower

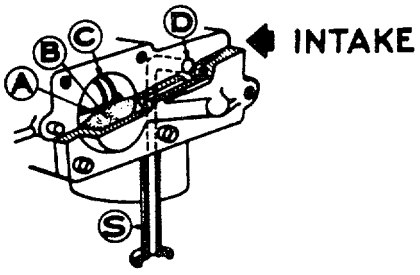


Figure 23A.

Vacuum created in the carburetor elbow by the intake stroke of the piston pulls cap A and pump diaphragm B inward and compresses spring C

The vacuum thus created on the "cover side" of the diaphragm pulls gasoline up suction pipe S and under intake valve D into the pocket created by the diaphragm moving inward

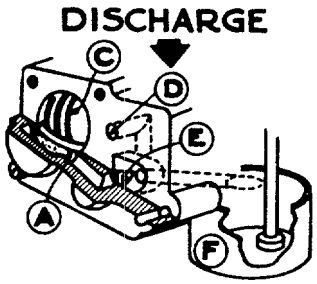


Figure 23B.

When engine intake stroke is completed, spring C pushes plunger A outward. This causes gasoline in the pocket above the diaphragm to close inlet valve D and open discharge valve E. The fuel is then pumped into fuel cup F

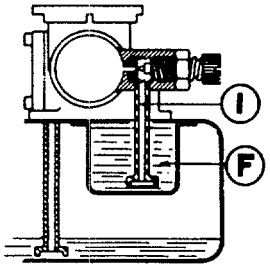


Figure 23C.

On the next intake stroke the cycle is repeated and this pulsation of the diaphragm keeps the fuel cup full. Excess fuel flows back into the tank

The venturi of the carburetor is connected to intake pipe I which draws gasoline from the fuel cup F

Since a constant level is maintained in the fuel cup, the engine gets a constant air-fuel ratio no matter what fuel level exists in the main tank

From this point on the carburetor operates and is adjusted in the same manner as is the Vacu-Jet carburetor except that the fuel tank does not have to be half full as in the Vacu-Jet. It can be full or almost empty and the adjustment will be the same since the fuel level in the small cup is always the same. There are no valve checks in the fuel pipes. The flaps on the diaphragm serve as valves

Gas and Oil

We recommend the use of fresh, clean, "REGULAR" gasoline. Do not use store gas, naptha or other such low-test fills that have a rating below 80 octane. Neither is it necessary to use highly leaded premium fuels

It is recommended also that fuel be purchased in amounts that will be used up within a short time. Stale gasoline can cause gum or varnish in the fuel tank, carburetor, and combustion chamber. If the engine is not to be used for a period of 30 days or more, drain the fuel tank and carburetor to avoid gum deposits

The recommended oils are those identified as being "suitable for service MS". For summer (over 400 F) use SAE 30. If not available, use 1OW-30 oil. For winter (under 400 F) use SAE 5W-20. If not available, use 10W oil and dilute with 10% kerosene

The air entering the engine is important in engine performance and engine life. Power will decrease 3½% for every 1,000 feet above sea level

Power will also decrease 1% for every 10 degrees Fahrenheit above the standard temperature of 60 degrees Fahrenheit. In addition the ambient temperature is important in the cooling of the engine. (Ambient temperature is the temperature of the air immediately surrounding the engine.)

One of the reasons for engine wear is dirt that gets into the engine. When you consider that one of these 3 HP engines operating at 3600 RPM uses about 390 cubic feet of air an hour entering at the rate of about 24 miles an hour and that many such engines operate in very dusty conditions you can visualize the amount of dust and dirt that can enter an engine if it does not have an air cleaner or if the air cleaner is not functioning properly. If dirt gets past the air cleaner it enters the combustion chamber Some may be blown out through the muffler but some may adhere to the cylinder where it creates ring wear or it may work down the walls into the crankcase where it causes wear on all the moving parts

While speaking of the air cleaner we should remember to stress regular and proper maintenance of this important device. Occasionally, we have reports of operators adding oil to the exact center of the air cleaner body. Of course this fills the air cleaner elbow and carburetor with oil, causing starting trouble and excess smoking. The operator should add oil to the air cleaner body only and not to fill above the oil level mark

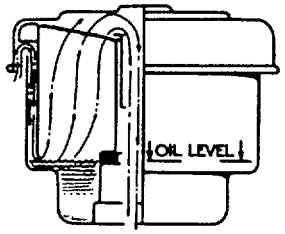


Figure 24.

Dirt that enters the engine through the breather also can wear out any engine. It is very important to see that the breather is vented on all engines used in dusty surroundings

Oil Foam No Spill Air Cleaners

For many years the oil bath air cleaner, see Fig. 24, was considered the best, but recently Briggs & Stratton developed the Oil Foam "No Spill" Air Cleaner. See Fig. 25. This cleaner employs a polyurethane element. The important patented feature is that it is sealed. Other cleaners are made with a polyurethane element but some are merely blocks of material with no seals of any kind thus allowing the air and dirt to by-pass the element. The Briggs & Stratton cleaner uses the edges of the element as gaskets so that the air must pass through the element

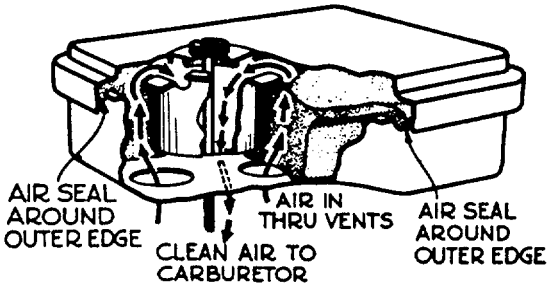


Figure 25.

There are two other important features of the "No Spill" cleaner. Oil will not spill if the engine is tilted. If the element becomes loaded with dirt the air supply will be shut off so the engine will lose power or stop entirely. Then the element can be cleaned, reoiled and reinstalled as good as new. The element must be re-oiled after cleaning

Ignition

IGNITION

A magneto in a sense consists of two simple circuits, one called a primary circuit and the other the secondary circuit. Both circuits have windings which surround the same iron core and the magnets in the flywheel or rotor act on both circuits. Current can be induced in each by changing the magnetism in or around the coils of the circuit

The primary circuit has relatively few turns of heavy wire and the circuit includes a set of breaker points and a condenser

The secondary circuit has a coil with many turns of lighter wire which are wound around the outside of the primary winding, and includes a spark plug. There are about 60 turns in the secondary to each turn in the primary

A permanent magnet is mounted in the flywheel or rotor. As the flywheel rotates, the magnet is brought into proximity with the coil and core

The Briggs & Stratton new ignition magneto system differs from ordinary magnetos in that the voltage produced is tailored to the needs of the engine. See Fig. 26. The magnet used in this new type is a ceramic which develops a very high magnetic strength in a very short distance The length of this magnet is 3/8" as compared with the Alnico magnet length of 7/8"

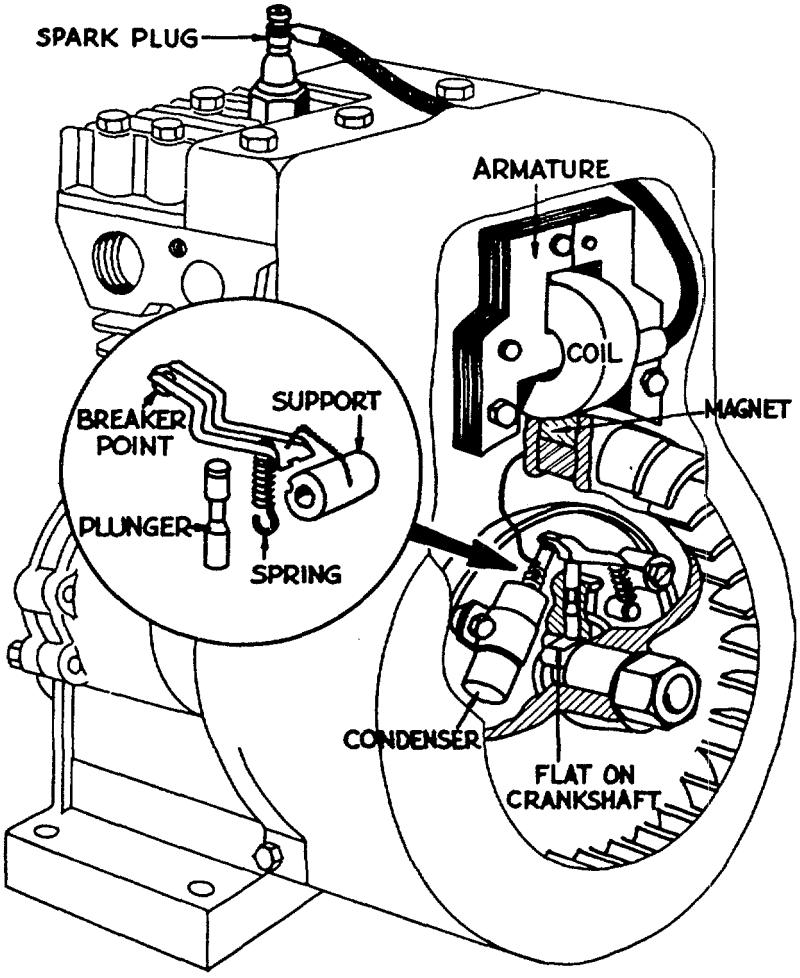


Figure 26.

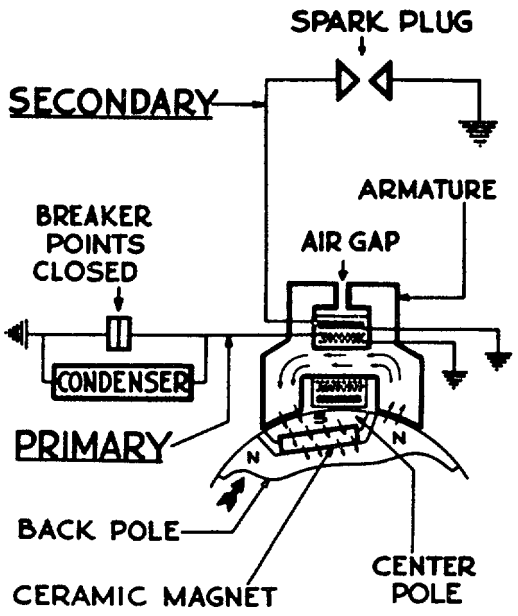


Figure 27.

Fig. 27 shows the flow of magnetism through the iron core of the coil as the magnet in the flywheel approaches the armature. The arrows indicate the direction of flow of the magnetic field. You will notice that there is no (or very little) magnetism flowing through the upper part of the core. This is because of the air gap at the top which causes a resistance. In this position our breaker points close

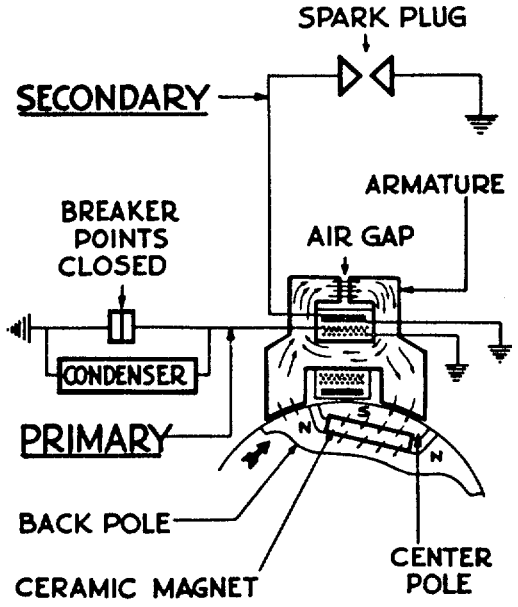


Figure 28.

The flywheel continues to rotate to the position shown in Fig. 28. The magnetism continues to flow in the same direction and magnitude through the center of the core because of primary current However, the magnetism flows in an opposite direction through the outer portion of the core and through the top air gap because of the change of flywheel position. Since the shunt air gap provides a path for the flux from the armature legs and the core, the required current flow through the primary circuit is low, assuring long breaker point life.

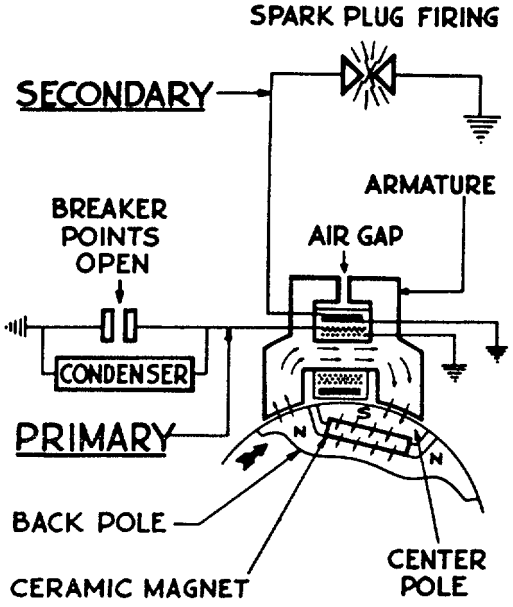


Figure 29.

At this position our breaker points open, the current stops flowing in the primary circuit and therefore the electromagnetic effect ceases. The magnetism instantaneously changes from the flow shown in Fig. 28 to that shown in Fig. 29 Note the opposite direction of the arrows indicating a complete reversal of magnetism which has happened so fast that the flywheel magnet has not had a chance to move any noticeable amount

The rapid change in magnetism produces 170 volts in the primary winding. A voltage is also induced in the secondary but it is in proportion to the turns ratio, i.e., 60 to 1 or 10,000 volts This voltage is more than ample to fire across the spark plug electrodes. This rapid magnetism change is very short and therefore the flow of current across the spark plug gap is as long as necessary, but short enough to afford long electrode life. Thus we achieve our aims of full power plus long life and dependability

THEORIES OF OPERATION

Ignition

Now, we haven't said much about one thing, the condenser. The condenser is a sort of safety valve on the primary circuit. It is connected across the breaker points to prevent the circuit from jumping the breaker point gap, arcing, as it is called .

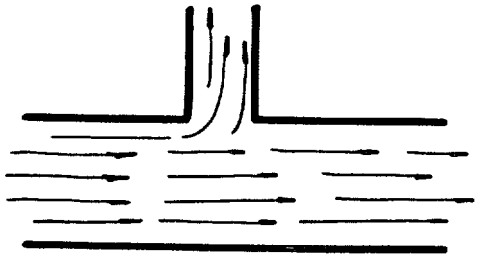


Figure 30A.

Let us explain it this way. Suppose we had a large pipe through which we forced water at a high rate of speed, Figure 30A. This corresponds to our primary circuit. Coming out of the large pipe is a much smaller pipe. This is our secondary circuit. As long as the large pipe is unobstructed, the water is free to flow and very little will flow out through the small pipe.

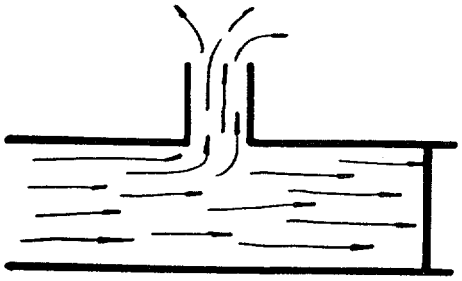


Figure 30B.

Now suppose we could suddenly shut off the large pipe, Figure 30B. The water will stop flowing through the large pipe, but the inertia of the water back in the large pipe will force the water out through the small pipe at a tremendous velocity until the pressure is dissipated. This corresponds to the high voltage in our secondary circuit.

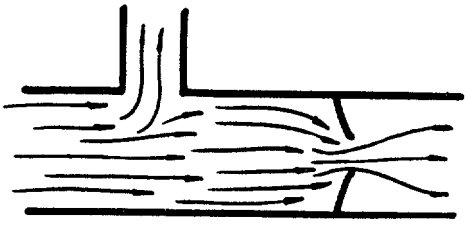


Figure 30C.

However, suppose our valve could not stand the pressure and would break. (Figure 30C.) This would correspond to arcing across the breaker points. The flow would continue through the large pipe, and very little would flow through the small pipe.

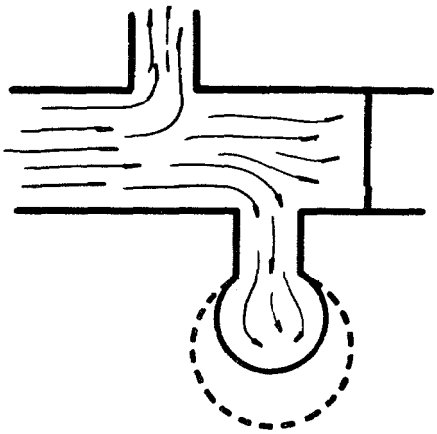


Figure 30D.

If we put another small pipe near the valve, (Figure 30D) and over the end place a strong rubber bag, we have the equivalent to our condenser. Thus, when we close our valve, the pressure on the valve would be partially absorbed by the rubber bag, the valve would not break and water would stream out the small pipe where we want it to go.

The rubber bag must be of the proper size and strength. If it is too small, it will not take up enough of the pressure and the valve will break anyway. If it is too large, it will hold too much water, and there will not be enough pressure to force the water out through the small pipe.

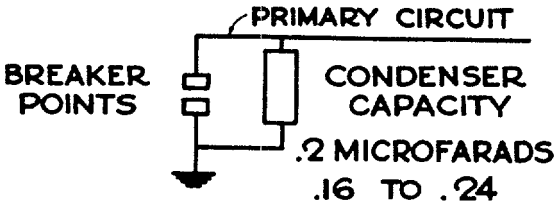


Figure 31.

The same thing applies to the condenser. The proper capacity should be about .2 microfarads or .16 to .24. This is just right to prevent arcing at the points and still cause the primary current to stop flowing

Spark plug cables are molded into the coil so that moisture cannot short out the spark as could happen on older coils that had an open connection between coil and spark plug cable

We would like to point out that at one time some mechanics would try to judge the condition of the magneto system by the brightness and the noise or "snap" of the spark. This is not a good criterion as you can quickly demonstrate by using a resistor type spark plug and a regular type spark plug. Lay them on top of the cylinder head and connect the spark plug cable to first one and then the other. Spin the flywheel and notice the spark across the electrodes. You will see that the spark across the resistor plug will be much thinner and makes less noise and yet we know that engines run very well on these plugs.

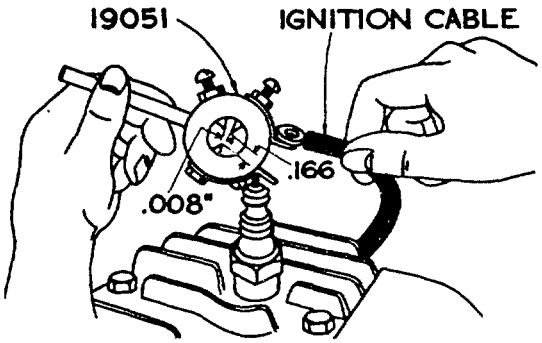


Figure 32.

The magneto can be tested by placing the spark tester, #19051, between the ignition cable and the spark plug as shown in Fig. 32. Then spin the flywheel vigorously. The spark should jump the .166" gap

This test can also be performed with the engine running but the cable should be shifted quickly from spark plug to tester or from tester to spark plug. Damage to the coil can result if the engine spins more than just a few revolutions with the cable disconnected. This running test should not be performed on the Models 9, 14, 19, 23 with the Magnematic ignition system.

Through the years the magneto systems on the various Briggs & Stratton engines have differed somewhat in the design of the parts. However, the basic principle of a primary and a secondary circuit is used in all models.

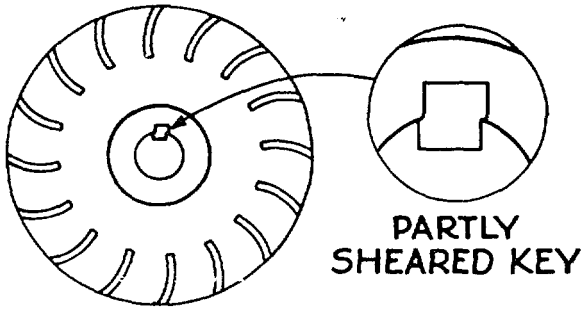


Figure 33.

On small engines, be sure that the flywheel key is not partially sheared as this can cause the timing to be off enough to result in hard starting. Do not, however, use a steel key. The soft metal key is used so that if the flywheel should become loose the key will be sheared, allowing the flywheel to shift and stop the engine before any further damage occurs. Remember that the flywheel key is a locater and not a driver

"EASY SPIN" STARTING

Good compression is necessary in order to obtain the full horsepower of the engine but at the same time this makes it more difficult to turn the engine over fast enough to start it. The resistance of compression is most noticeable during the first few revolutions after which the momentum of the flywheel and crankshaft help until firing starts in the cylinder.

In order to reduce this resistance during starting time, various types of compression releases have been used. However, none proved entirely satisfactory until Briggs & Stratton developed the "Easy Spin" starting system. This is so simple one wonders why it was never thought of before.

The intake lobe on the cam gear is ground with a small ramp which holds the intake valve open 1/100 of an inch for a tiny fraction of the compression stroke. At slow starting speed the interval of time that the valve is open is reactively long and therefore enough air escapes 1 noticeable reduce the compression. However at operating speeds the interval of time is s short that there is practically no escape an therefore horsepower is unimpaired. Actually l 3600 RPM the valve is opened for a mere 1/20 of a second. In all other respects the valve operate as in any other four stroke cycle engine.

The force required to start an engine is reduce by 50% with "Easy Spin" and would be notice most by a person who has difficulty starting the ordinary engine.

One thing we must remember. When testing the compression of "Easy Spin" engine one must spin the flywheel "backward", in the opposite direction to normal rotation. This will bring the compression stroke on the opposite side (the cam lobe and allow you to feel the compression

GOVERNING

While some people think that a governor on an engine is to prevent overspeeding, the real purpose in the small engine, field is to maintain a desired speed regardless of load. With a fixed throttle position, the engine could speed up if the load was lightened; if the load is increased the engine would slow down or even stop.

A governor on the other hand will close the throttle if the load is lightened or open the throttle to obtain more power if the load is increased.

Basically, governors consist of two types the pneumatic or air vane type, Fig. 34, and the mechanical or flyball weight type, Fig. 35.

The pneumatic governor as illustrated in Fig. 34 is operated by the force of the air from the flywheel fins. When the engine is running the air from the fins pushes against the air vane. The air vane is connected to the carburetor throttle by means of a link. The force and movement of these parts tends to close the carburetor and thus slow down the engine speed.

Opposed to this is the governor spring which tends to pull the opposite way, opening the throttle. This spring is usually connected to an adjustable control of some kind so that the tension on the spring can be changed at the will of the operator. Increasing the tension of the spring will increase the engine speed. Decreasing the tension will lower the engine speed The point at which the pull of the spring equals the force of the air vane is called the "governed speed"

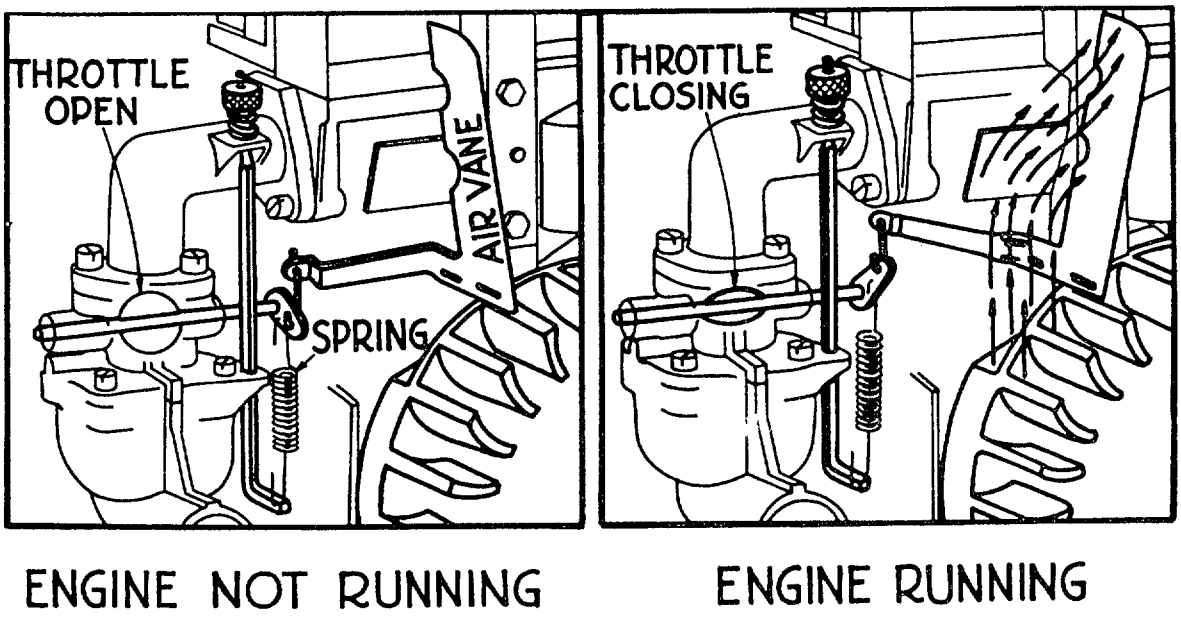


Figure 34.

Governing

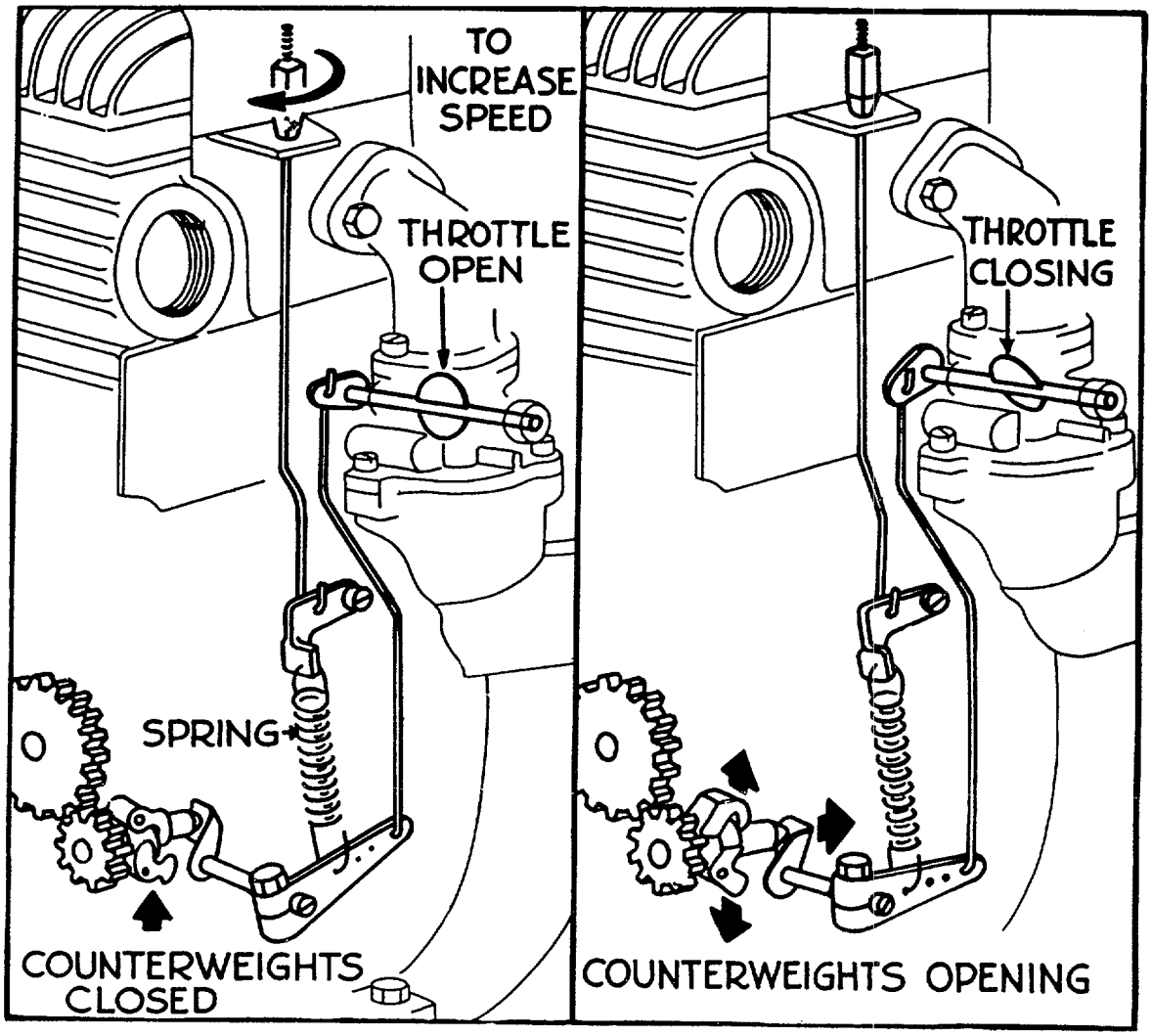


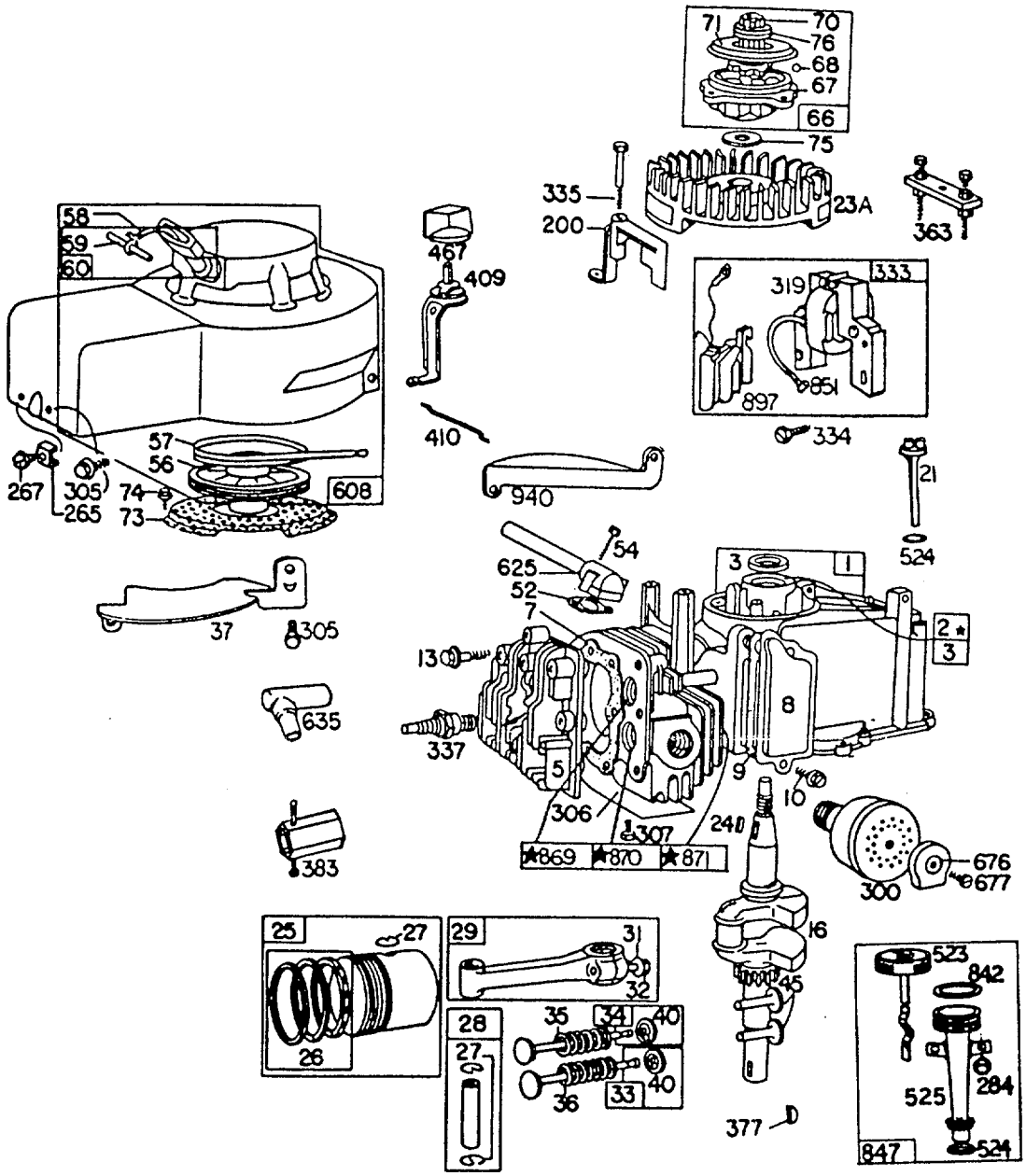
Figure 35.

The mechanical governor, Fig. 35, works in a similar manner except that instead of the force of the air blowing against the vane, we have the centrifugal force of flyball weights opposing the governor spring.

In either case, operation is the same. As the load on the engine increases, the engine will start to slow down. As soon as this happens, the centrifugal force of the flyball weights lessens. This allows the governor spring to pull the throttle open wider increasing the horsepower to compensate for the increased load and thus maintain the desired governed speed

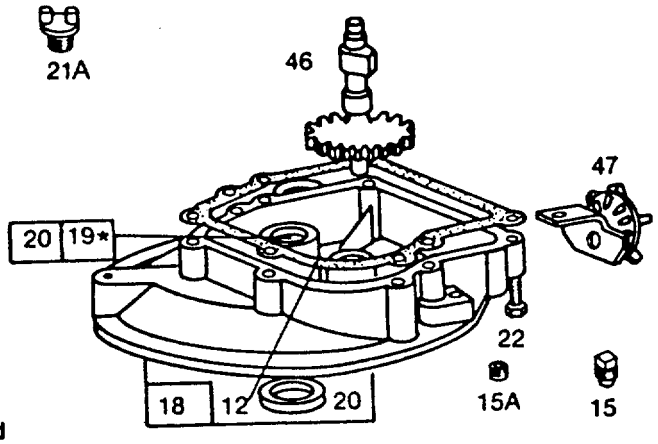
If the load on the engine lessens, the engine starts to speed up. This will increase the pressure of the centrifugal force and the spring will be stretched a little farther thus closing the throttle and reducing the engine power. A properly functioning governor will maintain this desired governed speed within fairly close limits.

In general, an engine that has good compression, carburetion, and ignition will operate efficiently. However, dirt or neglect can ruin an engine quickly. It should be the duty, therefore, of every salesman or repair man to instruct the customer in the proper operation and care of the engine so that he will obtain the long service life that is built into the engine at the factory.



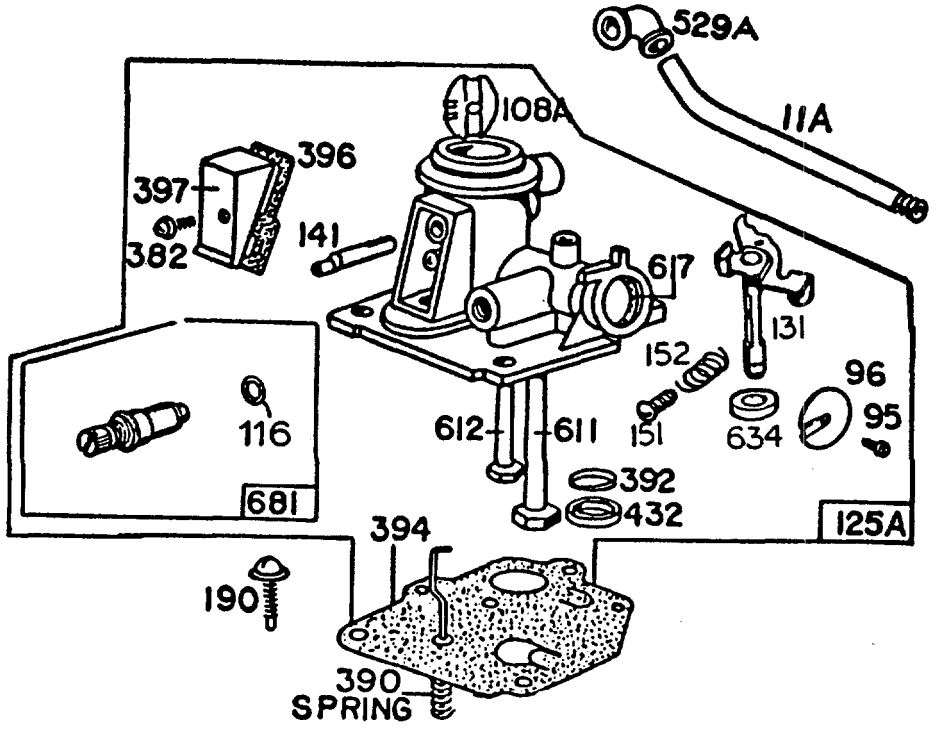
SPECIAL TOOLS REQUIRED FOR INSTALLING
SEE REPAIR INSTRUCTION MANUAL

REF NO.	PART NO.	DESCRIPTION
1	395373	Cylinder Assembly
2	293708	Bushing-Cylinder
	Note:	Requires special tools for installation.
3	299819	Seal-Oil
5	211479	Head-Cylinder
7	*270341	Gasket-Cylinder Head
8	298383	Breather-Valve Chamber
9	'270239	Gasket--Valve Cover
10	93394	Screw-Breather and P.T.O. Gear Sump Cover (Ref. No. 86) Mtg. Sem
13	93111	Screw-Cylinder Head (1-15/16" long)
16	260097	Crankshaft
21	A66768	Plug-Oil Filler
23	A395653	Flywheel-Magneto
24	222698	Key-Flywheel
25	298904	Piston-Assy.-
26	298982	Ring Set-Standard Piston
27	26026	Lock-Piston Pin
28	298909	Pin Assembly--Piston Standard
29	294201	Rod Assy.-Connecting
31	222282	Washer-Conn. Rod Screw (one for each screw)
32	92296	Screw-Connecting Rod
33	296676	Valve-Exhaust
34	296677	Valve-Intake
35	260552	Spring-Intake Valve
36	26478	Spring-Exhaust Valve
37	223150	Guard-Flywheel
40	93312	Retainer-Valve Spring
45	230173	Tappet-Valve
52	'270345	Gasket-intake Elbow
54	93485	Screw-intake Elbow Mounting
56	.280117	Pulley-Rewind Starter
57	294303	Spring-Rewind Starter
58	280406	Rope-Rewind Starter-81" long (For Intermediate Lengths, Cut to Required Size)
	Note:	If longer rope is needed, order No 280399 and cut to required length
59	230228	Pin-Starter Rope
60	393152	Grip-Starter Rope
66	394558	Clutch Assy.-Rewind Starter
67	394896	Housing-Starter Clutch
68	63770	Ball-Clutch
70	298436	Ratchet-Rewind
71	221653	Washer-Clutch Retainer
73	221661	Screen-Rewind Starter
74	93490	Screw—Sem
75	223047	Washer-Spring
76	68238	Washer-Ratchet Sealing
200	68388	Blade-Governor
265	22372	Clamp-Casing
267	93469	Screw-Clamp Mtg.
284	93984	Screw-Clamp Mtg.
300	298830	Muffler-Exhaust
305	93559	Screw-Blower Housing Mounting Sem
306	221805	Sheld-Cylnder
307	93490	Screw-Cylinder Shield and Rotating Screen
319	395488	Armature Assy (Less Trigger Coil)
333	395489	Armature--Magneto
334	93381	Screw-Armature Mounting Sem
335	93435	Screw-Armature and Governor Blade Mounting Sem
337	298809	Plug-Spark 1-1/2" high-37-42 M.M
358	298989	Gasket Set
363	19069	Puller-Flywheel
377	93065	Key-Woodruff No 6
383	89838	Wrench-Spark Plug
409	299839	Control-Dial
410	260993	Link-Control
1467	2.99858	Knob-Dial Control
523	396372	Cap with Dipstick-Oil Filler
524	271485	Seal-Filler Tube
525	280382	Tube-Oil Filler
608	395576	Starter Assy.-Rewind (12 o'clock position)
625	298775	Tube-Fuel Intake
635	66538	Elbow-Spark Plug
676	221794	Deflector-Muffler
677	93606	Screw-Muffler Deflector
842	270920	Seal-Oil Filler Cap
847	39';869	Tube Assy.--OI Fill
851	22'1798	Terminal-Ignition Cable
869	210879	Seat-Intake Valve (Standard)
870	211291	Seat-Exhaust Valve (Standard)
		Note: For installation and options see Repair Manual
871	63709	Guide-Exhaust Valve
897	394970	Trigger Coil
940	222403	Guard-Flywheel



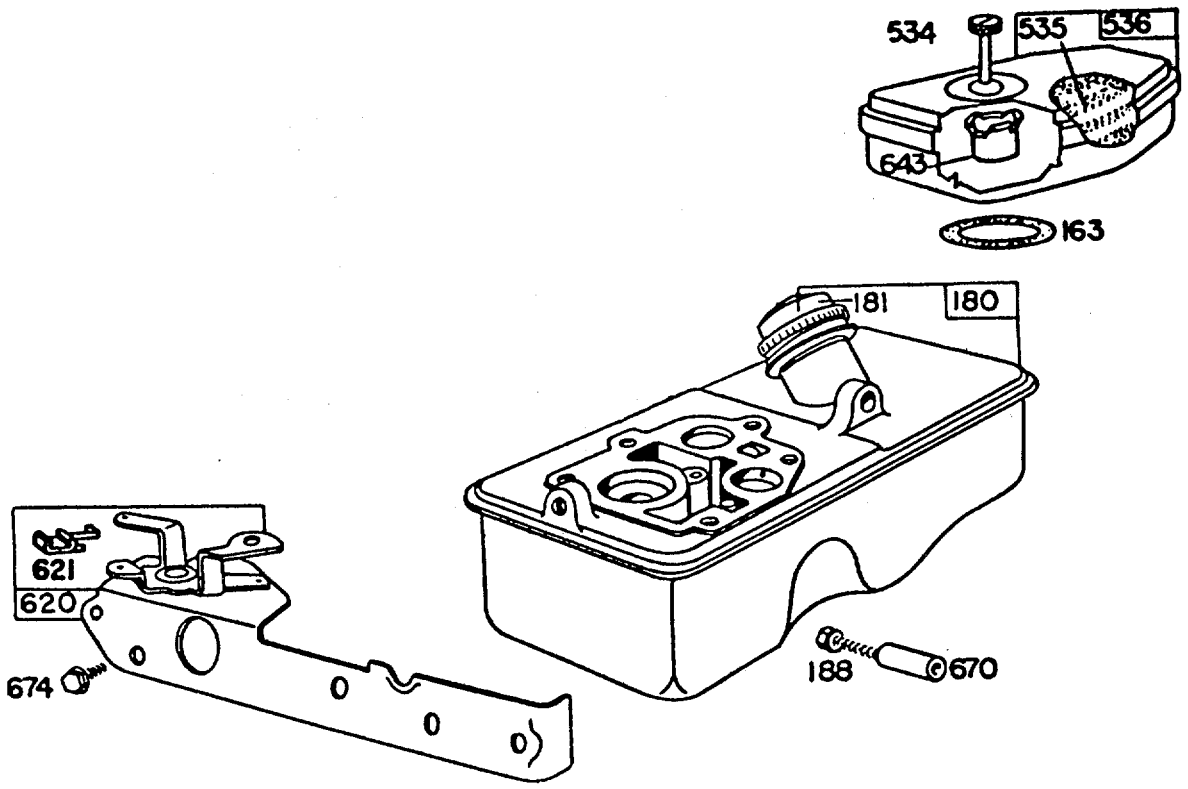
Sump assemblies illustrated on this page include an oil filler opening.

REF. NO.	PART NO.	DESCRIPTION
12	*270833	Gasket-Crankcase-
15	91084	Plug-Oil Drain
15A	93418	Plug-Oil Drain (Socket Head)
18	293512	Sump-Oil
19	293709	Bushing-Oil Sump
	Note:	Requires Special Tools for Installation
20	391483	Seal-Oil
21	280381	Plug-Oil Filler
21A	66768	Plug-Oil Filler
22	93032	Screw-Mtg. Sem
46	394800	Gear-Cam
47	294652	Oil Slinger Gear and Bracket



REF. NO.	PART NO.	DESCRIPTION
11A	230802	Tube-Breather
95	93499	Screw-Throttle Valve Mounting Sem
96	211237	Valve-Throttle
108A	280178	Valve-Choke
116	280203	O-Ring
125A	394063	Carburetor Assembly
131	299977	Shaft and Lever-Throttle
141	68908	Shaft-Choke
151	93524	Screw-Rd. Hd - 5-40 x 1/2
152	260746	Spring-Throttle Adl.
190	93440	Screw-Fuel Tank Mtg.
382	93545	Screw-Clfoke Link
390	261249	Spring-Diaphragm
392	260455	Spring-Fuel Pump

REF. NO	PART NO.	DESCRIPTION
394	391643	Diaphragm-Carburetor
396	270571	Gasket-Choke Link Cover
397	211678	Cover-Choke Link
432	221377	Cap-Spring
529A	67838	Grommet-Breather
611	297219	Pipe-Fuel (long)
612	296811	Pipe-Fuel (short)
617	270344	Seal-Fuel Intake Tube
681	395508	Needle Valve Kit (Nylon Body)



REF. NO.	PART NO.	DESCRIPTION
163	3271139	Gasket-Air Cleaner Mounting
180	391694	Tank Assembly-Fuel
181	298425	Cap-Fuel Tank
188	93585	Sciew-Fuel Tank and
534	93374	Screw-Air Cleaner
535	270579	Element-Air Cleaner
536	390055	Cleaner Assembly-Air
620	299974	Plate-Carburetor Control
621	297472	Switch-Stop
642	222626	Cover-Air Cleaner
643	280374	Cup-Air Cleaner
670	94038	Spacer-Fuel Tank
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General, United States Army
Chief of Staff

Official:

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