270962 - Single Cylinder L-Head
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CHECK

COMMON SPECIFICATIONS FOR

	BASIC MODEL SERIES	OIL CAPACITY Fl. Ozs.■	ARMATURE AIR GAP INCHES	TORQUE SPECIFICATIONS				VALVE CLEARANCE	
				FLYWHEEL NUT FT. LBS.	CYLINDER HEAD IN. LBS.	CONN. ROD IN. LBS.	CRANKCASE COVER OR SUMP IN. LBS.	INTAKE INCHES	EXHAUST INCHES
ALUMINUM	60000	H 21	.006 .010	55	140	100	85	.005 .007	.007 .009
	80000	H 21	.006 .010	55	140	100	85	.005 .007	.007 .009
	90000	H 21 V 18	.006 .010	55	140	100	85	.005 .007	.007 .009
	10A900, 10B900, 10C900	V 18	.006 .010	55	140	100	85	.005 .007	.007 .009
	100200, 100900	H 21 V 28	.006 .010	60	140	100	120	.005 .007	.007 .009
	100700	V 18	.006 .010	55	140	100	85	.005 .007	.007 .009
	110000	H 21 V 18▼	.006 .010	55	140	100	85	.005 .007	.007 .009
	120000	V 28	.006 .010	55	140	100	85	.005 .007	.007 .009
	130000	H 21 V 28	.010 .014	60	140	100	120	.005 .007	.009 .011
	170000	H 44 V 36	.010 .014	65	165	165	140	.005 .007	.009 .011
	190000	H 48 V 48	.010 .014	65	165	185	140	.005 .007	.009 .011
	220000	H 48 V 48	.010 .014	65	165	185	140	.005 .007	.009 .011
	250000	H 48 V 48	.010 .014	65	165	185	140	.005 .007	.009 .011
	280000 except 286700	V 48	.010 .014	100	165	See Section 9, Page 8, Table No. 4	140▲ 200▲	.005 .007	.009 .011
	286700	V 48	.010 .014	100	165	See Section 9, Page 8, Table No. 4	140▲ 200▲	.004 .006	.009 .011
CAST IRON	230000	H 64	.010 .014	145	190	190	90 mag. 190 PTO	.007 .009	.017 .019
	240000	H 64	.010 .014	145	190	190	90 mag. 190 PTO	.007 .009	.017 .019
	300000	H 64	.010 .014	145	190	190	90 mag. 190 PTO	.007 .009	.017 .019
	320000	H 64	.010 .014	145	190	190	90 mag. 190 PTO	.007 .009	.017 .019

■ H for Horizontal Crankshaft & V for Vertical Crankshaft, ◆ Governed Idle, See Section 5 for adjustment procedures, ▼ Right Angle Drive 21 Fl. Ozs.,
▲ See Section 11, page 11, TABLE NO. 5.

CHART

ALL SINGLE CYLINDER "L" HEAD ENGINE MODELS

STANDARD CYLINDER BORE INCHES	CRANKSHAFT						
	STROKE INCHES	STANDARD CRANKPIN JOURNAL INCHES	JOURNAL REJECT SIZES INCHES			END PLAY	
			MAGNETO	CRANKPIN	PTO	HORIZONTAL INCHES	VERTICAL INCHES
2.3740 2.3750	1.500	Not Required	.873	.870	.873	.002 .008	–
2.3740 2.3750	1.750	.9983 .9988	.873	.996	.873	.002 .008	–
2.5615 2.5625	1.750	.9983 .9988	.873	.996	.873	.002 .010	.002 .030
2.5615 2.5625	1.876	.8731 .8739	.873	.872	.873	.002 .030	.002 .030
2.4990 2.5000	2.125	.9983 .9988	.873	.996	.998	.002 .008	.002 .008
2.5615 2.5625	1.940	.9983 .9988	.873	.996	1.060	.002 .030	.002 .030
2.7802 2.7812	1.940	.9983 .9988	.873	.996	.873	.002 .008	.002 .008
2.6875 2.6885	2.020	▶.9983/.9988 ◀1.0983/1.0991	.873	.996	1.060	.002 .030	.002 .030
2.5615 2.5625	2.438	.9983 .9988	.873	.996	.998	.002 .008	.002 .008
2.9990 3.0000	2.375	1.0920 1.0924	.997 1.179●	1.090	1.179	.002 .008	.002 .008
2.9990 3.0000	2.750	1.1239 1.1243	.997 1.179●	1.122	1.179	.002 .030	.002 .030
3.4365 3.4375	2.375	1.2489 1.2493	1.376	1.247	1.376	.002 .030	.002 .030
3.4365 3.4375	2.625	1.2489 1.2493	1.376	1.247	1.376	.002 .030	.002 .030
3.4365 3.4375	3.062	1.2489 1.2493	1.376	1.247	1.376	.002 .023	.002 .023
3.4365 3.4375	3.062	1.2489 1.2493	1.376	1.247	1.376	.002 .023	.002 .023
2.9990 3.0000	3.250	1.1840 1.1868	1.3769	1.1844	1.3769	.002 .008	.002 .008
3.0615 3.0625	3.250	1.3114 1.3118	Ball	1.3094	Ball	.002 .008	.002 .008
3.4365 3.4375	3.250	1.3114 1.3118	Ball	1.3094	Ball	.002 .008	.002 .008
3.5615 3.5625	3.250	1.3114 1.3118	Ball	1.3094	Ball	.002 .008	.002 .008

● Synchro-Balance®, ◀ after Date Code 97011200, ▶ before Date Code 97011300

English to Metric Conversion Table

Fraction	Decimal	mm
1/64	0.0156	0.3969
1/32	0.0312	0.7938
3/64	0.0469	1.1906
1/16	0.0625	1.5875
5/64	0.0781	1.9844
3/32	0.0938	2.3812
7/64	0.1094	2.7781
1/8	0.1250	3.1750
9/64	0.1406	3.5719
5/32	0.1562	3.9688
11/64	0.1719	4.3656
3/16	0.1875	4.7625
13/64	0.2031	5.1594
7/32	0.2188	5.5562
15/64	0.2344	5.9531
1/4	0.2500	6.3500
17/64	0.2656	6.7469
9/32	0.2812	7.1438
19/64	0.2969	7.5406
5/16	0.3125	7.9375
21/64	0.3281	8.3344
11/32	0.3438	8.7312
23/64	0.3594	9.1281
3/8	0.3750	9.5250
25/64	0.3906	9.9219
13/32	0.4062	10.3188
27/64	0.4219	10.7156
7/16	0.4375	11.1125
29/64	0.4531	11.5094
15/32	0.4688	11.9062
31/64	0.4844	12.3031
1/2	0.5000	12.7000

Fraction	Decimal	mm
33/64	0.5156	13.0969
17/32	0.5312	13.4938
35/64	05469	13.8906
9/16	0.5625	14.2875
37/64	0.5781	14.6844
19/32	0.5938	15.0812
39/64	0.6094	15.4781
5/8	0.6250	15.8750
41/64	0.6406	16.2719
21/32	0.6562	16.6688
43/64	0.6719	17.0656
11/16	0.6875	17.4625
45/64	0.7031	17.8594
23/32	0.7188	18.2562
47/64	0.7344	18.6531
3/4	0.7500	19.0500
49/64	0.7656	19.4469
25/32	0.7812	19.8438
51/64	0.7969	20.2406
13/16	0.8125	20.6375
53/64	0.8281	21.0344
27/32	0.8438	21.4312
55/64	0.8594	21.8281
7/8	0.8750	22.2250
57/64	0.8906	22.6219
29/32	0.9062	23.0188
59/64	0.9219	23.4156
15/16	0.9375	23.8125
61/64	0.9531	24.2094
31/32	0.9688	24.6062
63/64	0.9844	25.0031
1	1.0000	25.4000

Drill Size – Decimal Equivalent In Inches

60——.040
59——.041
58——.042
57——.043
56——.0465
55——.052
54——.055
53——.0595
***1/16* —.0625**
52——.0635
51——.067
50——.070
49——.073
48——.076
***5/64* —.0781**
47——.0785
46——.081
45——.082
44——.086
43——.089
42——.0935
***3/32*—.0938**
41——.096
40——.098

39——.0995
38——.1015
37——.104
36——.1065
***7/64*—.1094**
35——.110
34——.111
33——.113
32——.116
31——.120
***1/8*——.125**
30——.1285
29——.136
28——.1405
***9/64*—.1406**
27——.144
26——.147
25——.1495
24——.152
23——.154
***5/32*—.1562**
22——.157
21——.159

20——.161
19——.166
18——.1695
***11/64*–.1719**
17——.173
16——.177
15——.180
14——.182
13——.185
***3/16*—.1875**
12——.189
11——.191
10——.1935
9——.196
8——.199
7——.201
***13/64*–.2031**
6——.204
5——.2055
4——.209
3——.213
***7/32*—.2188**
2——.221

1——.228
A——.234
***15/64*–.2344**
B——.238
C——.242
D——.246
E, *1/4*–.250
F——.257
G——.261
***17/64*–.2656**
H——.266
I——.272
J——.277
K——.281
***9/32*—.2812**
L——.290
M——.295
***19/64*–.2969**
N——.302
***5/16*—.3125**
O——.316
P——.323
***21/64*–.3281**

Q——.332
R——.339
***11/32*–.3438**
S——.348
T——.358
***23/64*–.3594**
U——.368
***3/8*——.375**
V——.377
W——.386
***25/64*–.3906**
X——.397
Y——.404
***13/32*–.4062**
Z——.413
***27/64*–.4219**
***7/16*—.4375**
***29/64*–.4531**
***15/32*–.4688**
***31/64*–.4844**
***1/2*——.500**

SECTION 1
General Information

Section Contents

IN THE INTEREST OF SAFETY

The safety alert symbol (⚠) is used to identify safety information about hazards that can result in personal injury.

A signal word (DANGER, WARNING, or CAUTION) is used with the alert symbol to indicate the likelihood and the potential severity of injury. In addition, a hazard symbol may be used to represent the type of hazard.

⚠ **DANGER** indicates a hazard which, if not avoided, **will result in death or serious injury.**

⚠ **WARNING** indicates a hazard which, if not avoided, **could result in death or serious injury.**

⚠ **CAUTION** indicates a hazard which, if not avoided, **might result in minor or moderate injury.**

CAUTION, when used **without** the alert symbol, indicates a situation that **could result in damage to the engine.**

HAZARD SYMBOLS AND MEANINGS

- ✓ Prior to work, read and understand the section(s) of this manual that pertain to the job. Follow all safety warnings.
- ✓ WEAR suitable eye protection (safety glasses, goggles or face shield when performing repair procedures).
- ✓ PREVENT ACCIDENTAL STARTING by removing spark plug wire from spark plug when servicing engine or equipment. Disconnect negative wire from battery terminal if equipped with electric starting system.
- ✓ PERIODICALLY clean engine. Keep governor parts free of dirt, grass and other debris which can affect engine speed.
- ✓ USE fresh gasoline. Stale fuel can gum carburetor and cause leakage.
- ✓ CHECK fuel lines and fittings frequently for cracks or leaks. Replace if necessary.

⚠ WARNING: ⚠

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

⚠ WARNING

Gasoline and its vapors are extremely flammable and explosive.

Fire or explosion can cause severe burns or death.

WHEN ADDING FUEL

- Turn engine OFF and let engine cool at least 2 minutes before removing gas cap.
- Fill fuel tank outdoors or in well-ventilated area.
- Do not overfill fuel tank. Fill tank to approximately 1-1/2 inches below top of neck to allow for fuel expansion.
- Keep gasoline away from sparks, open flames, pilot lights, heat, and other ignition sources.
- Check fuel lines, tank, cap, and fittings frequently for cracks or leaks. Replace if necessary.

WHEN STARTING ENGINE

- Make sure spark plug, muffler, fuel cap and air cleaner are in place.
- Do not crank engine with spark plug removed.
- If fuel spills, wait until it evaporates before starting engine.
- If engine floods, set choke to OPEN/RUN position, place throttle in FAST and crank until engine starts.

WHEN OPERATING EQUIPMENT

- Do not tip engine or equipment at angle which causes gasoline to spill.
- Do not choke carburetor to stop engine.

WHEN TRANSPORTING EQUIPMENT

- Transport with fuel tank EMPTY or with fuel shut-off valve OFF.

WHEN STORING GASOLINE OR EQUIPMENT WITH FUEL IN TANK

- Store away from furnaces, stoves, water heaters or other appliances that have a pilot light or other ignition source because they can ignite gasoline vapors.

⚠ WARNING

Unintentional sparking can result in fire or electric shock.

Unintentional start-up can result in entanglement, traumatic amputation, or laceration.

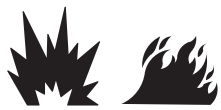
BEFORE PERFORMING ADJUSTMENTS OR REPAIRS

- Disconnect spark plug wire and keep it away from spark plug.
- Disconnect battery at negative terminal (only engines with electric start).

WHEN TESTING FOR SPARK

- Use approved spark plug tester.
- Do not check for spark with spark plug removed.

⚠ WARNING



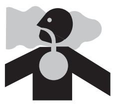
Starting engine creates sparking.

Sparking can ignite nearby flammable gases.

Explosion and fire could result.

- If there is natural or LP gas leakage in area, do not start engine.
- Do not use pressurized starting fluids because vapors are flammable.

WARNING

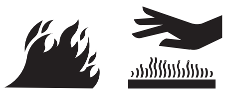


Engines give off carbon monoxide, an odor-less, colorless, poison gas.

Breathing carbon monoxide can cause nau-sea, fainting or death.

- Start and run engine outdoors.
- Do not start or run engine in enclosed area, even if doors or windows are open.

WARNING



Running engines produce heat. Engine parts, especially muffler, become extremely hot.

Severe thermal burns can occur on contact.

Combustible debris, such as leaves, grass, brush, etc. can catch fire.

- Allow muffler, engine cylinder, fins, and radiator to cool before touching.
- Remove accumulated combustibles from muffler area and cylinder area.
- Install and maintain in working order a spark arrester before using equipment on forest-covered, grass-covered, brush-covered unimproved land. The state of California requires this (Section 4442 of the California Public Resources Code). Other states may have similar laws. Federal laws apply on federal land.

WARNING

Rotating parts can contact or entangle hands, feet, hair, clothing, or accessories.

Traumatic amputation or severe laceration can result.

- Operate equipment with guards in place.
- Keep hands and feet away from rotating parts.
- Tie up long hair and remove jewelry.
- Do not wear loose-fitting clothing, dangling drawstrings or items that could become caught.

WARNING

Broken bones, fractures, bruises or sprains could result.

- Remove all external equipment/engine loads before starting engine.
- Direct coupled equipment components such as, but not limited to, blades, impellors, pulleys, sprockets, etc., must be securely attached.

Gasoline Engines

FUEL RECOMMENDATIONS

These engines are certified to operate on unleaded gasoline. Use clean, fresh, regular unleaded gasoline with a minimum of 77 octane. Do not mix oil with gasoline. Fresh fuel prevents gum from forming in fuel system or on essential carburetor parts. Purchase fuel in quantity that can be used within 30 days to assure fuel freshness. We recommend the use of Briggs & Stratton Gasoline Additive. (See your Authorized Briggs & Stratton Service Dealer for Part No. 5041 or the single-use pouch.)

In countries other than U.S.A., leaded gasoline may be used if it is commercially available and unleaded is unavailable.

NOTE: Some fuels, called oxygenated or reformulated gasolines, are gasoline blended with alcohols or ethers. Excessive amounts of these blends can damage the fuel system or cause performance problems. Do not use gasoline which contains Methanol. If any undesirable operating symptoms occur, use gasoline with a lower percentage of alcohol or ether.

Kerosene Engines

FUEL RECOMMENDATIONS

These engines are certified to operate on kerosene and start on gasoline (petrol). Fresh fuel prevents gum from forming in fuel system or on essential carburetor parts. Purchase fuel in quantity that can be used within 30 days to assure fuel freshness. We do not recommend the use of fuel additives in kerosene engines.

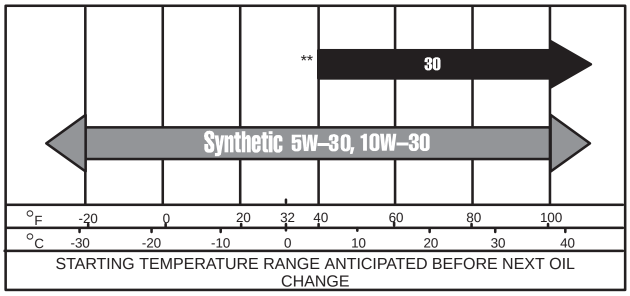
Do not mix kerosene with gasoline.
Do not use fuel additives.
Do not mix oil with kerosene or gasoline.

LUBRICATION

Use a high quality detergent oil classified “For Service SF, SG, SH, SJ” or higher. Briggs & Stratton strongly recommends the use of synthetic oil. If synthetic oil is not available, Briggs & Stratton non-synthetic 30 weight oil P/N 1000005 (20 oz.) or P/N 1000028 (48 oz.) is an acceptable substitute.
No special additives should be used with recommended oils.
Do not mix oil with gasoline.

Engine Oil

SAE VISCOSITY GRADES



* Air cooled engines run hotter than automotive engines. Use of non-synthetic multi-viscosity oils (10W-30, etc.) in ambient temperaturesabove 40° F (4° C) will result in high oil consumption. If multi-viscosity oil is used, check oil level more frequently to prevent engine damage due to lack of lubrication.

** SAE 30 oil, if used below 40° F (4° C), will result in hard starting and possible engine damage due to inadequate lubrication.

Note: Synthetic oil meeting ILSAC GF-2, API certification mark and API service symbol (shown at left) with “SJ/CF ENERGY CONSERVING” or higher is an acceptable oil at all temperatures. **Use of synthetic oil does not alter required oil change intervals**.

1

1

CHANGE OIL after first 5 hours of operation. Thereafter, change oil monthly or every 50 hours of operation. Change oil more often if engine is operated under heavy load or in high ambient air temperatures.

During normal operation, partially burned gasoline, small particles of metal from the cylinder walls, pistons, bearings, combustion deposits, and dust particles from the air will gradually contaminate the oil. If oil is not changed regularly, these foreign particles can cause increased friction and a grinding action which shortens the life of the engine. Fresh oil also assists in cooling. Old oil gradually becomes thick and loses its cooling ability as well as its lubricating qualities.

OIL CAPACITY CHART

Basic Model Series	Capacity Ounces (Liters)
Vertical Crankshaft Aluminum Cylinders	
60000, 80000, 90000, 100700, 110000, 120000	20 (.6)
100900, 130000	28 (.8)
170000, 190000	36 (1.1)
220000, 250000, 280000	48 (1.4)
Horizontal Crankshaft Aluminum Cylinders	
60000, 80000, 90000, 9K400, 100200, 130000	20 (.6)
100900, 130000, 135400, 13K400	28 (.8)
19K400	44 (1.3)
220000, 250000	40 (1.2)
Horizontal Crankshaft Cast Iron Cylinders	
230000, 240000, 300000, 320000, 32K400	64 (1.9)

BE SURE OIL LEVEL IS PROPERLY MAINTAINED. Always fill to dipstick “FULL” mark (1), Fig. 1.

Plug and dipstick combinations, automotive style dipsticks, or a screw type cap and dipstick combination (1), Fig. 3 and Fig. 4, all should be inserted completely and then retracted to measure the oil level of the engine.

Checking the oil level: If the engine is equipped with an oil fill plug (2) (Fig. 2), the oil level should be up to the plug opening (3).

Fig. 3 – Model Series 90000

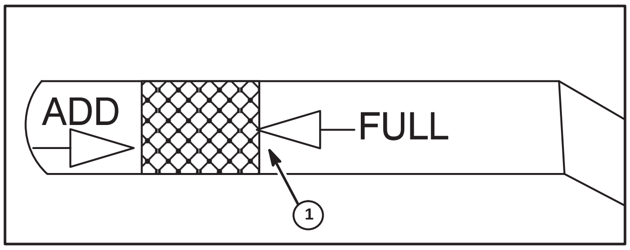


Fig. 1

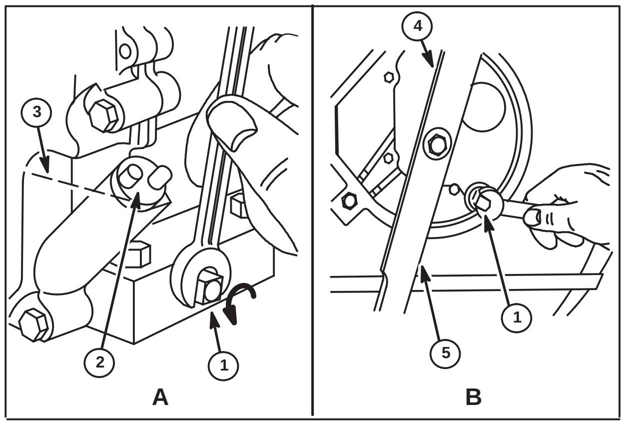


Fig. 2

Change Crankcase Oil

Remove oil drain plug (1), shown in Fig. 2. “A” shows horizontal shaft engines, “B” shows vertical shaft application – bottom view of mower deck showing cutting blade (4). Drain oil while engine is warm.

Replace drain plug. Remove dipstick or oil fill plug (2), Fig. 2. Refill with new oil of proper weight and classification. Fill engines with oil fill plug to the top of plug opening (3). Replace dipstick or oil fill plug.

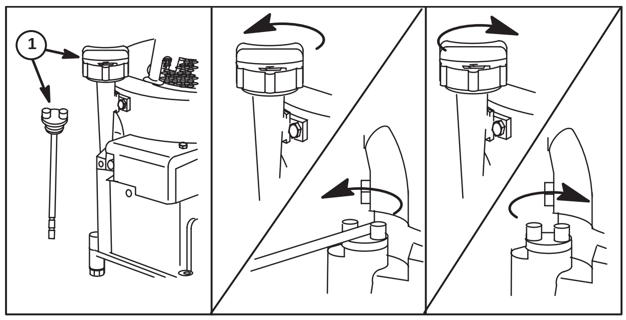


Fig. 3

Fig. 4: Model Series 110000, 120000, 130000

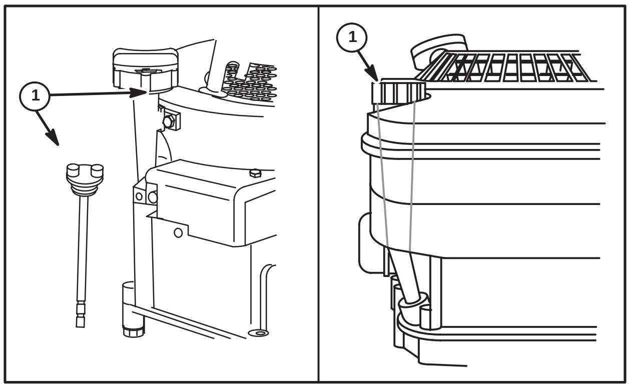


Fig. 4

CLEAN COOLING SYSTEM

Grass particles, chaff or dirt can clog the air cooling system. Continued operation with a clogged cooling-system can cause severe overheating and possible engine damage. Figures 5, (vertical crankshaft model), and 6, (horizontal crankshaft model) show the blower housing removed and areas to be cleaned (1). This should be a regular maintenance operation, performed yearly or every 100 hours, whichever comes first. Clean more often if necessary.

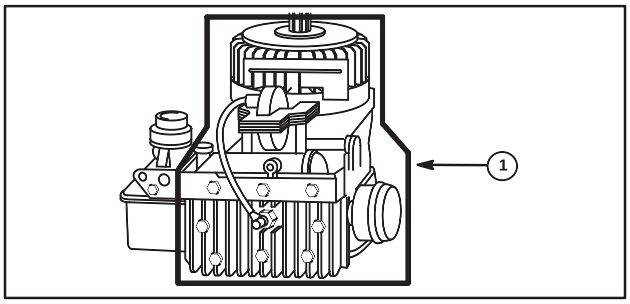


Fig. 5

AIR CLEANERS

A properly serviced air cleaner protects internal parts of the engine from dust particles in the air. If air cleaner maintenance instructions are not carefully followed, dirt and dust which should be collected in the air cleaner cartridge or foam element, will be drawn into the engine.

The air cleaner should be examined during engine service. If air cleaner, element or foam pre-cleaner (1) shows signs of damage or restriction, clean or replace parts as necessary.

NOTE: Also replace air cleaner gaskets and mounting gaskets that are worn or damaged to prevent dirt and dust from entering engine.

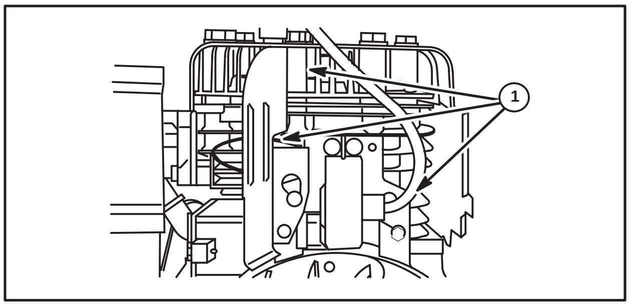


Fig. 6

1

AIR CLEANER IDENTIFICATION

Refer to Figs. 7 through 16 to determine air cleaner type and service procedures.

CARTRIDGE TYPE (Fig. 7)

(with or without Oil-Foam®
pre-cleaner or non-oiled pre-cleaner)

Remove and Install

1. Remove wing nut or loosen screw (6) .Remove cover (5).
2. Carefully remove cartridge (3) to prevent dirt entry into carburetor.
3. Replace grommet if torn or damaged.
4. Clean or replace cartridge (3) as described on page 11.
5. If equipped with pre-cleaner (1), Fig. 7A, slide off cartridge and clean as described on page 11. Note position of pre-cleaner edge (7), Fig. 7.
6. Assemble so pre-cleaner edge (2) touches base (4) in direction shown in Fig. 7.

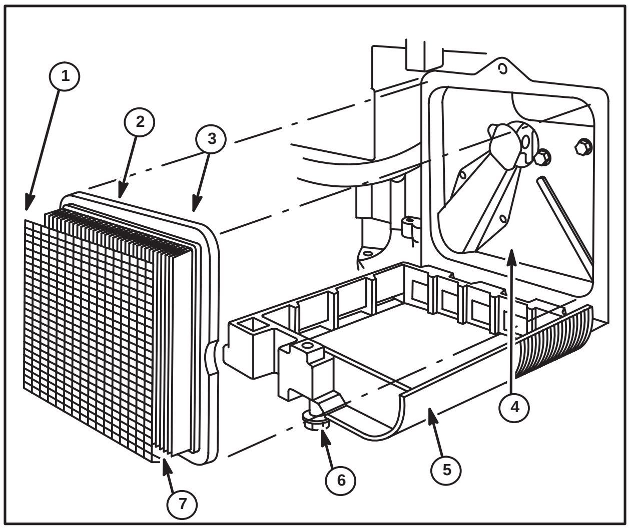


Fig. 7

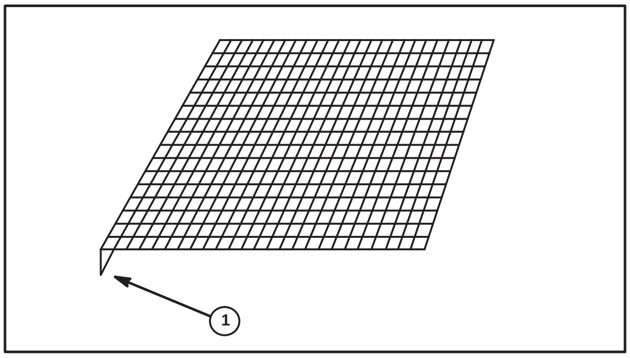


Fig. 7A

Reverse Flow Cartridge Air Cleaner, Vertical Crankshaft (Fig. 8)

Remove and Install

1. Remove air cleaner stud (1), cover screw (10), cover (2), and gasket (9). Replace gasket if damaged.
2. Remove plate screw (3), washer (8) and plate (7).
3. Remove cartridge (4) and clean air cleaner body (5) carefully to prevent dirt from entering carburetor. Brush dirt from body through holes into duct.

   NOTE: On reverse flow air cleaners, dirt accumulates on the inside surface of element.

4. Re-assemble air cleaner as shown in Fig. 8.

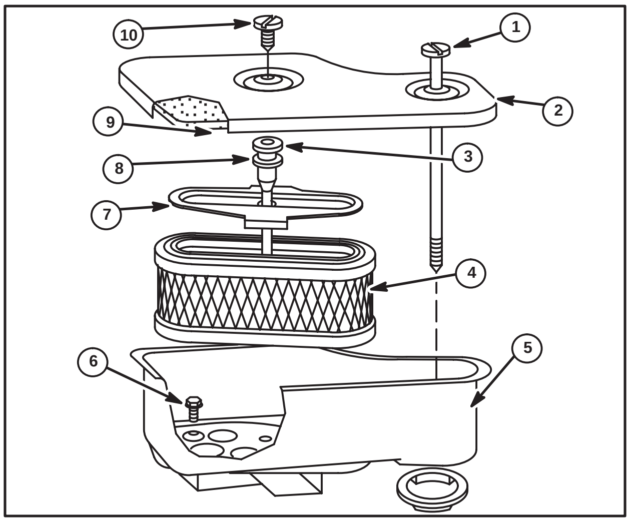


Fig. 8

DUAL ELEMENT AIR CLEANERS
Flat Cartridge (Figs. 9, 10)
Remove and Install (Typical)

1. Loosen screw(s) (7) and remove cover (6). Tilt to remove covers with tabs (3) and slots (4), Fig. 9.
2. Carefully remove cartridge (2) and foam pre-cleaner (1) if equipped.
3. Clean pre-cleaner (1) as described on page 11.
4. Install cartridge and foam pre-cleaner. If pre-cleaner has lip, note orientation during disassembly and re-assemble accordingly.
5. Close cover (6) and fasten screw(s) (7) securely. Tabs in cover (3) (if present) must be in slots (4) of back plate (5), Fig. 10.

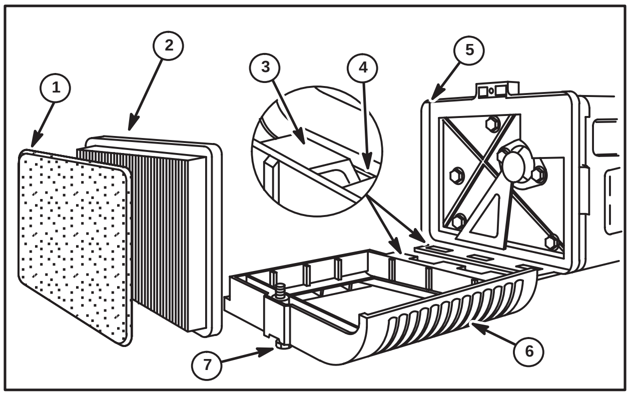


Fig. 9

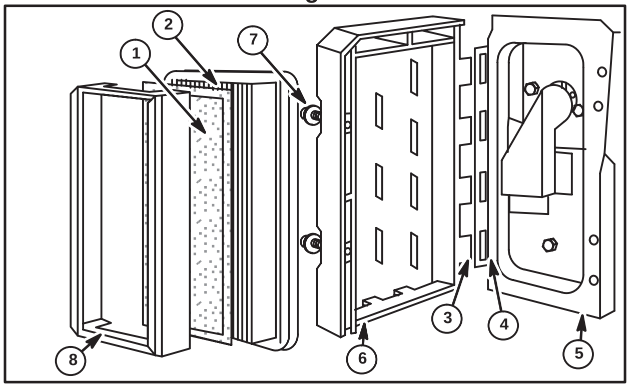


Fig. 10

Elliptical Cartridge (Fig. 11)
Remove and Install

1. Remove one or two knobs (1) or wing nuts (according to style) and air cleaner cover (2).
2. To service pre-cleaner (5) only, slide pre-cleaner off cartridge and clean as described on page 11. If servicing both pre-cleaner and cartridge (4), remove wing nuts, then pre-cleaner with cartridge together. Slide pre-cleaner from cartridge and clean both as described on page 11.
3. Slide pre-cleaner (5) on cartridge (4) and install assembly over shaft (6) on air cleaner base (7).
4. Install one or two knobs or wing nuts (according to style) and tighten securely.
5. Install air cleaner cover (2) and two knobs securely.

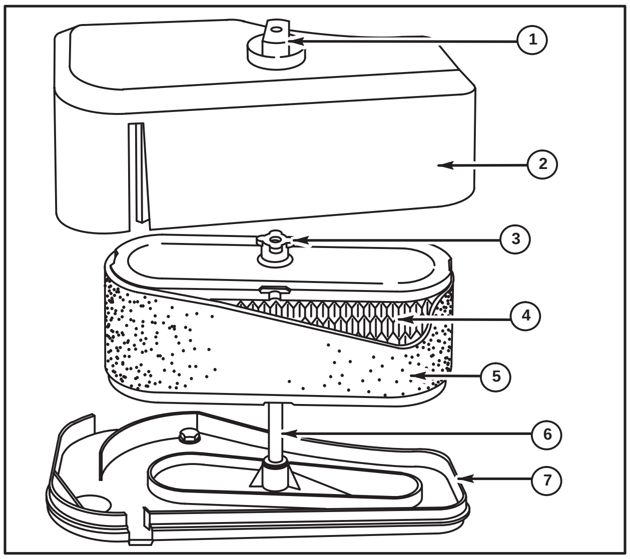


Fig. 11

OIL-FOAM® AIR CLEANER
Remove and Install (Typical, Fig. 12)

1. Remove screw or wing nut (1).
2. Remove cover (2) and air cleaner (3) carefully to prevent dirt from entering carburetor around sealing lip (4), base (5), and gasket (6).
3. Disassemble air cleaner.
4. Clean Oil-Foam® element (7), as described on page 11.
5. Reassemble air cleaner.

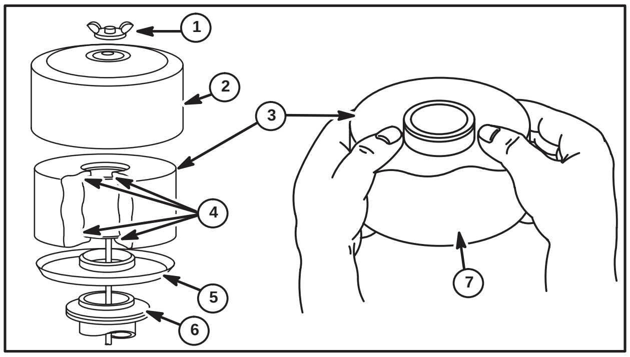


Fig. 12

1

Remove and Install Air Cleaner, Vertical Crankshaft (Typical, Fig. 13)

1. Lift latch (1) on narrow end of air cleaner cover (2) and remove cover.
2. Remove Oil-Foam® (3) from air cleaner body.
3. Clean as described on page 11.
4. Place Oil-Foam® element (3) in air cleaner body (5) making sure lip (4) of element extends over all edges of air cleaner body to form a seal.
5. Insert slot (7) on cover into tabs (6) on air cleaner body and press down to snap cover shut.

Remove and Install Oil-Foam® Air Cleaner (Typical, Figs. 14, 15, 16)

1. Remove screw(s) (1) and lift off complete air cleaner.
2. Disassemble air cleaner.
3. Clean spacer(s), element support, screen, cup (3), body (4), and cover (5), (when used).
4. Clean Oil-Foam® element (6) as described on page 11.
5. Insert element support, when used, (15), into body (4), making sure that carburetor air intake aligns with cutout in blower housing. Place Oil-Foam® element and diverter shield into body. Assemble one of the low points (2) toward narrow edge of element. Make sure that lip (7) of Oil-Foam® element extends over edge of body all the way around to assure a protective seal.
6. Install spacer(s) (12) with tangs up (if present) Fig. 15. Install screen (14), diverter shield (13), and cup (3) (when used).
7. Place cover on air cleaner assembly with screw(s).
8. Seat air cleaner gasket (8) between body (4) and carburetor and re-install air cleaner assembly on carburetor.

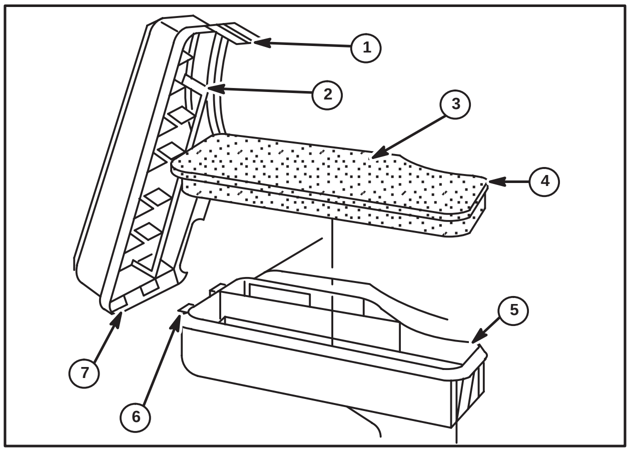


Fig. 13

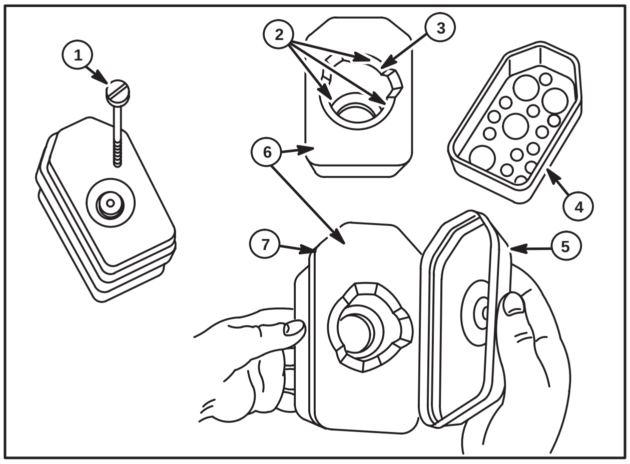


Fig. 14

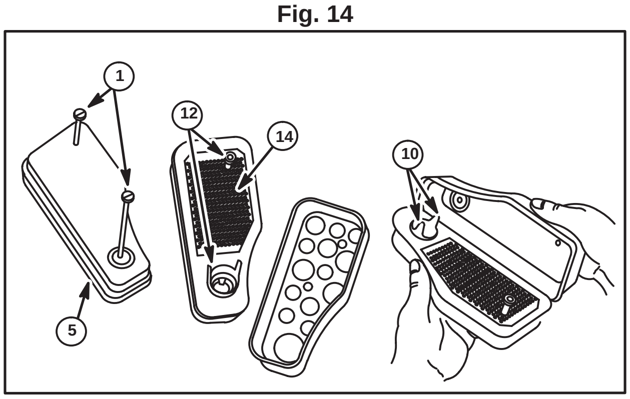


Fig. 15

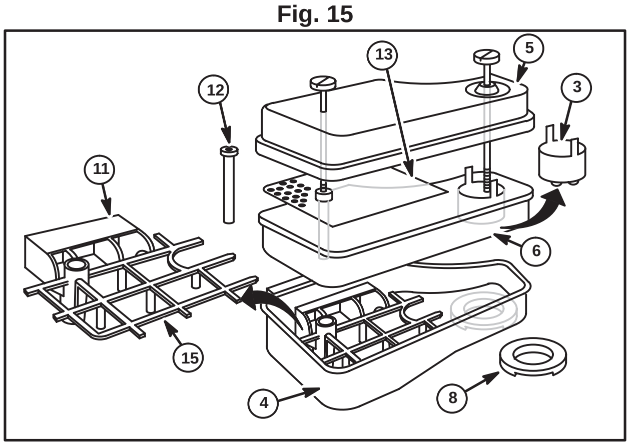


Fig. 16

CLEANING AIR CLEANER CARTRIDGE OIL-FOAM® ELEMENTS

When to Clean

CARTRIDGE only, Clean every 25 hours or once a season, whichever comes first. More often in dusty conditions.

CARTRIDGE with dry or oiled foam pre-cleaner, pre-cleaner every 25 hours and cartridge every 100 hours. More often in dusty conditions.

OIL-FOAM® ELEMENT

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

Clean Cartridge

1. Clean cartridge by tapping gently on flat surface.
2. Do not use cleaning fluids or soapy water to attempt to clean the paper cartridge. Replace dirty cartridge with genuine Briggs & Stratton part.
3. Reassemble.

CAUTION:

Petroleum solvents, such as kerosene, are not to be used to clean cartridge. They will cause deterioration of cartridge. Do not oil cartridge. DO NOT USE PRESSURIZED AIR TO CLEAN OR DRY CARTRIDGE.

Clean Oil-Foam® Element or Foam Pre-cleaner (Fig. 17)

1. WASH foam element in liquid detergent and water to remove dirt.
2. Wrap foam in cloth and squeeze dry.
3. Saturate foam with engine oil. Squeeze to remove excess oil.
   DO NOT OIL PRE-CLEANERS THAT ARE IMPRINTED "DO NOT OIL."
4. Reassemble.

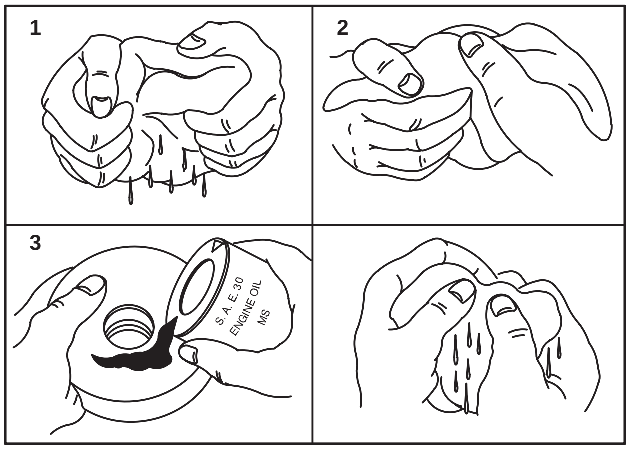


Fig. 17

1

TUNE-UP PROCEDURE

A “Tune-Up,” as listed below, would normally be performed on relatively new engines brought in for minor difficulties. Performing these steps will either assure that the engine is functioning properly or will point out necessary repairs.

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

STEP NO.

1.	Remove spark plug lead from spark plug.
2.	Remove air cleaner.
3.	Check oil level and drain. (Clean fuel tank and lines if separate from carburetor.)
4.	Remove blower housing, inspect rope and rewind assembly and starter clutch if equipped.
5.	Clean cooling fins and entire engine.
6.	Rock flywheel counterclockwise to check compression or do cylinder leakage test.
7.	Remove carburetor, disassemble and inspect for wear or damage. Wash in solvent, replace parts as necessary and assemble. Set initial adjustment.
8.	Inspect crossover tube or intake elbow for damaged gaskets.
9.	Check air vane governor blade, linkage and spring for damage or wear.
10.	Remove flywheel, check for oil seal leakage, both flywheel and PTO sides. Check flywheel key.
11.	Check armature, inspect all wires for breaks or damaged insulation. Be sure lead wires do not touch flywheel. Check stop switch and lead.
12.	Install flywheel. Time engine if necessary. Set air gap. Check for spark with #19051 or 19368 tester.
13.	Remove cylinder head, check gasket, remove spark plug, and clean carbon. Inspect valves for proper seating.
14.	Replace cylinder head. Torque to specifications, set spark plug gap or replace plugs if necessary.
15.	Replace oil and fuel, check muffler for restrictions or damage.
16.	Adjust remote control linkage and cable (if used), for correct operation.
17.	Service air cleaner. Check gaskets and element for damage.
18.	Run and adjust mixture and top speed.

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 and averting future problems. 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

WARNING

Unintentional sparking can result in fire or electric shock.

Unintentional start-up can result in entanglement, traumatic amputation, or laceration.

- Before checking compression, remove spark plug wire from spark plug and ground to engine.

There is only one accurate method of checking the sealing ability of the combustion chamber. This test uses compressed air and a leakdown test tool. Refer to Section 6, page 2, Cylinder Leakdown Test.

If compression is poor, look for:

1. Loose spark plug
2. Loose cylinder head bolts
3. Blown head gasket
4. Burned valves, valve 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

WARNING

Unintentional sparking can result in fire or electric shock.

Unintentional start-up can result in entanglement, traumatic amputation, or laceration.

WHEN TESTING FOR SPARK

- Use approved spark plug tester.
- DO NOT check for spark with spark plug removed.

Connect spark plug wire to long terminal of tester, Tool #19051 or #19368 and ground tester to engine with alligator clip. Operate starter and observe spark gap in tester. If spark jumps tester gap, you can assume ignition is good. Try a new spark plug.

If spark does not occur, look for:

1. Improperly operating interlock system
2. Shorted ground wire (when so equipped)
3. Shorted stop switch (when so equipped)
4. Armature failure
5. Worn bearings and/or shaft on flywheel side only

NOTE: If engine runs but misses during operation, a quick check to determine if ignition is at fault can be made by inserting the #19051 or #19368 tester between the ignition cable and the spark plug. A spark miss will be readily apparent.

1

1

Check Carburetion

Before making a carburetion 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 through the fuel line. On all models, inspect and adjust the mixture needles per specification. Check to see that the choke closes completely. If engine will not start, remove and inspect the spark plug.

If 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 inlet screen or check valve (Pulsa-Jet and Vacu-Jet carburetors)
3. Inlet needle stuck shut (Flo-Jet carburetors)
4. Inoperative pump (Pulsa-Jet carburetors)
5. Plugged fuel filter
6. Closed fuel tank valve

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 (1 teaspoon or 10 ml.) through the spark plug hole. Install spark plug. If the engine fires a few times and then quits, look for the same condition as for a dry plug.

Equipment-Affecting Engine Operation

Frequently, what appears to be a problem with engine operation, such as hard starting, vibration, etc., may be caused by the equipment being powered rather than the engine itself. Since many varied types of equipment are powered by Briggs & 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. Check for partially sheared flywheel key, damaged blade and hub.
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; if the unit isengaged, that it does not have a heavy parasitic load.
4. Check remote Choke-A-Matic® or speed 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. Check for partially sheared flywheel key.
2. Crankshaft bent – replace.
3. Worn blade coupling – replace if coupling allows blade to shift.
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 check 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 oversize or worn coupling can result in knocking, usually under acceleration. Check for fit, or tightness.
2. No lubricant in transmission or gear box.

YOUR KEY TO THE WORLD'S FINEST ENGINES

This 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 approximate CUBIC INCH DISPLACEMENT.

B. The first digit after the displacement indicates the BASIC DESIGN SERIES, relating to cylinder construction, ignition, general configuration, etc.

C. The second digit after the displacement indicates ORIENTATION OF CRANKSHAFT.

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.

BRIGGS & STRATTON MODEL NUMBERING SYSTEM

	FIRST DIGIT AFTER DISPLACEMENT	SECOND DIGIT AFTER DISPLACEMENT	THIRD DIGIT AFTER DISPLACEMENT	FOURTH DIGIT AFTER DISPLACEMENT
A	B	C	D	E
CUBIC INCH DISPLACEMENT	BASIC DESIGN SERIES	CRANKSHAFT ORIENTATION	PTO BEARING, REDUCTION GEAR, AUXILIARY DRIVE, LUBRICATION	TYPE OF STARTER
6	0	0 to 4 – Horizontal Shaft	0 – Plain Bearing/DU Non-Flange Mount	0 – Without Starter
8	1	5 to 9 – Vertical Shaft	1 – Plain Bearing Flange Mounting	1 – Rope Starter
9	2	A to G – Horizontal Shaft	2 – Sleeve Bearing Flange Mounting Splash Lube	2 – Rewind Starter
10	3	H to Z – Vertical Shaft	3 – Ball Bearing Flange Mounting Splash Lube	3 – Electric Starter Only 110 or 230 Volt Gear Drive
11	4		4 – Ball Bearing Flange Mounting Pressure Lubrication	4 – Electric Starter/110 or 230 Volt Gear Drive with Alternator
12	5		5 – Plain Bearing Gear Reduction (6 to 1) CCW Rotation Flange Mounting	5 – Electric Starter Only 12 or 24 Volt Gear Drive
13	6		6 – Plain Bearing Gear Reduction (2 to 1) CCW Rotation	6 – Alternator Only
16	7		7 – Plain Bearing Pressure Lubrication	7 – Electric Starter 12 or 24 Volt Gear Drive with Alternator
18	8		8 – Plain Bearing Auxiliary Drive (PTO) Perpendicular to Crankshaft	8 – Vertical Pull Starter or Side Pull Starter
19	9		9 – Plain Bearing Auxiliary Drive Parallel to Crankshaft	9 – Mechanical Starter
20	A to Z		A – Plain Bearing Pressure Lubrication Without Oil Filter	A – Electric Starter 12 or 24 Volt Gear Drive with Alternator and Inverter
21				
22				
23				
24				
25				
28				
29				
30				
31				
32				
35				
38				
40				
42				
43				
44				
46				
47				
52				
54				
58				

EXAMPLE – To identify Model 303447:

30	3	4	4	7
30 Cubic Inch	Design Series 3	Horizontal Shaft	Ball Bearing Flange Mounting Pressure Lubrication	Electric Starter 12 or 24 Volt Gear Drive with Alternator

TYPE 1234-01, The type number identifies the engines mechanical parts, color of paint, decals, governed speed, and Original Equipment Manufacturer.

CODE 01061201, The code is the manufacturing date and is read as follows:

YEAR	MONTH	DAY	ASSEMBLY LINE AND MANUFACTURING PLANT
01	06	12	01

Revised 5/03

SECTION 2
Ignition

2

Section Contents

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 15 OF THIS SECTION.

2

BRIGGS & STRATTON IGNITION SYSTEM

1. Magnetron® ignition, a self-contained transistor module (2), ignition armature, (1) and flywheel (3), Fig. 1. Inset: current style

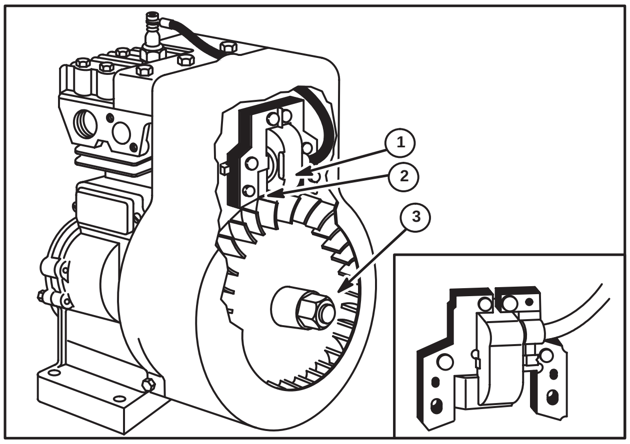


Fig. 1

CHECK IGNITION

WARNING

Unintentional sparking can result in fire or electric shock.

- Use approved spark plug tester.
- DO NOT check for spark with spark plug removed.

1. Connect spark plug wire to long terminal of Spark Tester tool #19051 (2) or #19368 (1), and ground tester to engine with alligator clip, Fig. 2.
2. Operate starter and observe spark gap in tester.
3. If spark jumps gap, ignition is good.

   NOTE: Flywheel must rotate at 350 RPM minimum on engines equipped with Magnetron® ignition.

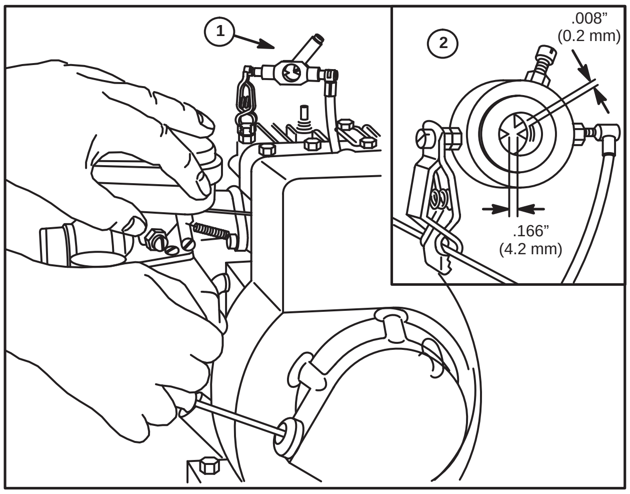


Fig. 2

If engine runs but misses during operation, a quick check can determine if the miss is ignition or not.

Check For Spark Miss

1. Place Spark Tester tool #19051 (2) or 19368 (1), in series with engine's spark plug and spark plug wire, Fig. 3.
2. Intermittent spark will be readily apparent when the engine is started and run.
3. If ignition is good, check compression and fuel system.

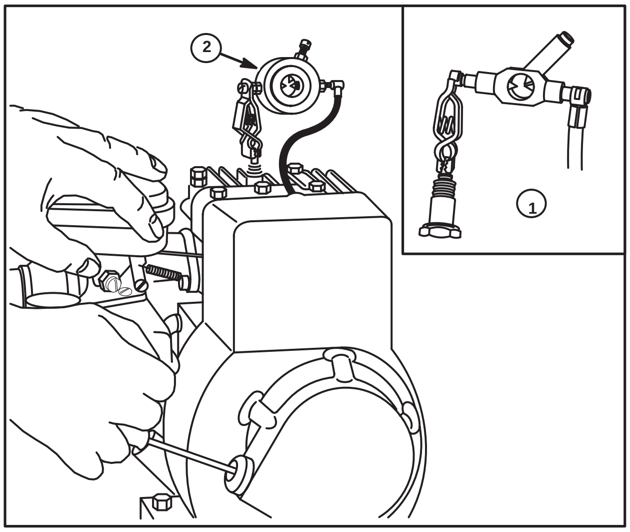


Fig. 3

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 15 OF THIS SECTION.

SPARK PLUGS

Spark Plug Service

Gap spark plug to .030” (0.76 mm) gap (1), Fig. 4. Replace spark plug if electrodes are burned away or porcelain is cracked. DO NOT USE ABRASIVE CLEANING MACHINES.

NOTE: In some areas, local law requires the use of a resistor spark plug to suppress ignition signals. If originally equipped with a resistor spark plug, use the same type of spark plug for replacement.

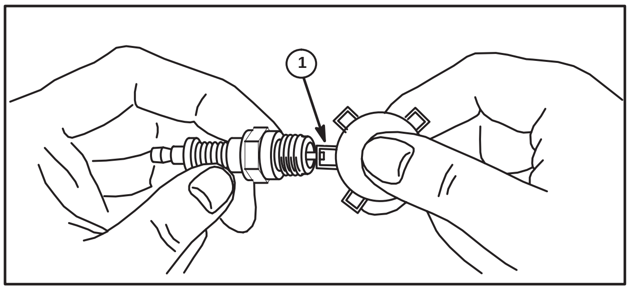


Fig. 4

REMOVE FLYWHEEL

Important: All Model Series (Except 80000, 100700, 100200, 100900, 130000 & 280000)

Specifications for flywheel torque, flywheel holders and flywheel pullers by engine model are found in Table No. 1, page 15. In all cases, use correct tools to avoid damaging flywheel fins, magnet or ring gear.

Remove Flywheel Nut or Rewind Starter Clutch (Figs. 5, 6, 7)

1. Remove blower housing and rotating screen, when so equipped.
2. Use correct flywheel holder (see Table No. 1) to keep flywheel from turning while loosening and removing flywheel nut or rewind starter clutch, depending on application. Note that Flywheel Holder #19372 can be used on all models listed. Only use Flywheel Holder #19167 (1) on flywheels smaller than 6-3/4 in. diameter or less with metal fins only.
3. Use Tool #19244, Starter Clutch Wrench (2), to remove rewind starter clutch, if so equipped. If crankshaft extension is used with starter clutch, remove it before attempting to pull flywheel.
4. Remove fan retainer or flywheel fan, if used.

NOTE: Do not use fins on magnet insert to prevent flywheel from turning.

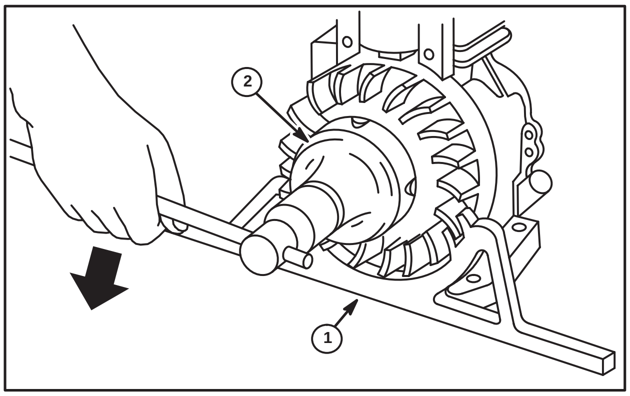


Fig. 5

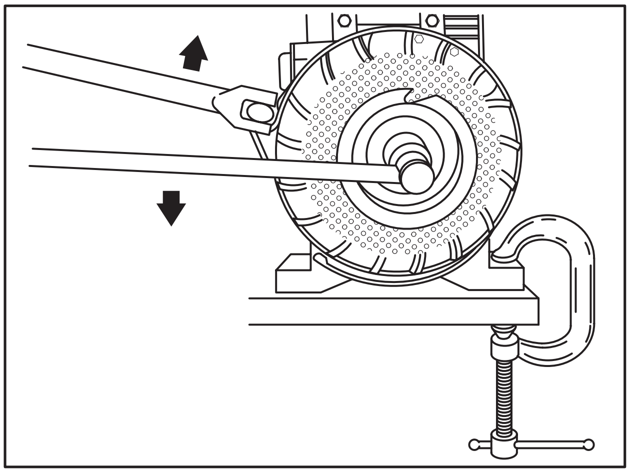


Fig. 6

2

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 15 OF THIS SECTION.

Remove Flywheel

NOTE: For Aluminum Series engines: 80000 (with cast iron flywheel), 100200, 100900, 110000 and 130000, and also for kerosene Model Series 135400, 13K400, see text.

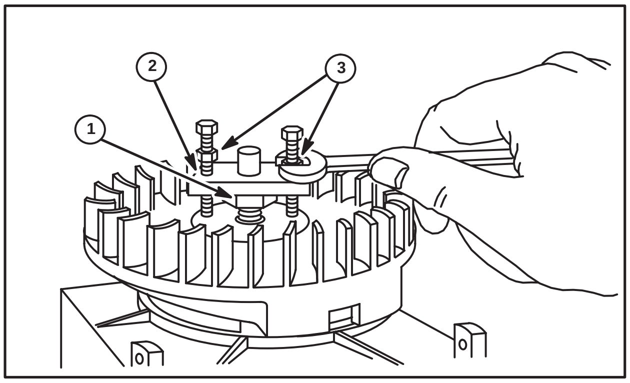


Fig. 7

1. See Table No. 1, page 15 for correct flywheel puller.
2. Use flywheel nut to protect crankshaft threads and for puller to bear against, Fig. 7.
3. Thread flywheel nut (1) onto crankshaft until top of nut is flush with crankshaft threads or slightly above end of threads.

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

4. Fasten flywheel puller to flywheel with two screws (2). Turn down two nuts (3) to loosen flywheel.

Cast Iron Flywheel
Model Series 80000, 100200, 100900, 110000, 130000

1. Support flywheel with a gloved hand or a shop rag while exerting an upward pull.
2. Strike outside rim of flywheel with a soft faced hammer using a sharp blow.
3. Several blows may be required on a tight or rusted flywheel, Fig. 8.

DO NOT STRIKE MAGNETS OR FINS.

NOTE: If puller screws on Flywheel Puller #19203 are too short, use two head bolts from Model Series 280000, Part #93723.

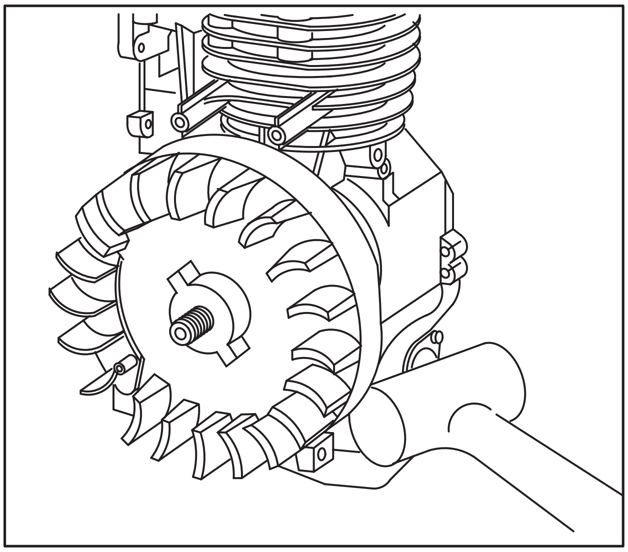


Fig. 8

Model Series 280000

1. Remove blower housing and rotationg screen, when so equipped.
2. Place Tool #19321, Flywheel Holder (1), on fan retainer with lugs of flywheel holder engaging the slots of the fan retainer, or use Tool #19372, Flywheel Holder.
3. Loosen flywheel nut, flywheel screw, or rewind starter clutch with socket and wrench or Tool #19244, Starter Clutch Wrench, and wrench, Fig. 9.

NOTE: If crankshaft extension, used with rewind starter clutch, remains in crankshaft, remove at this time.

4. Remove two screws and fan retainer. Refer to Table No. 1, Page 15 for correct flywheel puller by Model Series.

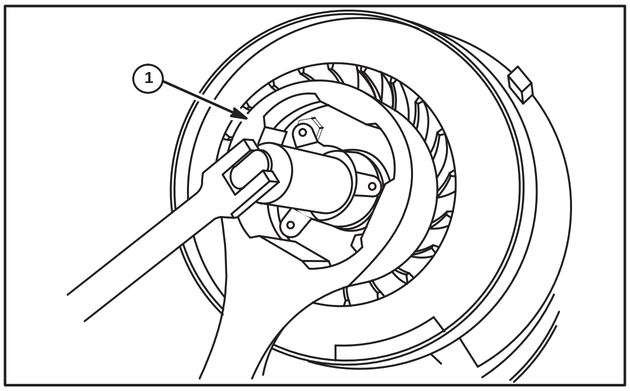


Fig. 9

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 15 OF THIS SECTION.

5. Use flywheel nut (1) to protect crankshaft threads and for puller to bear on, Fig. 10.
6. Tighten both puller screws equally until flywheel is loose.

   NOTE: If puller screws on Tool #19203, Flywheel Puller, are too short, use two head bolts from Model Series 280000, Part #93723.

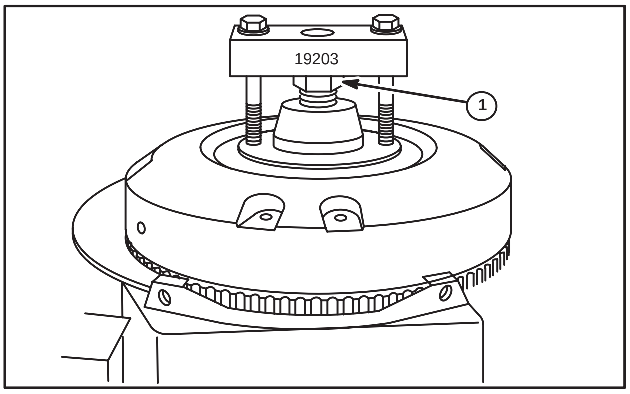


Fig. 10

INSPECT – FLYWHEEL KEY, FLYWHEEL AND CRANKSHAFT KEYWAYS

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

Install Flywheel

All Model Series

1. Clean flywheel taper and crankshaft taper of all grease, oil, and dirt.
2. Slide flywheel onto crankshaft and line up both keyways.
3. Insert flywheel key into keyway.

CAUTION
• DO NOT use a steel key under any circumstances. Use only genuine replacement flywheel keys.

Install Flywheel Nut or Rewind Starter Clutch

1. Install fan retainer or rotating screen cup (when used), then flat or Belleville washer (hollow side toward flywheel), and flywheel nut, shoulder screw, or rewind starter clutch.

   NOTE: Some Model Series 280000 engines use a crankshaft extension for the rewind starter clutch. Install as follows:

   A. Thread crankshaft extension into rewind starter clutch.
   B. Place flywheel washer on extension and thread extension and rewind starter clutch into crankshaft.
   C. Go to Step 2.

2. Use tools as listed in Table No. 1, page 15 to hold flywheel and torque nut or rewind starter clutch to specifications listed in table.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 15 OF THIS SECTION.

MAGNETRON® IGNITION SYSTEM

Identification

Magnetron® has been produced in two versions, composite Type I (Inset A), Type II (Inset B), and replaceable module (2), Fig. 11.

NOTE: Magnetron® ignition armatures used on Model Series 120000, 280000 do not have a visible trigger pole (3) and do not have a Mylar spacer (1), Fig. 11.

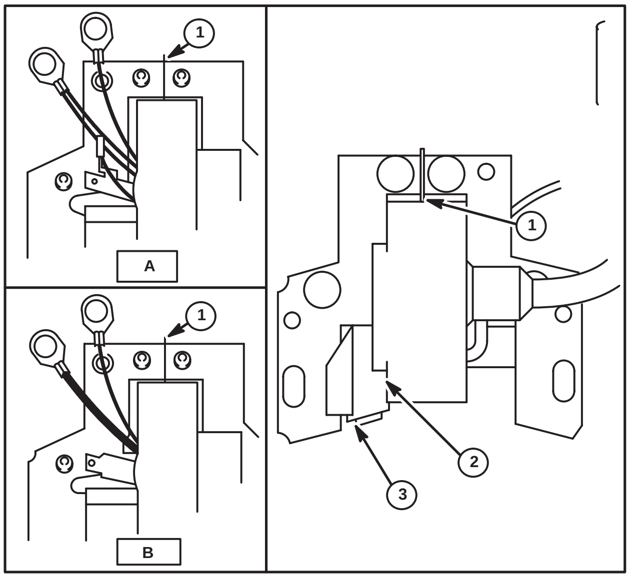


Fig. 11

Remove Magnetron® Ignition Armatures

Disconnect Stop Switch Wire

Removal of the flywheel is not required to remove Magnetron® ignition armatures.

1. Remove ignition armature mounting screws.
2. For composite armatures: Disconnect stop switch wire at spade terminal.
3. For replaceable module armatures: use breaker point condenser from #294628 point set or a 3/16 inch (4.7 mm) diameter pin punch to release wires from module, Fig. 12.
4. Unsolder stop switch wire from module wire and ignition armature primary wire (1), Fig. 12.

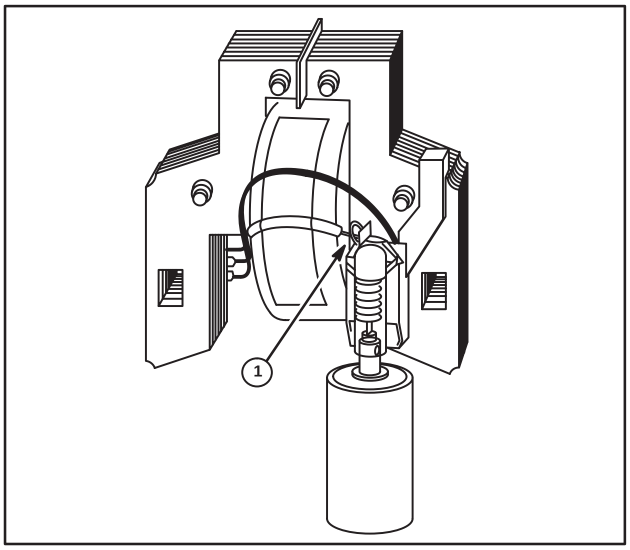


Fig. 12

Remove Magnetron® Module

1. Remove sealant and/or tape holding ignition armature wires to ignition armature.
2. Unsolder and separate remaining wires.

NOTE: On some ignition armatures, the module ground wire must be unsoldered from the armature ground wire.

3. Move all wires so module will clear ignition armature and laminations.
4. Lift module retainer (1) and push module off laminations, Fig. 13.

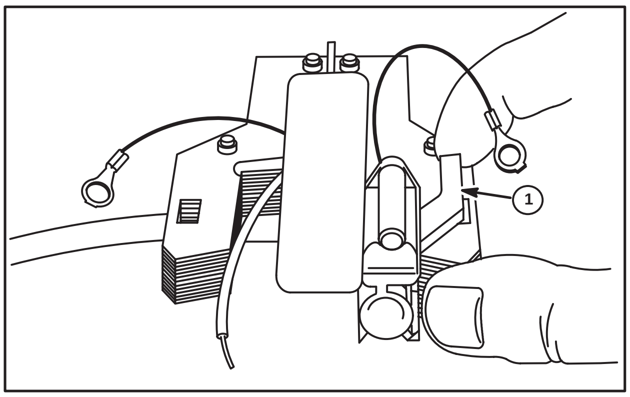


Fig. 13

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 15 OF THIS SECTION.

Install Module on Ignition Armature

Install the module with the retainer on the side of the armature with small rivet ends (1), Fig. 14.

Ignition armature ground wire (2), Fig. 14.

Ignition armature primary wire (3), Fig. 14.

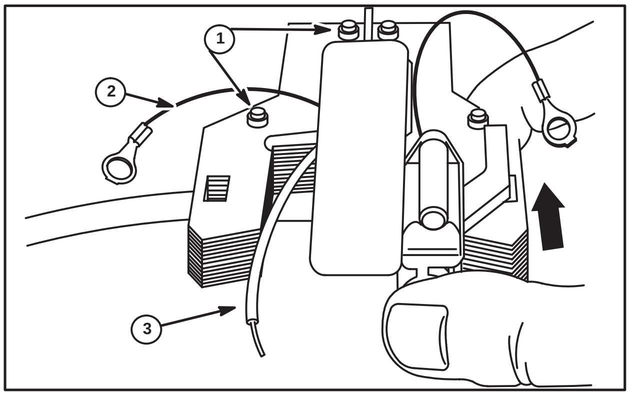


Fig. 14

Install Stop Switch and Ignition Armature Primary Wire

1. Remove all insulating material from ends of wires to ensure good contact.
2. Use a 3/16 inch (4.7 mm) diameter pin punch (5) or a condenser from point set Part #294628 to compress wire retainer spring and insert stop switch and ignition armature primary wire under hook of wire retainer, Fig. 15. Module ground lead (1), module wire (2), coil primary wire (3), wire to stop switch (ground wire) (4).

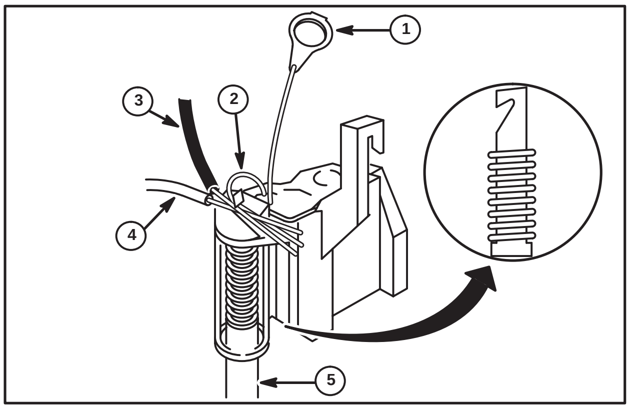


Fig. 15

3. Twist wires together and solder with 60/40 rosin core solder. **DO NOT OVERHEAT WIRES OR MODULE BODY.**
4. Install wires in module retainer.
5. Seal wires to ignition armature (1) with Permatex® No. 2 or similar sealer to prevent wires from vibrating and breaking, Fig. 16.

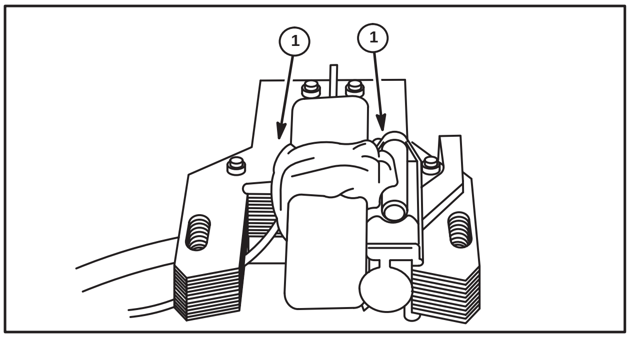


Fig. 16

Timing Magnetron® Ignition

Timing of Magnetron® ignition is solely controlled by the flywheel key on all Model Series except 230000, 240000 and 320000.

Timing Magnetron® Ignition Armature Model Series 230000, 240000, 320000

Position adjustable ignition armature bracket (1) so mounting screws are centered (2) in ignition armature bracket slots (gasoline engines), Fig. 17. Ignition armature with Magnetron® module assembly.

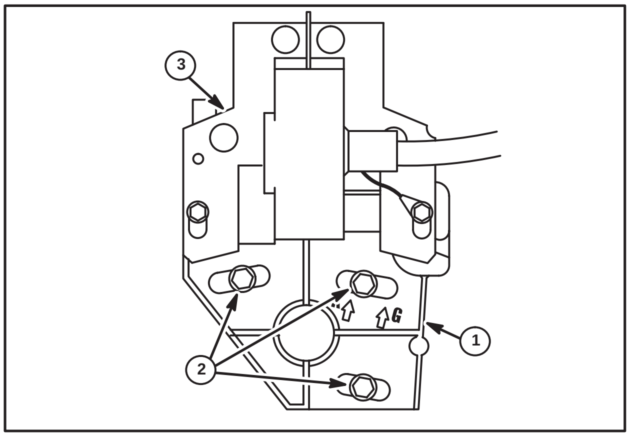


Fig. 17

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 15 OF THIS SECTION.

Timing Magnetron® Ignition Armature Model Series 32K400

Position ignition armature bracket so mounting screws are to the far left in the ignition armature bracket slots. Tighten screws.

INSTALL IGNITION ARMATURES

Pneumatic (Fig. 18) and Mechanical (Fig. 19)

1. Install ignition armature and air vane or air guide (3), when used. The mounting holes of the ignition armature are slotted.
2. Push ignition armature away from flywheel (4) as far as possible and tighten one mounting screw (1). Ignition armature coil (2).

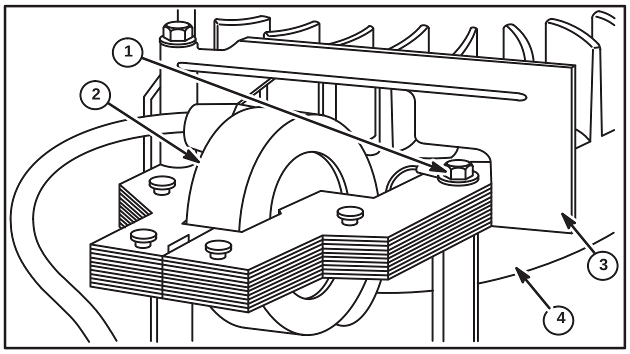


Fig. 18

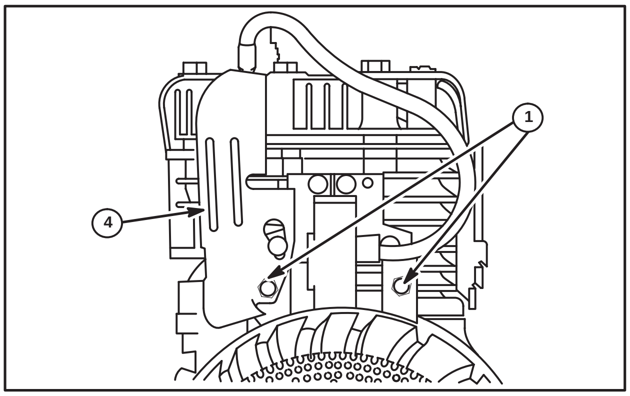


Fig. 19

Adjust Ignition Armature Air Gap

1. Ignition armature air gaps are found in Table No. 1, page 15.
2. With ignition armature away from flywheel as far as possible and one screw (2) tightened, turn flywheel so magnets (1) are away from armature legs.
3. Place the proper thickness gauge (3) between rim of flywheel and laminations of the ignition armature.
4. While holding gauge, turn flywheel until magnets are directly under legs.
5. Loosen the screw holding armature and let magnets pull ignition armature down against flywheel.
6. Tighten both mounting screws.
7. Rotate flywheel until gauge is free (4), Fig. 20.

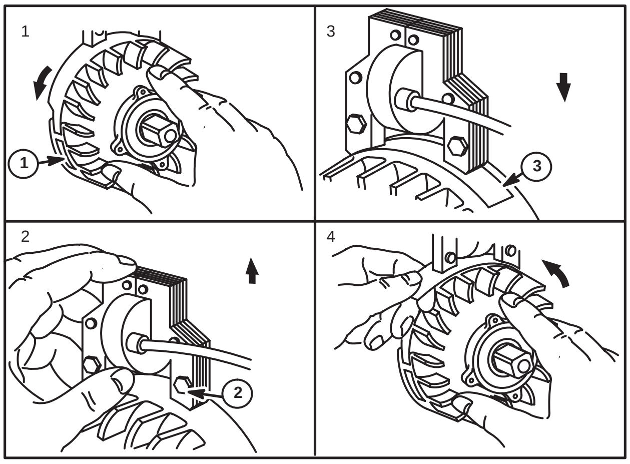


Fig. 20

STOP SWITCH IDENTIFICATION

Stationary (2), rotary (3), toggle (1), and key stop (4) switches are used to meet various equipment needs, Fig. 21.

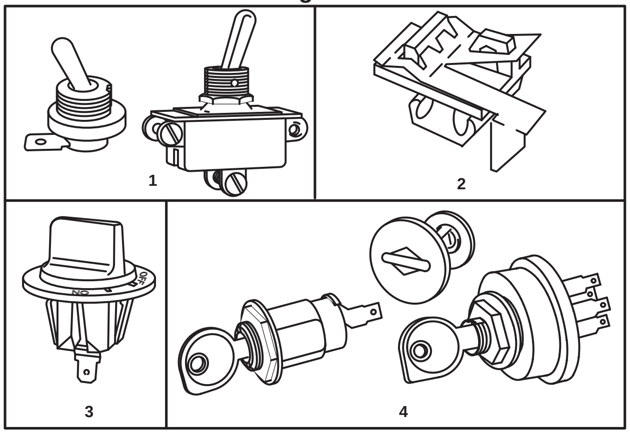


Fig. 21

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 15 OF THIS SECTION.

Stationary Stop Switch Location

Stationary stop switches are located on fuel tank brackets, governor control brackets, cylinder head brackets, System 2® and System 4® band brake control brackets, and brake shoe on Model Series 100700, 120000. Typical installation, Fig. 22.

Stop switch assembly (1), slot in bracket (2), insert stop switch into slot (3), push down until it snaps into place (4), stop switch in position (5). Reverse steps to remove.

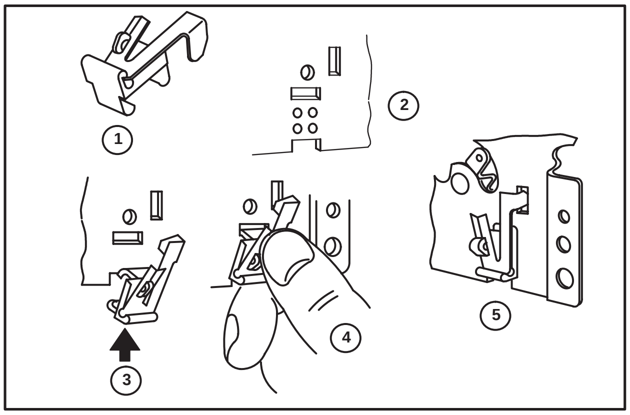


Fig. 22

Mechanical Check, Typical Control

RUN Position

Move control lever away from stop switch using safety control (1) shown on handle (2) in Fig. 23, or by moving control lever (3) at engine in direction shown in Fig. 24.
Stop switch (4)
Control bracket (5)

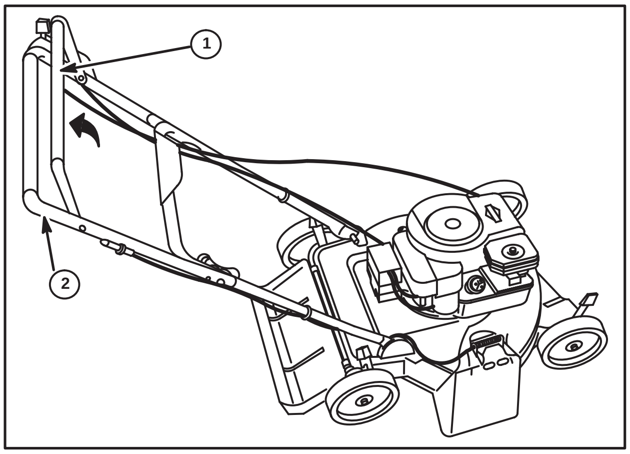


Fig. 23

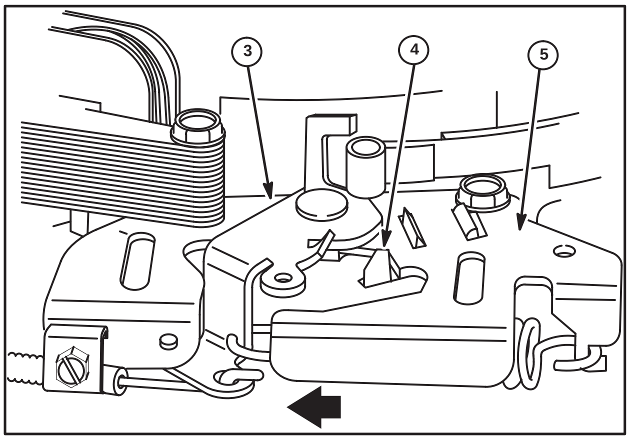


Fig. 24

1. For STOP position, release control completely. Control lever (1) at engine must contact (2) stop switch (3) at tang (5) shown in Fig. 25.
   Control bracket (4)
   Ground wire (6)
   Direction of movement (7)

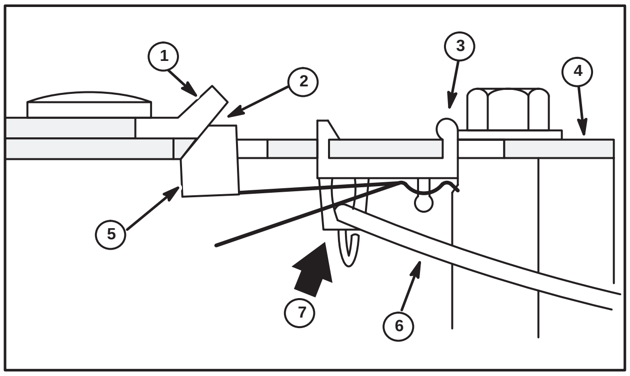


Fig. 25

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 15 OF THIS SECTION.

Stationary Stop Switch, Electrical Check

1. Push down on wire retainer and remove stop switch wire. On System 2®, System 3® and System 4® engines, the band brake control cover (2) must be removed, Figs. 26 and 27. If battery (5) is mounted on the engine, it must be removed from the battery holder before the cover can be removed. On series 100700 engines, the flywheel must be removed before the stop switch can be tested.
   Spark plug wire holding tab (3)
   Spark plug (4)
   Fig. 26

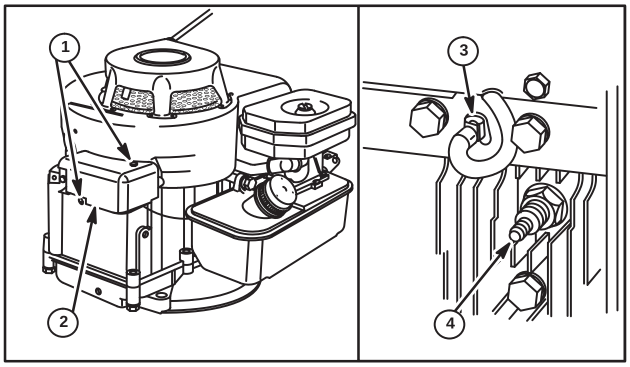


Fig. 26

2. Battery holder bolt (6), connector (7), Fig. 27.

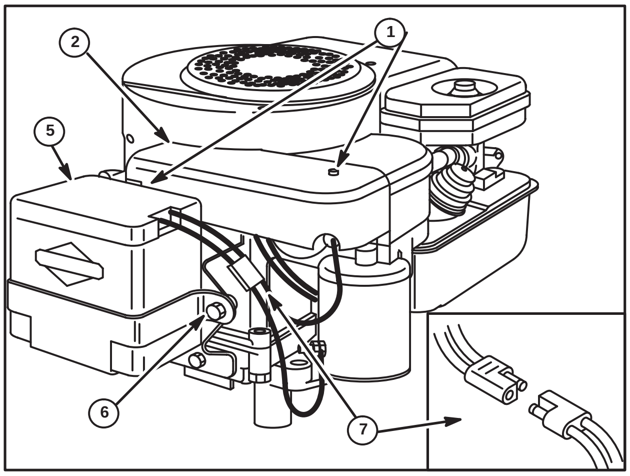


Fig. 27

WARNING
• Disconnect battery before testing.

3. Using Tool #19464, Digital Multimeter, set meter to ohms (Ω) and connect test leads to engine ground and other test lead to wire retainer. Move control lever to run position Fig. 24.

NOTE: On System 2® and System 4® engines operate safety control (operator presence control) to move control lever away from stop switch (4), Figs. 24, 28 and 29.

4. With control lever in run position, meter should show no continuity (high ohms reading).
5. Move control lever or release safety control to move control lever to stop position.
6. Meter should show continuity (low ohms reading).
7. If switch shows continuity in both run and stop positions or no continuity in both positions, replace stop switch and check stop switch wire for damage.

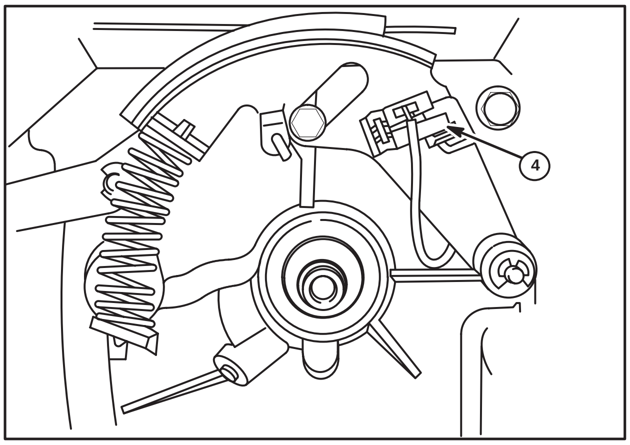


Fig. 28

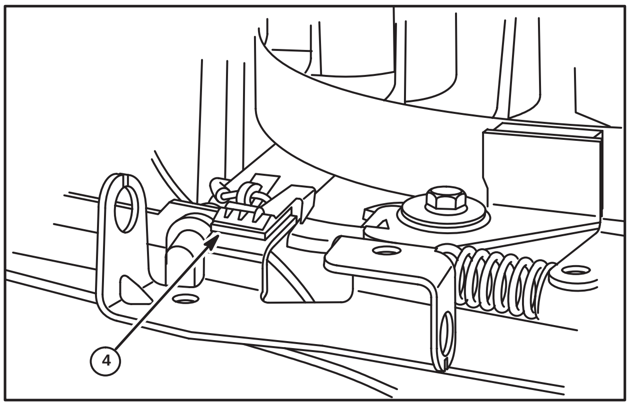


Fig. 29

Rotary, Toggle and Key Operated Stop Switch Check (Figs. 30, 31, typical)

1. Disconnect stop switch wire or wires from switch terminals. If there is more than one terminal on switch, mark wires/terminals for correct reinstallation.
2. Using Digital Multimeter set to ohms (Ω), connect one test lead to switch terminal and the other to ground. With switch “OFF” there should be continuity. With switch on “RUN”, there should be no continuity.
3. If there is no continuity in both the “OFF” and ‘‘RUN” positions, or if there is continuity in both positions, replace the switch and check the stop switch wire for damage.
4. MULTI-TERMINAL TOGGLE SWITCH: Connect test leads to either center terminal and either end terminal on same side of switch as center terminal selected. If meter shows continuity, move toggle switch to other position and the meter should read no continuity. Repeat test for other side of switch.

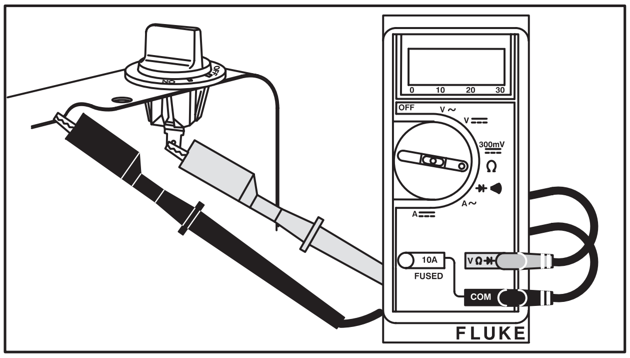


Fig. 30

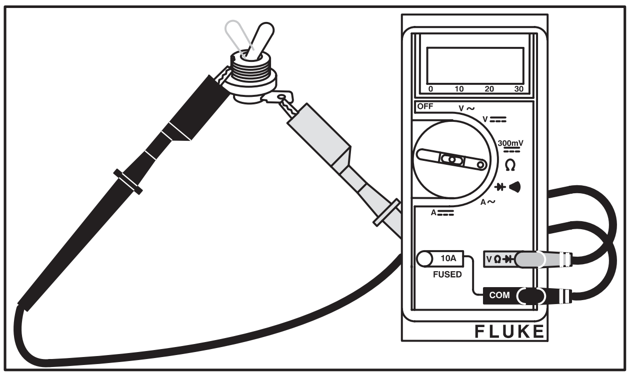


Fig. 31

2

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 15 OF THIS SECTION.

2

5. METAL KEY SWITCH – FIVE OR SIX TERMINALS: Meter must indicate continuity between terminals as noted in keyswitch positions as shown in Fig. 32.
6. SWITCH WITH PLASTIC KEY: Meter should indicate no continuity with key pushed in, and continuity with key pulled out.

Fig. 32 B – Terminal Positions: Terminal 1 grounded to switch case. Meter must also indicate continuity between terminal 1 and switch case.

Switch Position	Continuity
1. OFF	1+3+6
2. RUN	2+5+6
3. START	2+4+5

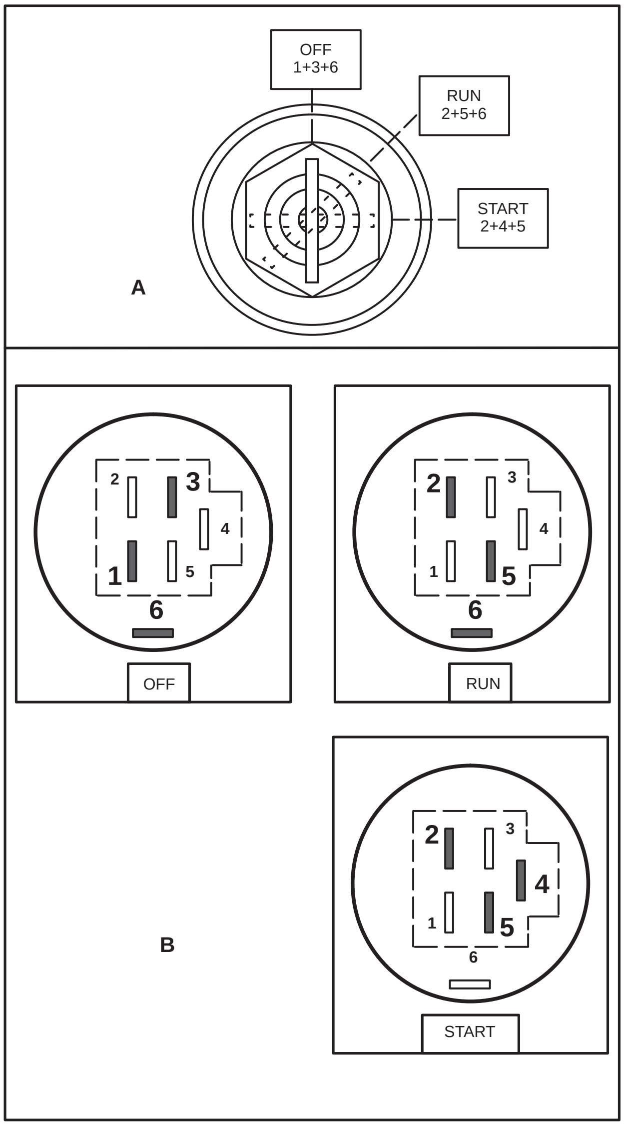


Fig. 32

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 15 OF THIS SECTION.

Check Stop Switch Wire Continuity

To test, first place control lever or safety control in run position.

1. Use a Digital Multimeter, set meter to ohms (Ω) and connect one test lead to ground (unpainted bracket or engine surface).
2. Hold other test lead against stop switch tang, Fig. 33, while moving stop switch wire up and down. **DO NOT** pull on stop switch wire.
3. Meter should read less than 1 ohm or more than 0.3 ohms during stop switch wire movement.
4. If meter reads open circuit, check for proper contact at stop switch tang (1) and engine ground.
5. Poor or no continuity requires replacing stop switch wire and/or soldering stop switch wire to ignition armature primary wire at MAGNETRON® module terminal.

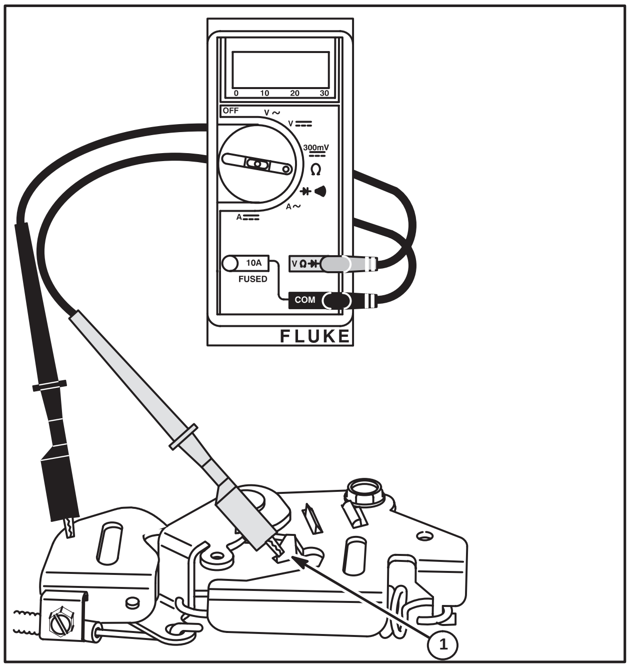


Fig. 33

Stop Switch Wire Routings – Typical

To prevent stop switch wire damage, route as shown in Fig. 34: System 2®, except Model Series 120000

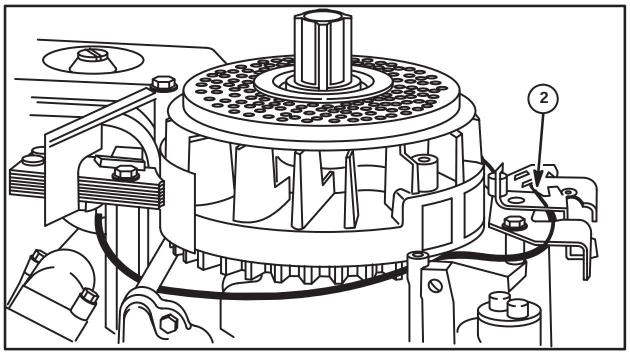


Fig. 34

Fig. 35: System 3®, System 4®, except Model Series 120000

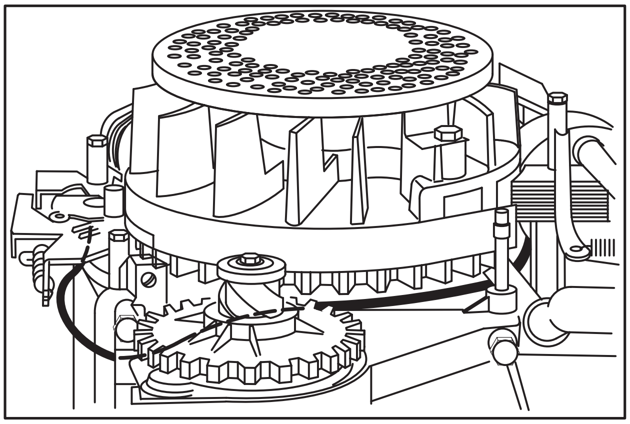


Fig. 35

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 15 OF THIS SECTION.

2

Fig 36: Model Series 100700 System 2®

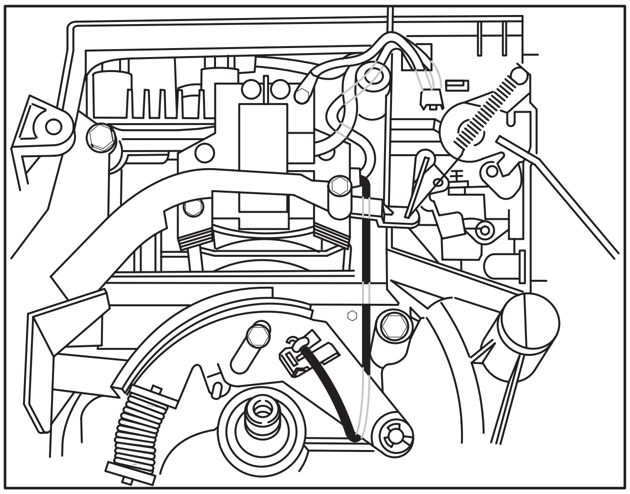


Fig. 36

Fig. 37: Model Series 120000 System 2®

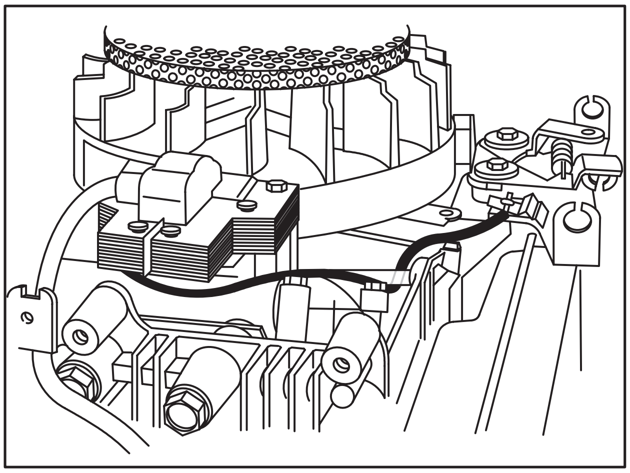


Fig. 37

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 15 OF THIS SECTION.

SPECIFICATION TABLES

TABLE NO. 1

SPECIFICATIONS FOR ALL POPULAR ENGINE MODELS

1. Spark plug gap: .030”

BASIC MODEL SERIES	IGNITION ARMATURE		FLYWHEEL PULLER TOOL NO.	FLYWHEEL HOLDER TOOL NO.	FLYWHEEL TORQUE
	TWO-LEG AIR GAP	THREE-LEG AIR GAP			
ALUMINUM CYLINDERS					
60000, 80000	.006”-.010”	.012”-.016 ”	19069	19167 or 19372	55 Ft. Lbs.♦ (75 Nm)
90000, 9K400, 10A900, 10B900, 10C900, 110000, 120000	.006”-.010”		19069	19167 or 19372	55 Ft. Lbs.♦ (75 Nm)
100700	.006”-.010”		19069	19310 or 19372	55 Ft. Lbs.♦ (75 Nm)
100200, 100900, 130000, 135400, 13K400	.010”-.014”	.012”-.016 ”	none	19372	65 Ft. Lbs.♦ (88 Nm)
170000, 190000, 19K400	.010”-.014”	.012”-.016 ”	19165	19372	75 Ft. Lbs.♦ (102 Nm)
220000, 250000*	.010”-.014”		19203●*	19372	75 Ft. Lbs.♦ (102 Nm)
280000	.010”-.014”		19203	19321 or 19372	100 Ft. Lbs.♦ (136 Nm)
CAST IRON CYLINDERS					
233400	.010”-.014”	.022”–.026”	19068 or 19203	19372	145 Ft. Lbs.♦ (197 Nm)
240000, 300000, 320000, 32K400	.010”-.014”		19068 or 19203	19372	145 Ft. Lbs.♦ (197 Nm)

♦ Use 19244 starter clutch wrench on rewind starter engines.
● Use 19203, Flywheel Puller, on Model Series 250000 built after 1975 and all Model Series 220000.
* Use 19165, Flywheel Puller, on Model Series 250000 built 1975 and before.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 15 OF THIS SECTION.

SECTION 3
Carburetion

Section Contents

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

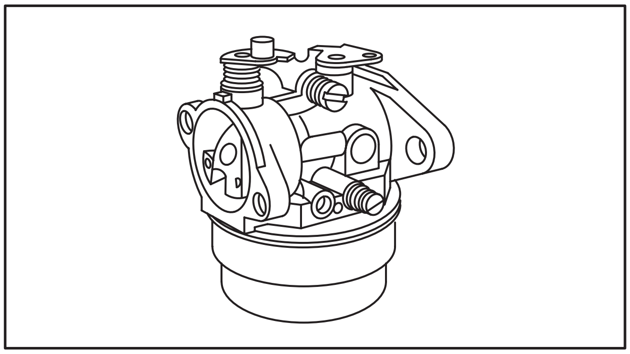
Section Contents, Cont'd.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

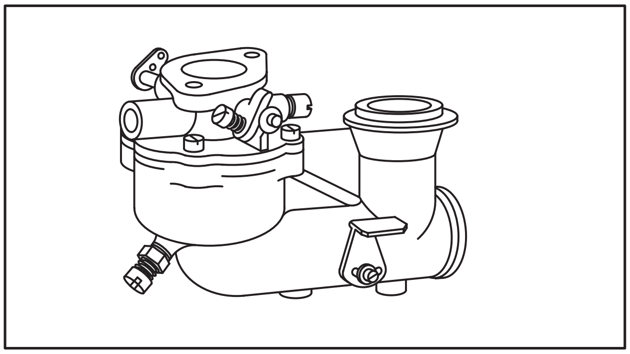
CARBURETOR IDENTIFICATION

Several styles of carburetors are used on Briggs & Stratton engines. Compare carburetor to be repaired with the following illustrations for identification. Refer to section index for location of service and repair information.

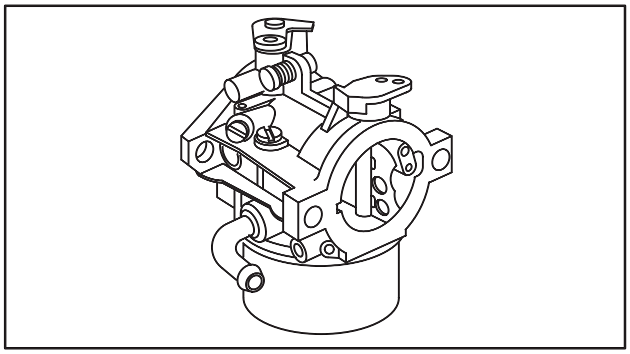
FLO-JET CARBURETORS



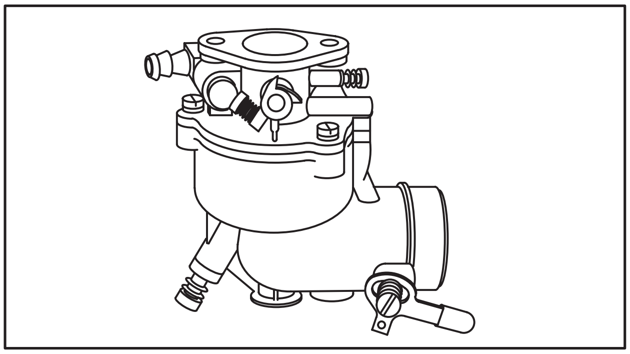
LMS



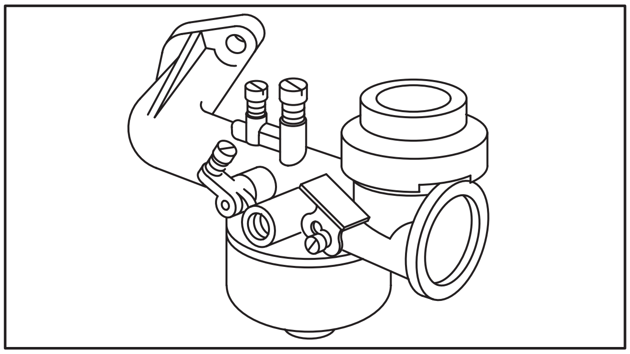
Small Two Piece



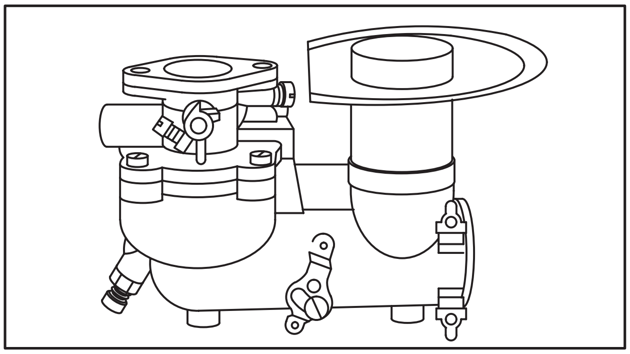
LMT



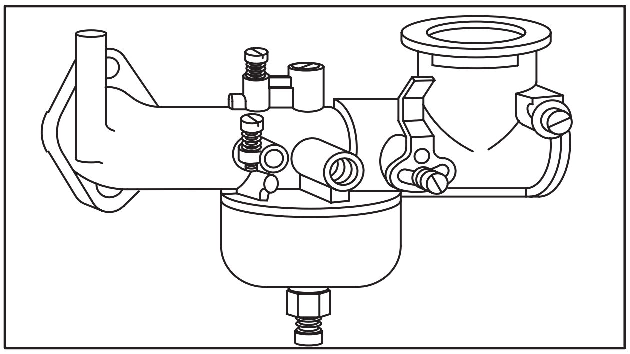
Medium Two Piece



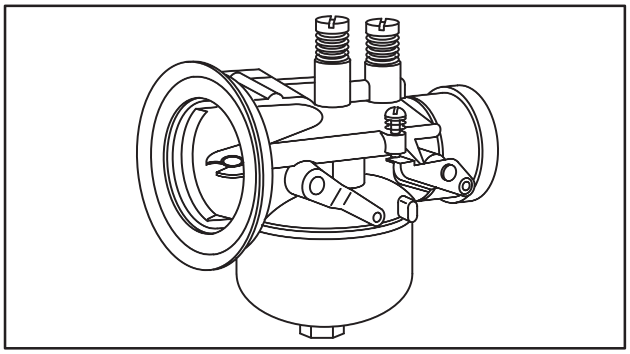
Small One Piece



Large Two Piece



Large One Piece



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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

3

TANK MOUNTED CARBURETORS, VERTICAL CRANKSHAFT:

Fig. A – Pulsa-Prime: Primer bulb (1)

Fig. B – Pulsa-Jet All Temperature/Automatic Choke: Large breather opening (1), Choke link cover (2)

Fig. C – Pulsa-Jet Automatic Choke: Small breather opening (1), Choke link cover (2)

Fig. D – Pulsa-Jet Choke-A-Matic®: Choke-A-Matic® lever

Fig. E – Vacu-Jet All Temperature/Automatic Choke: Large breather opening (1), Choke link cover (2)

Fig. F – Vacu-Jet Automatic Choke: Small breather opening (1), Choke link cover (2)

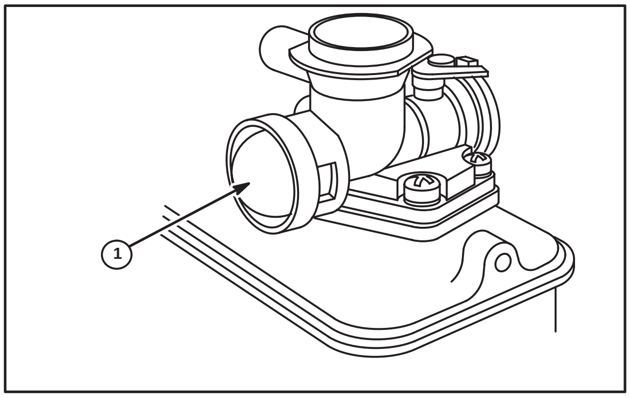


Fig. A

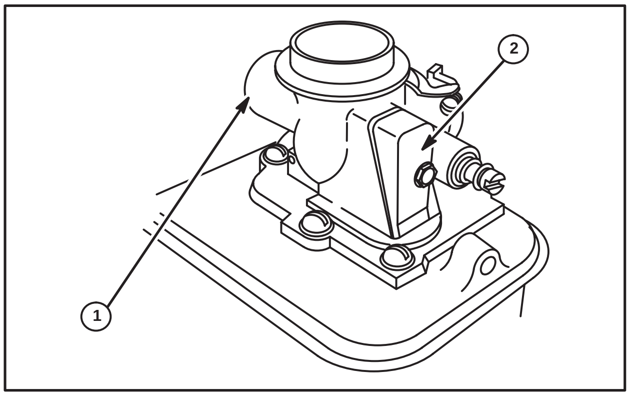


Fig. B

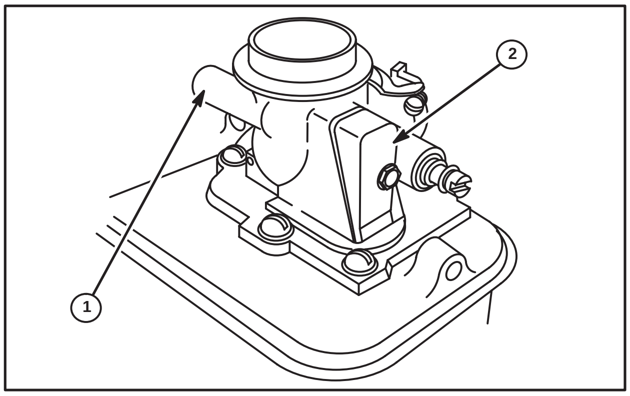


Fig. C

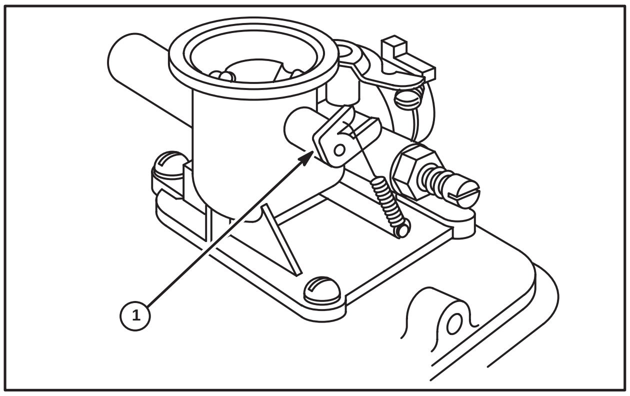


Fig. D

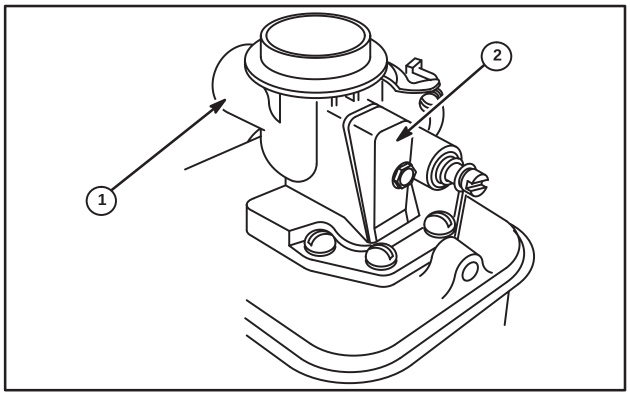


Fig. E

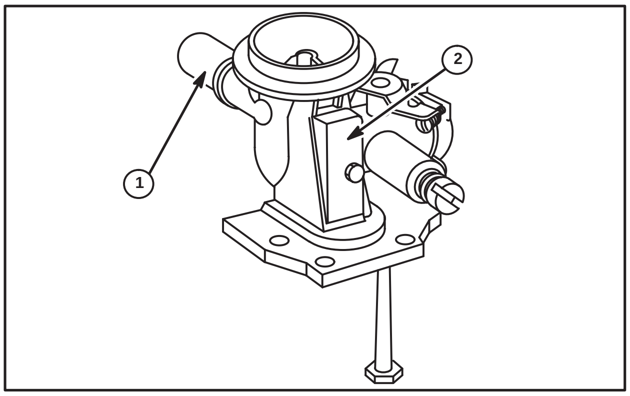


Fig. F

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

TANK MOUNTED CARBURETORS, VERTICAL CRANKSHAFT

Fig. G – Pulsa-Jet Choke-A-Matic®: Choke-A-Matic® lever.

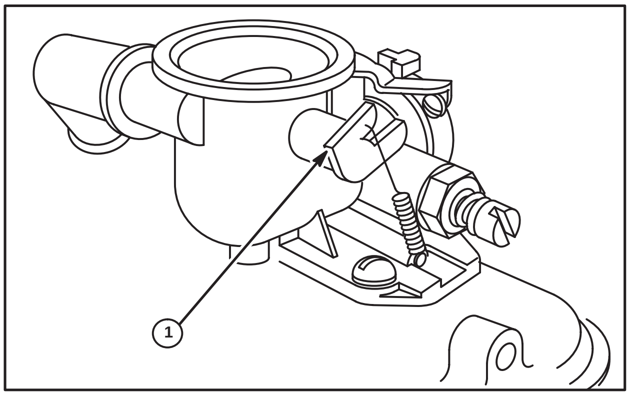


Fig. G

TANK MOUNTED CARBURETORS, HORIZONTAL CRANKSHAFT

Fig. A: Air cleaner post (1), Welch plug (2), Idle mixture adjustment needle or fixed pilot jet (3)
Fig. B: Pulsa-Jet with Rotary Choke – Rotary choke (1)
Fig. C: Pulsa-Jet, Slide Choke: Fuel pump cover (1), Slide choke (2)
Fig. D: Vacu-Jet, Slide Choke

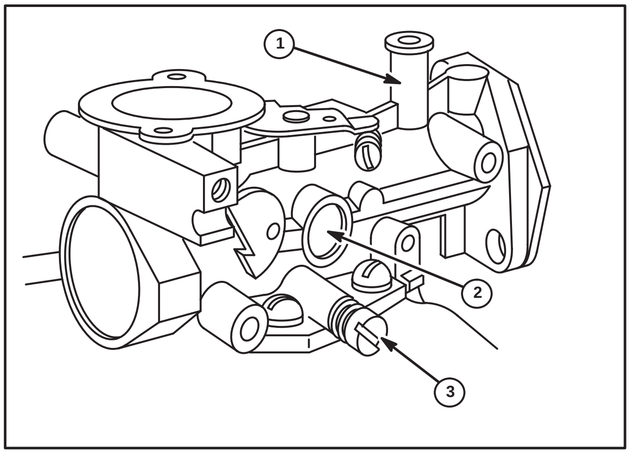


Fig. A

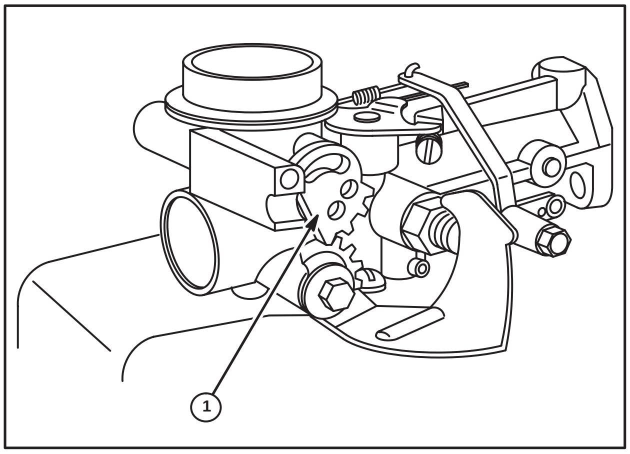


Fig. B

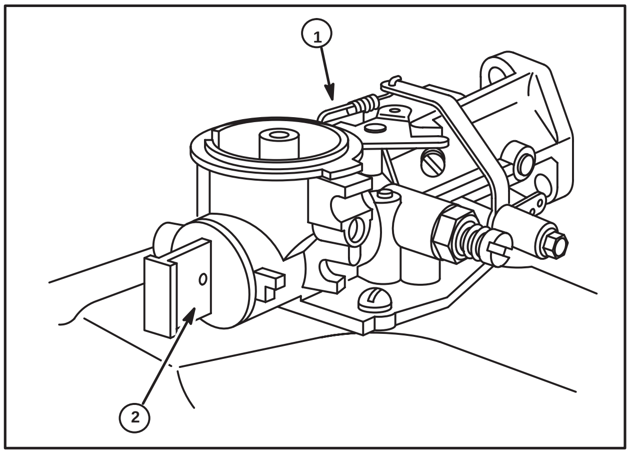


Fig. C

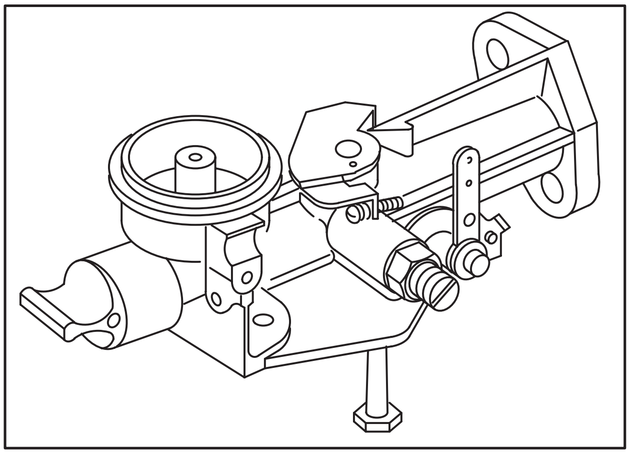


Fig. D

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

BEFORE REMOVAL OF CARBURETOR

WARNING

Gasoline and its vapors are extremely flammable and explosive.

Fire or explosion can cause severe burns or death.

- When removing the fuel hose from the carburetor on a machine without a fuel shut off, drain any fuel from the tank first.
- Do not thread a a bolt or cap screw in the removed hose end. Screw threads will damage the hose ID and rubber particles will enter the fuel system.

Note position of governor springs, governor link, remote control or other attachments to facilitate reassembly. Do not bend links or stretch springs. (See also Section 4, Governor Controls & Carburetor Linkages.)

CARBURETOR CLEANING RECOMMENDATIONS

1. Disassemble carburetor.
2. Remove all old gaskets, seals and sealing material.
3. Use commercial carburetor cleaning solvents (such as Briggs & Stratton Spray Cleaner, Part #100041 or 100042) to clean carburetor parts and body.
4. When cleaning non-metallic parts (plastic, nylon, Minlon™, etc.), do not leave in commercial carburetor cleaner bath more than 15 minutes.

NOTE: Parts containing rubber, such as seals, "O" rings or pump diaphragms should never be placed in commercial carburetor cleaner bath.

5. Use only compressed air (blowing in both directions) to clean out all openings and passages.

NOTE: Do not use wires, drills or any other devices to clean out metering holes or passages.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

TANK MOUNTED CARBURETORS – VERTICAL CRANKSHAFT ENGINES

Pulsa-Prime
Model Series 9B900, 9C900, 9D900, 93900, 95900, 96900, 10A900, 10B900, 10C900

Remove Carburetor and Tank Assembly (Figs. 1 & 2)

1. Remove fuel tank mounting bolts (1), Fig. 1.

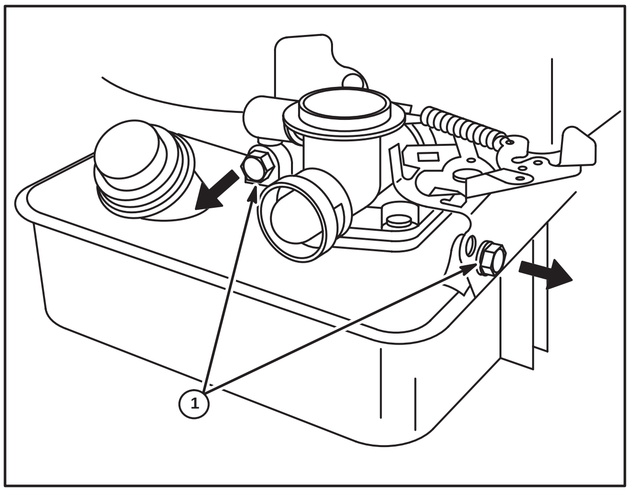


Fig. 1

2. Slip carburetor and fuel tank assembly off fuel intake tube (3).
3. Turn assembly to free throttle link from throttle lever (1).
4. This procedure leaves governor link (2) and governor spring connected to governor blade and control lever (4), Fig. 2.

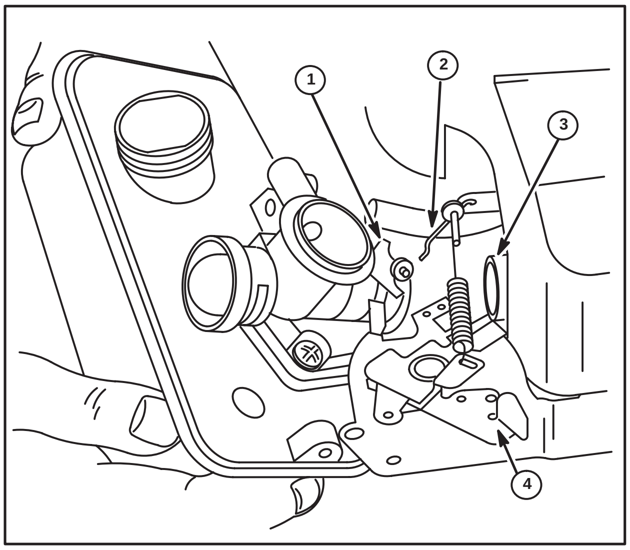


Fig. 2

Fig. 3 – Remove Carburetor from Fuel Tank

1. Remove five screws holding carburetor (1) to tank.
2. Remove carburetor, diaphragm and gasket (2) from tank, Fig. 3.

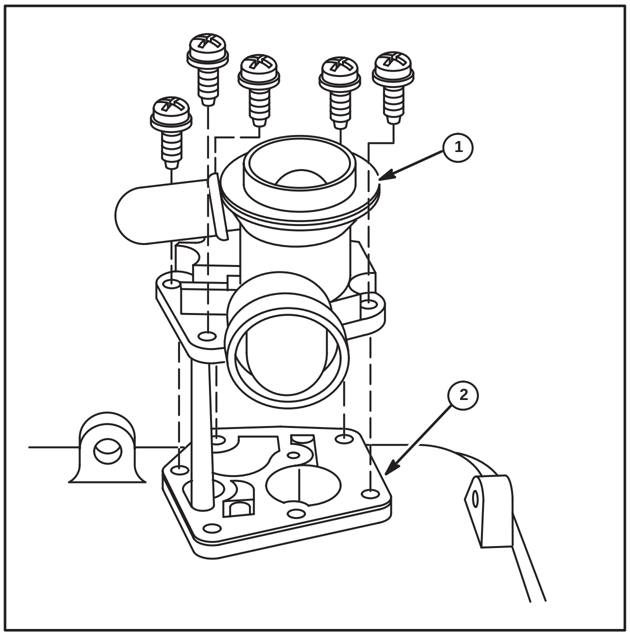


Fig. 3

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Install Primer, Disassemble Carburetor

1. Slide jet screen off carburetor body. Fixed main jet is not a service part.
2. Press in from both sides of primer bulb cavity to release retainer tabs (inset 4).
3. Pry retainer out and remove primer bulb from primer seat groove (3).
4. Remove primer seat using a crochet hook or other type of hook. Ball (2) and spring (1) will fall out, Fig. 4.
5. Remove intake tube “O” ring from carburetor.

NOTE: Do not stretch, bend or compress primer spring.

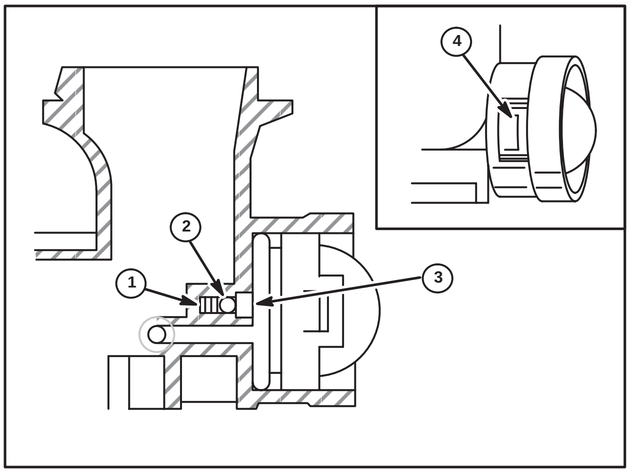


Fig. 4

Remove Throttle Plate and Shaft

1. Rotate throttle shaft lever to wide open throttle position.
2. With a needle nose pliers, grasp center of throttle plate and pull out of throttle shaft carefully.
3. Remove throttle shaft and foam dust seal.

Remove Fuel Pick-Up Tube (Fig. 5)

Pick-up tube (1) on Pulsa-Prime carburetor is the snap-in design. Pipe requires considerable force to snap out, Fig. 5.

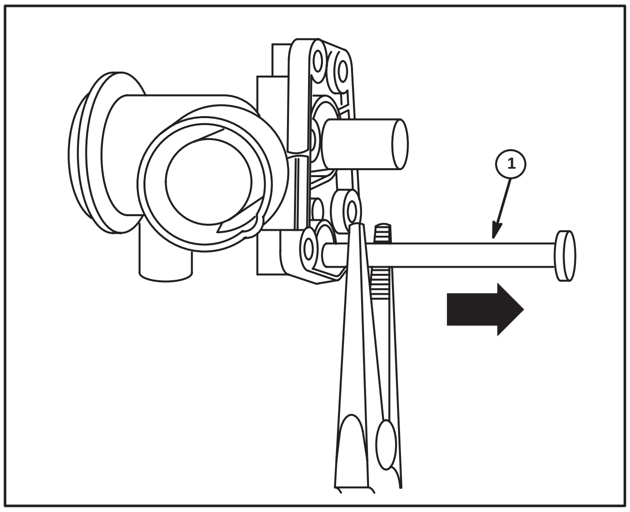


Fig. 5

INSPECTION

Inspect jet screen for clogging, varnish deposits, and damage to screen. Thoroughly clean or replace components if necessary. Inspect throttle shaft and throttle shaft bearing for excessive wear. Replace throttle shaft and/or carburetor body if required. Inspect diaphragm for holes, tears or curled fuel valves. Replace if necessary.

High Altitude Compensation

NOTE: If engine is operated at high altitudes, performance may decrease. If poor performance is experienced remove main air bleed jet (1), Fig. 6.

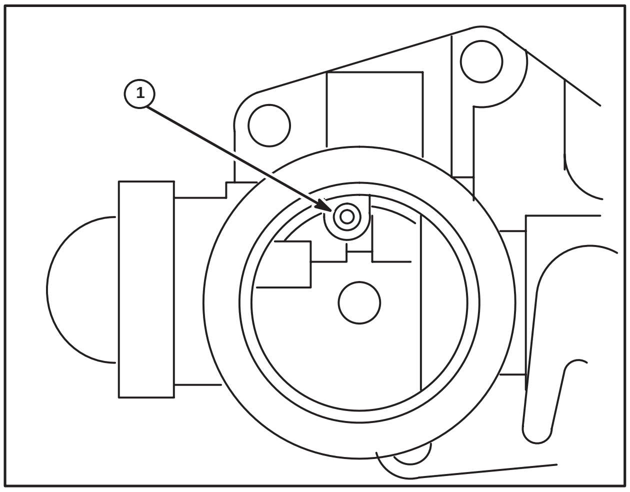


Fig. 6

Assemble Carburetor

1. Place primer spring and ball in primer valve bore.
2. Press primer seat into bore with groove on seat facing out, Fig. 4.
3. Insert primer bulb into retainer and moisten inside diameter of primer bulb.
4. Press into primer cavity lining up locking tabs with locking slot in cavity.
5. Press until both tabs are seated in locking slots.

Install Fuel Pick-Up Tube (Fig. 7)

Insert pick-up tube (1) in carburetor body. Place screen squarely on a hard surface. Push firmly on carburetor with palm of hand. Tube may require considerable force to snap into place, Fig. 7.

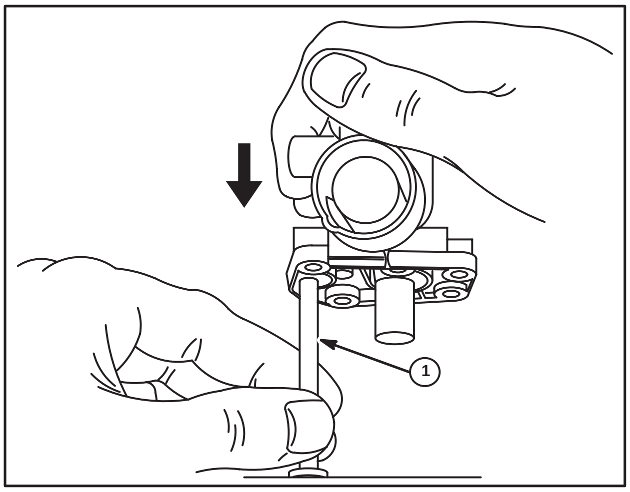


Fig. 7

Install Throttle Shaft and Plate (Fig. 8)

1. Insert throttle shaft and new foam dust seal into carburetor body.
2. Insert throttle plate into throttle shaft with single dimple in first. Push until two dimples contact shaft.
3. Rotate shaft and plate to check for freedom of movement and to center plate in shaft.
4. Slide jet screen (2) onto main jet tube and place fuel pump spring (1) on spring boss, Fig. 8.

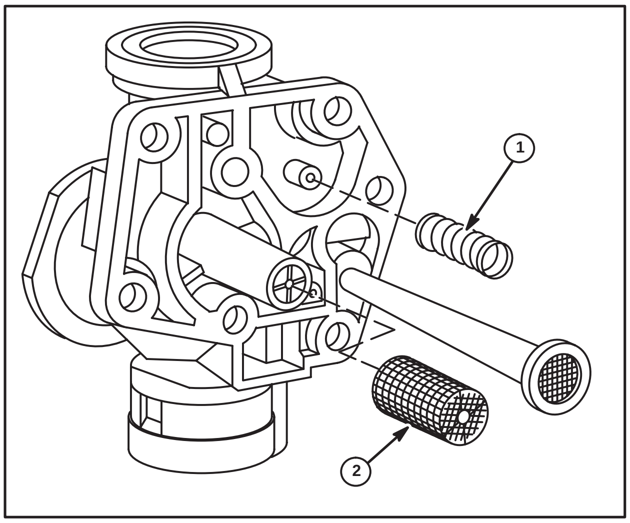


Fig. 8

Install Carburetor to Fuel Tank

1. Place new diaphragm on tank top and new gasket on top of diaphragm (2), Fig. 3.
2. Lower carburetor assembly down onto gasket and diaphragm.
3. Install five screws (1) and tighten, Fig. 3.

Screw Tightening Sequence (Fig. 9)

1. During routine service and to assure that the Pulsa-Prime carburetor diaphragm seals properly, it is recommended that the carburetor mounting screws be tightened in the following sequence, Fig. 9. While tightening screws, be sure that throttle shaft is held in wide open position.
2. After screws are tightened to 15 in. lbs. (2 Nm), push down on throttle shaft and rotate shaft to closed throttle position. This will properly position the throttle plate.

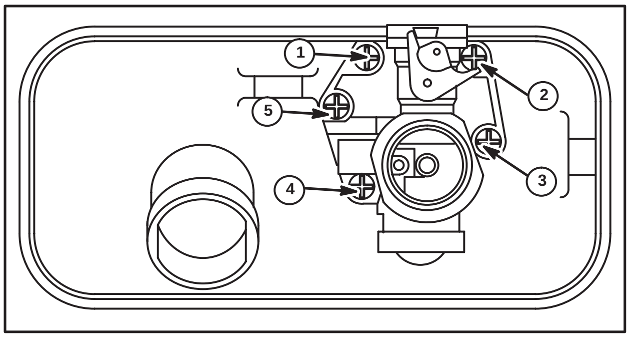


Fig. 9

Assemble Carburetor and Fuel Tank to Engine

1. Insert throttle link into throttle lever and rotate carburetor and fuel tank assembly.
2. Install “O” ring in carburetor intake opening and oil “O” ring.
3. Slide carburetor onto intake tube until fuel tank mounting boss is lined up. Insert breather tube into breather grommet.
4. Install and tighten mounting screws securely, Fig. 1.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Pulsa-Jet Carburetors
Model Series 92900, 94900, 110900, 112900, 113900, 114900

Vacu-Jet Carburetors
Model Series 92500, 93500, 94500, 95500

NOTE: Pulsa-Jet and Vacu-Jet carburetors for vertical crankshaft models are combined in this section. Issues specific to individual models or types will be noted in the text and corresponding illustrations.

3

Carburetor Types (Fig. 10)

There are three basic types of Pulsa-Jet and Vacu-Jet carburetors used on above series engines. They are (1) All-Temperature/Automatic Choke, (2) Automatic Choke, and (3) Choke-A-Matic®, Fig. 10.

All-Temperature/Automatic Choke Operation

The All-Temperature/Automatic Choke carburetor is equipped with a bimetal spring, (inside cavity), (3) which compensates for temperature and regulates automatic choke action. The bimetal spring reacts to crankcase air temperature via breather tube (1), attached to rubber elbow (2), Figs. 11 and 12.

Inspect bimetal spring cavity where indicated (4) for damage or debris, Fig. 12.

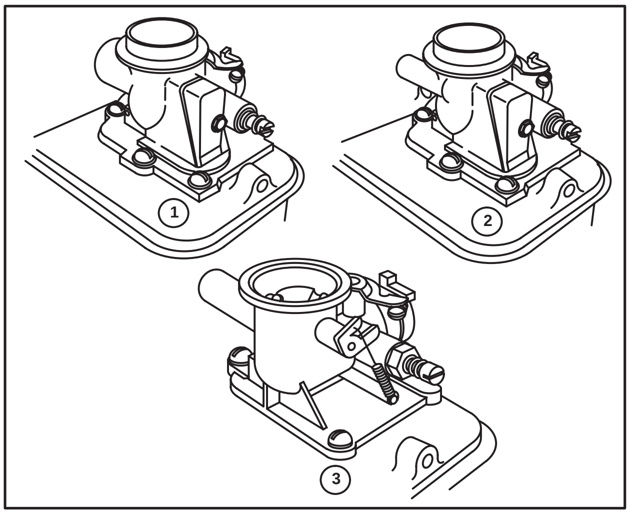


Fig. 10

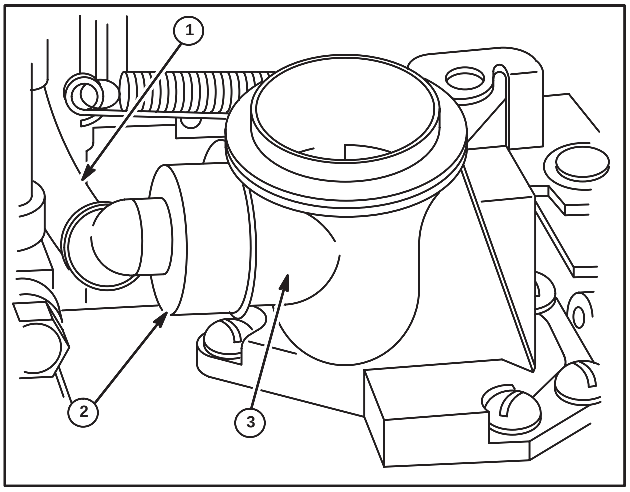


Fig. 11

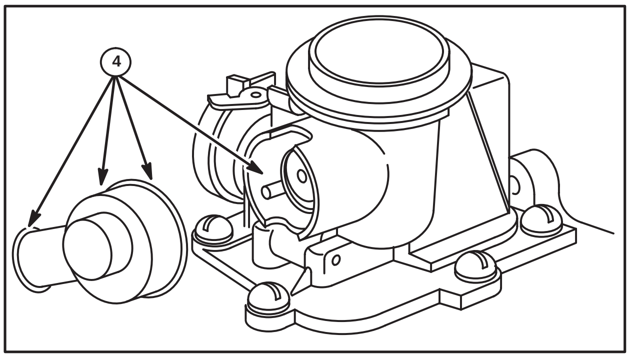


Fig. 12

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Automatic Choke Operation (Fig. 13)

A diaphragm under the carburetor (3) is connected to choke shaft by a link (2), Fig. 13. A calibrated spring under diaphragm holds choke plate (1) closed when engine is not running.

When running, vacuum created during intake stroke is routed to the bottom of the diaphragm, through a calibrated passage, opening choke against spring pressure.

Also, as speed decreases during heavy loads, the choke plate partially closes, enriching the mixture, improving low speed performance and lugging power.

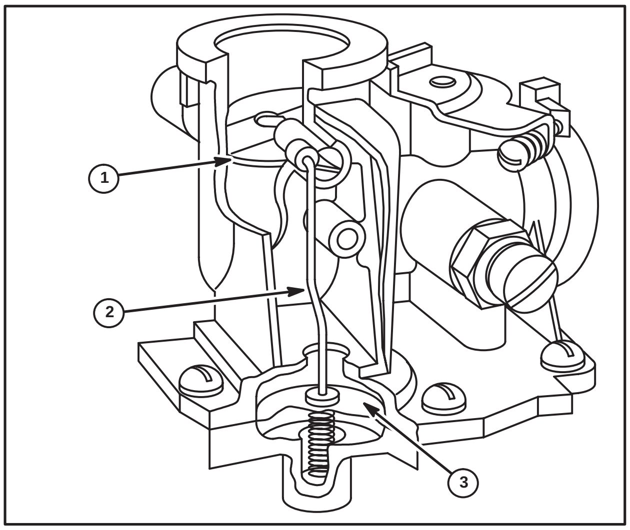


Fig. 13

Check All-Temperature/Automatic Choke

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

1. Remove air cleaner and replace stud. Observe position of choke plate; it should be fully closed.
2. Move speed control to stop position; governor spring should be holding throttle in a closed position. Pull starter rope rapidly. Choke plate should alternately open and close.
3. If engine can be started, run for two or three minutes, at normal operating speed. Check to be sure fuel tank is 1/4 full of fuel. Close needle valve to be sure mixture can be made too lean. Adjust needle valve 3/8 turn open from lean position.

Allow engine to run at idle speed for three to five minutes. Again, close needle valve; engine should stop. If engine continues to run at idle with needle valve closed, a fuel leak is occurring in one of the following areas: Check items 2D, 2H, 2I, 2J and 2K.

If choke plate does not react as stated in Steps 1, 2, and 3, carburetor will have to be disassembled to determine problem.

The following list is given to aid you in checking performance of All-Temperature/Automatic Choke and automatic choke carburetion systems.

1. Engine Appears to be Under-Choked:
   a. Carburetor adjusted too lean
   b. Bent air cleaner stud
   c. Sticking choke shaft due to dirt, etc.
   d. Choke spring damaged or too short
   e. Diaphragm not pre-loaded
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
   k. Needle valve seat loose

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

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

NOTE: A heavy, high-inertia disc type cutter blade rotates for a longer period of time, after governor control is placed in "STOP" position. During this "coasting" period, engine continues to induct fuel-air mixture, even when choke is open.

If carburetor mixture is too rich, warm engine may flood and become hard starting. If original carburetor adjustment has not been changed, turn needle valve clockwise (leaner) approximately 1/8 turn. If original carburetor adjustment has been changed, check previous list, this page, paragraph No. 2-A, B and C, then adjust 1/8 turn leaner.

Remove Carburetor and Fuel Tank Pneumatic Governor (Figs. 14 & 15)

1. Remove fuel tank mounting bolts.
2. Slip carburetor and fuel tank assembly off end of fuel intake tube and turn assembly to free throttle link from throttle lever.
3. This will leave governor link (1) and governor spring connected to governor blade and control lever (2), Fig. 14.

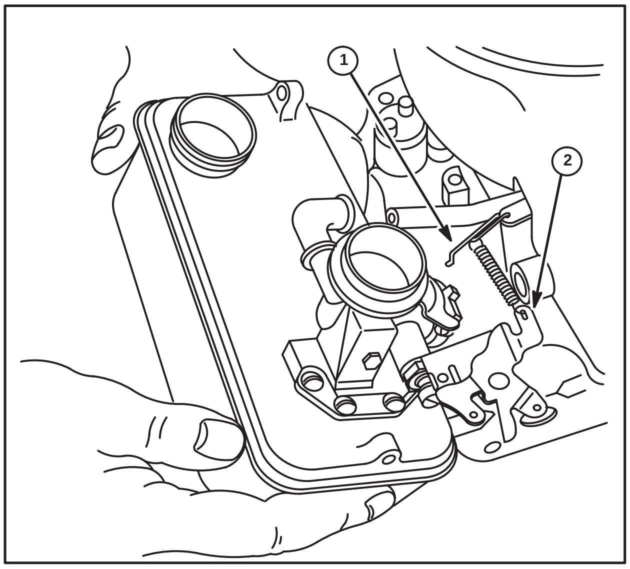


Fig. 14

Mechanical Governor Model Series 92900, 94000, 95000, 112900, 113900 (Except Type Number 2999), 114900

1. Disconnect governor spring from control lever.
2. Slide carburetor and fuel tank assembly off end of fuel intake tube and turn assembly to disconnect governor link (1) from bell crank lever.
3. This will leave governor spring and bell crank assembly on carburetor and fuel tank assembly, Fig. 15.

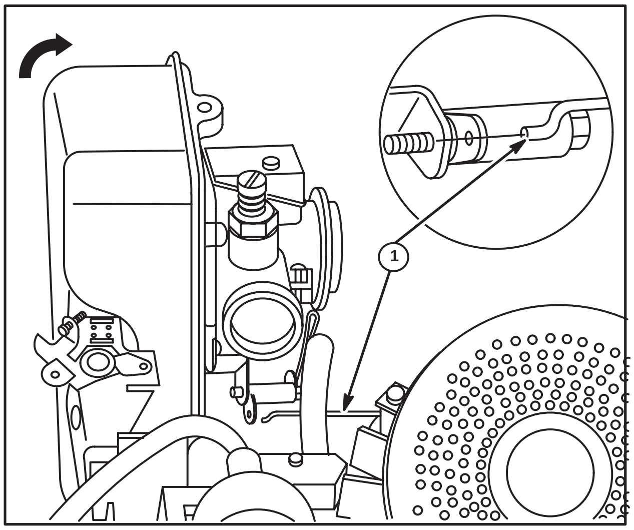


Fig. 15

Removing Carburetor Model Series 100900, 113900 Type #2999, 130900, 131900, 132900, Vertical Crankshaft

1. Disconnect stop switch wire and governor spring.
2. Remove two cylinder head bolts or studs and rear tank mounting screw.

NOTE: Model Series 113900 Type #2999 has a stud (at lower rear of fuel tank) and a mounting screw (at top of fuel tank between carburetor and fuel cap).

3. Slip carburetor over notch in cylinder shield (4) and away from intake manifold (5), and seal (3), Fig. 16. Rotate carburetor and tank assembly to disconnect governor link (2) from throttle lever (1).

NOTE: On some models, it may be necessary to remove blower housing.

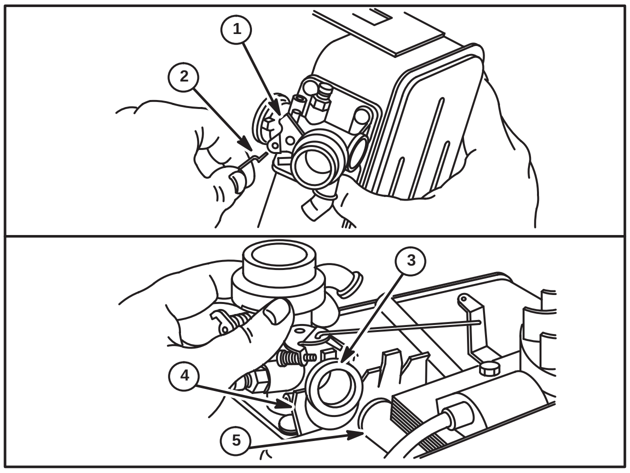


Fig. 16

Remove Carburetor from Fuel Tank Model Series 92000, 93000, 94000, 95000, 96000, 110900, 111900, 112900, 113900 (Except Type Number 2999), 114900

1. Remove screws holding carburetor on tank body.

NOTE: On Model Series 110900, 111900, 113900 (except Type #2999), and 114900 a mounting screw may be located under choke plate. To gain access to screw, open choke plate completely. Use a #2 Phillips head screwdriver to remove screw, Fig. 17.

NOTE: On Model Series 100900, 130900, 131900 and 132900, the Choke-A-Matic® valve lever is operated by the carburetor control plate. Removing the plate is all that is required.

2. Lift carburetor straight up.
3. Remove pump spring, spring cup (when used) and diaphragm.

Model Series 113900, Type #2999

1. Remove three screws holding carburetor to fuel tank.
2. Remove choke lever and choke lever bracket.
3. Disconnect breather tube and grommet from carburetor.
4. Lift carburetor straight up from fuel tank. Remove and discard fuel tank gasket.

Model Series 92500, 93500, 94500, 95500

1. Remove screws holding carburetor on tank body.
2. Lift carburetor straight up.
3. Remove diaphragm.

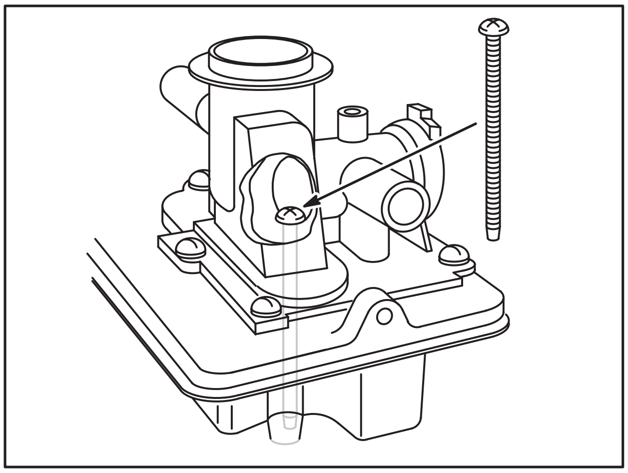


Fig. 17

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Disassemble Pulsa-Jet, Vacu-Jet Carburetors

Remove Needle Valve Assembly

NOTE: Metering holes in carburetor body (1) should be cleaned with solvent and compressed air only, Fig. 18. Typical “O” ring (2), early “O” ring (inset 3), Fig. 18.

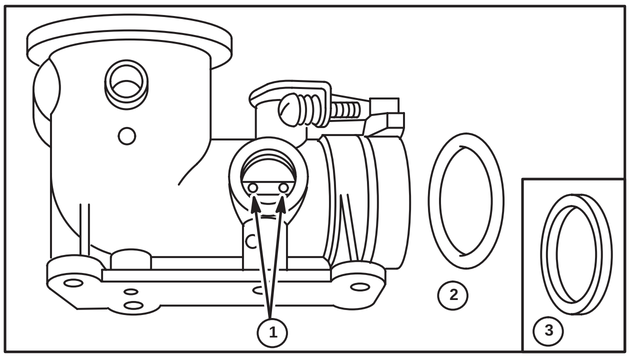


Fig. 18

DO NOT ALTER SIZE OF HOLES

Inspect mixture adjustment needle (1), Fig. 19, and replace if bent (2), or grooved (3).

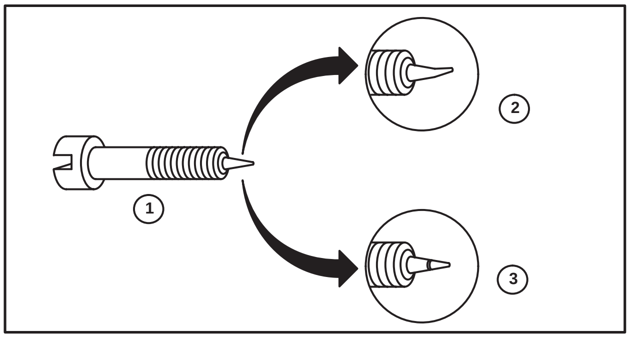


Fig. 19

Screw-In Type (Fig. 20)

1. Remove and discard “O” ring.
2. Remove needle valve assembly (2) and inspect needle valve and seat (1).

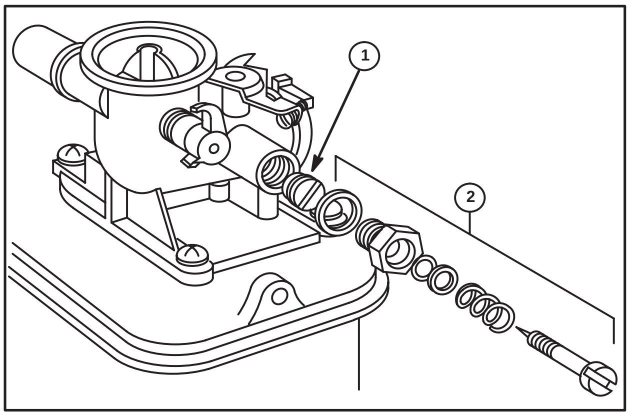


Fig. 20

Minlon™ Pressed-In Type, Used On Some Zinc Carbs (Fig. 21)

1. Remove and discard “O” ring (Fig. 18).
2. Back out mixture adjusting needle about four to five turns counterclockwise.
3. Then pull needle and seat (3) assembly out (4).
4. Remove inner “O” ring (2).

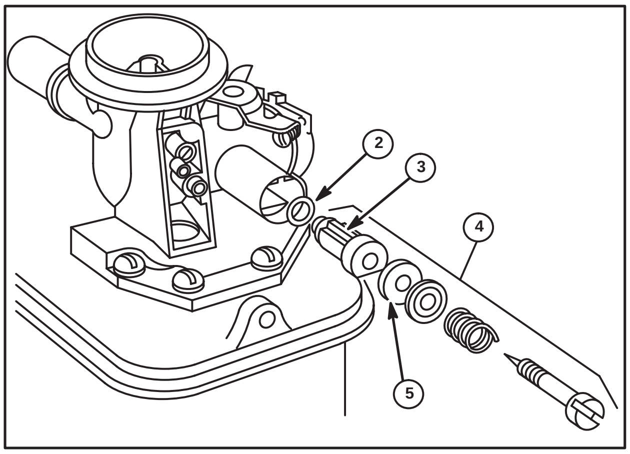


Fig. 21

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Remove Throttle Plate and Shaft

Throttle shaft, Fig. 22, is removed by backing out idle speed adjusting screw and removing the throttle plate screw (3). After removal of plate, throttle shaft may be lifted out. Throttle (1), throttle plate (2), pencil (4).

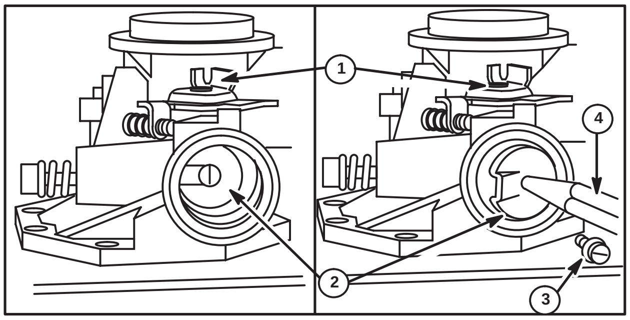


Fig. 22

Remove Fuel Pick-Up Tubes
Zinc Carburetors
Model Series 92000, 110900, 111900, 112900, 113900 (except Type #2999), 114900, 130900, 131900, 132900

Short nylon fuel pipes (1) are threaded into carburetor body. To remove, use six-point socket, (3/8” or 9mm), as shown in Fig. 23.

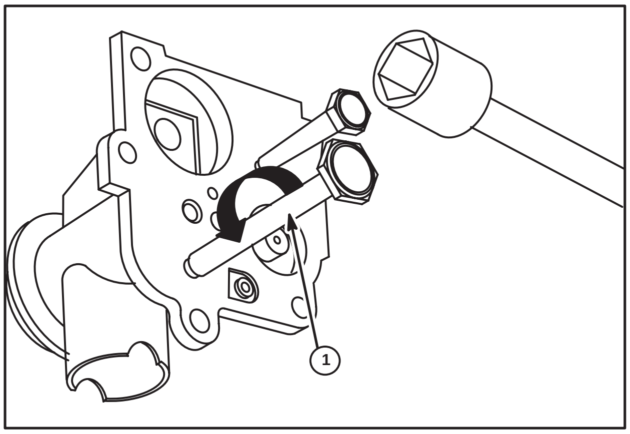


Fig. 23

Model Series 113900, Type #2999

1. Short nylon pick-up tube is threaded into carburetor body. To remove, use socket as shown in Fig. 23.
2. To remove nylon pick-up tube extension from brass pipe, slide retaining clip (1) up onto brass pipe (3), Fig. 24.
3. Cut end of nylon extension where it connects to brass pipe and remove it.
4. Slide off old retaining clip and discard.

NOTE: Do not remove brass pipe.

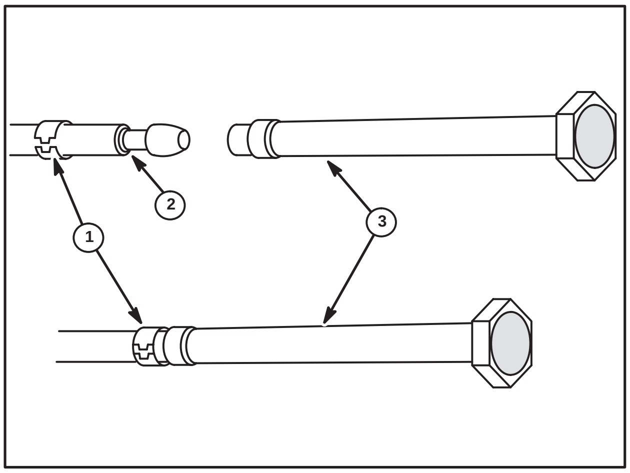


Fig. 24

Vacu-Jet Carburetors
Model Series 92500, 93500, 94500, 95500

Fuel pick-up tubes on Minlon™ carburetors are the snap-in design. Tubes may snap out with considerable force, Fig. 25.

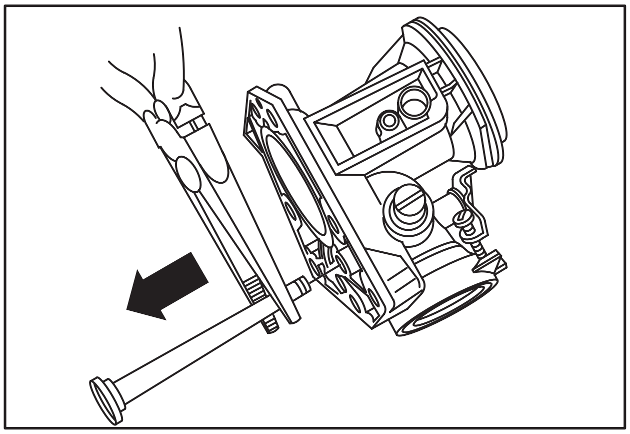


Fig. 25

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

3

Screw-in Type
Model Series 92500, 93500, 94500, 95500

NOTE: Vacu-Jet carburetors have a metal ferrule (1) and check ball (3) in nylon fuel pick-up tube (2). To function properly, screen (4) must be clean and check ball free. Replace tube if screen is clogged or check ball is not free, Fig. 26.

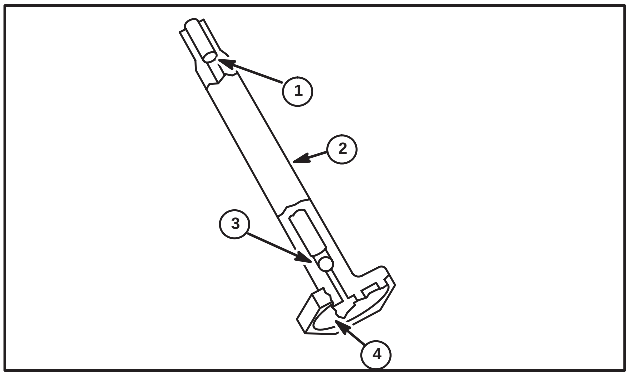


Fig. 26

Breather and Intake Manifold (Fig. 27)

Intake manifold (2) is bolted to cylinder on Model Series 90000, 92000, 93000, 94000, 95000, 100000, 110000, 110900, 111900, 112900, 113900, 114900, 130000, Fig. 27. Check for good fit or damaged gaskets to prevent air leaks or entry of dirt.

NOTE: When installing reinforced plastic or metal intake manifold (2) and new gasket (1), torque screws to 30 in. lbs. (3.4 Nm) or 40 in. lbs (4.5 Nm). Breather tube (3).

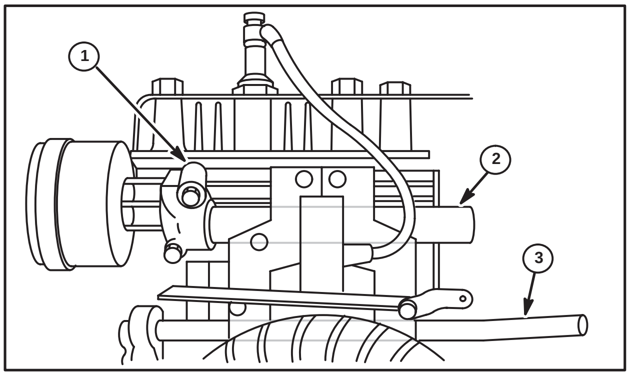


Fig. 27

Remove Automatic Choke (Fig. 28)

1. To remove choke parts, first remove automatic choke link cover.
2. Then slide choke link (1) out choke shaft (2) lever. Pull shaft out of plate, Fig. 28.

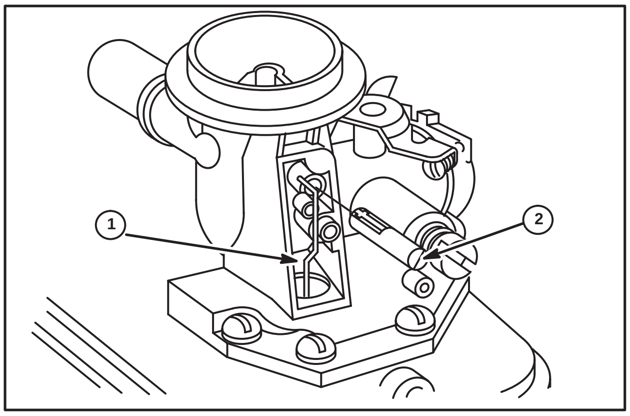


Fig. 28

Remove All-Temperature/Automatic Choke System

Remove rubber elbow which connects breather tube to carburetor and inspect for leaks or damage. Inspect bimetal spring assembly cavity. Clean if required, Fig. 12.

Remove Bimetal Spring Assembly

1. Remove air cleaner assembly and rubber elbow.
2. Apply pressure on end of shaft to loosen as shown in Fig. 29.
3. Remove bi-metallic spring from anchor post. Assembly may now be removed for cleaning or replacement.

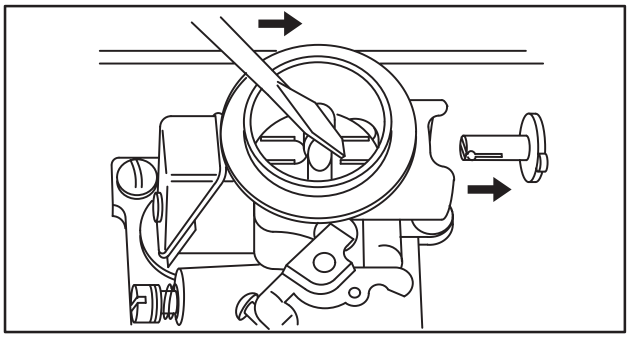


Fig. 29

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Remove Nylon Choke Plate and Shaft Choke-A-Matic® or Manual Choke Model Series 92000, 92500, 93500, 94500, 95500, 100900, 113900 (Type #2999), 130900, 131900, 132900

1. To remove choke parts, disconnect choke return spring (2) (when used), from lever (1) Fig. 30.
2. Pull nylon choke shaft (4) sideways to separate choke shaft from choke plate.

NOTE: If choke plate is heat-sealed to choke shaft, loosen by sliding sharp pointed tool (3) along edge of shaft.

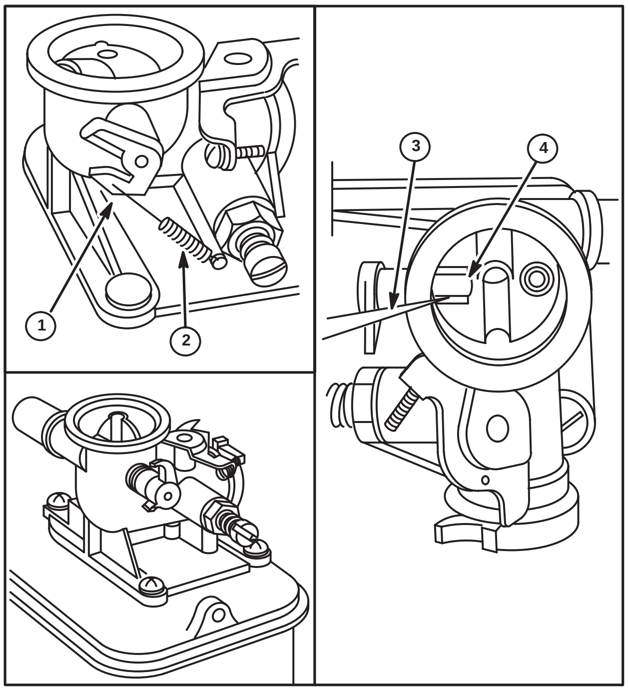


Fig. 30

Disassemble Fuel Pump, Pulsa-Jet Model Series 113900, Type #2999

1. Remove fuel pump cover (1), diaphragm (2), spring (4), and cup (3), Fig. 31.
2. Inspect diaphragm for punctures, cracks and fatigue. Replace if damaged. Inspect all sealing surfaces for nicks or damages and repair or replace as required.

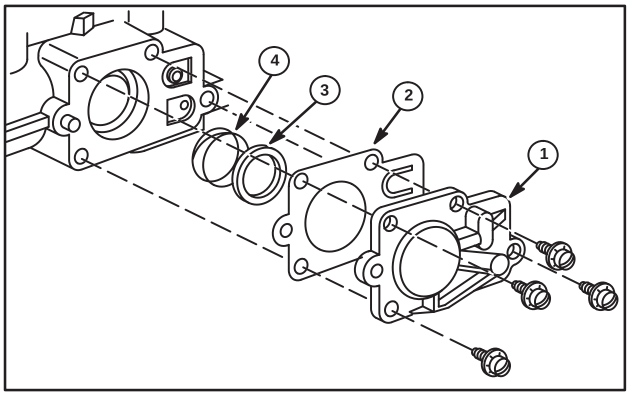


Fig. 31

Inspect Tank

After removal of carburetor from fuel tank, inspect tank for presence of water and deposits of dirt, rust, gum, and/or varnish.

Check Diaphragm and Spring

The diaphragm is suitable for further use, provided it has not developed wear spots, become stiff, or has punctures. Check to ensure fuel pump flapper valves are not damaged.

Also check choke spring length, NO TAG, Specifications.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

3

Check Tank Top

Machined surface on top of fuel tank must be flat in order for diaphragm to provide an adequate seal between carburetor and tank. If surface is not flat, it is possible for gasoline to enter vacuum chamber and into carburetor by passing between tank and diaphragm.

Flatness can be checked with a straight edge (1) and feeler gauge (2), as shown in Fig. 32. A .002" (.05 mm) feeler gauge should not enter between straight edge and machined surface, when checking at shaded areas shown. Replace tank if gauge enters.

NOTE: Do not file tank top to restore flatness, this will worsen condition.

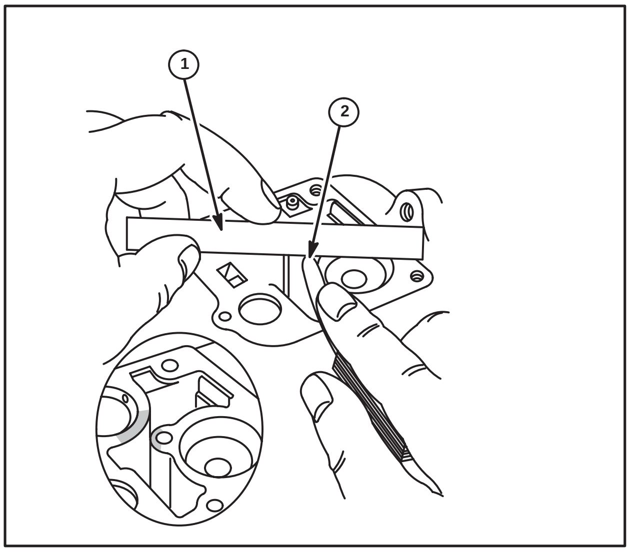


Fig. 32

Repair kit #391413 may be used to repair Pulsa-Jet fuel tanks which are not flat. Install roll pin (1) and Teflon washer (2) as shown in Fig. 33.

NOTE: This kit cannot be used on **All-Temperature/Automatic Choke** carburetors.

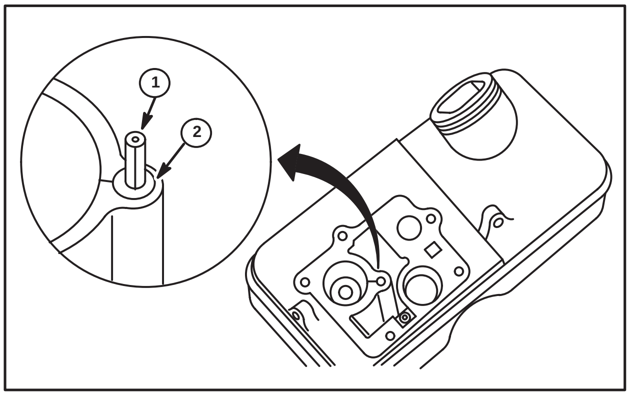


Fig. 33

Assemble Pulsa-Jet, Vacu-Jet Carburetors

Install Fuel Pick-Up Tubes
Zinc Bodies (except Model Series 113900 Type #2999) and Vacu-Jet, Metal Body

Thread tubes into carburetor body using either a 3/8" or 9/16" wrench or socket, Fig. 34. No sealant is required on threads of tubes.

Install Fuel Pick-Up Tube
Model Series 113900, Type #2999

1. Thread tube into carburetor body using a 3/8" wrench or socket (2), Fig. 34. No sealant is required on threads of tube.
2. Slide new retainer clip onto brass pipe. Heat small end of new nylon tube in hot water and push onto brass pipe. Slide retaining clip down onto nylon tube over groove on brass pipe, Fig. 24.

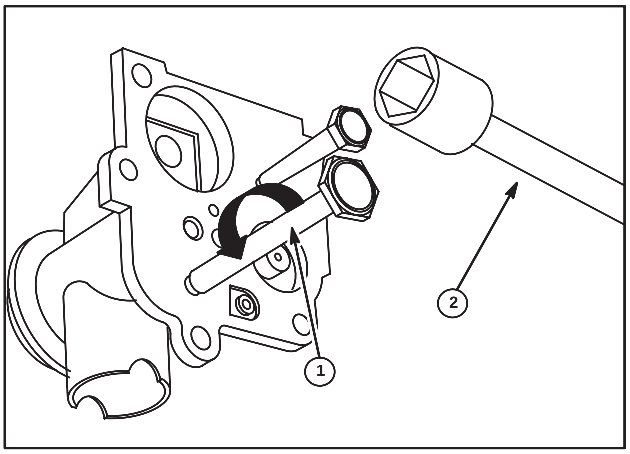


Fig. 34

Install Pressed-In Type Fuel Pick-Up Tube (Vacu-Jet)

Insert pick-up tube in carburetor body. Place pick-up tube screen squarely on a hard surface. Push firmly on carburetor with palm of hand. Pick-up tube may snap into place with considerable force, Fig. 35.

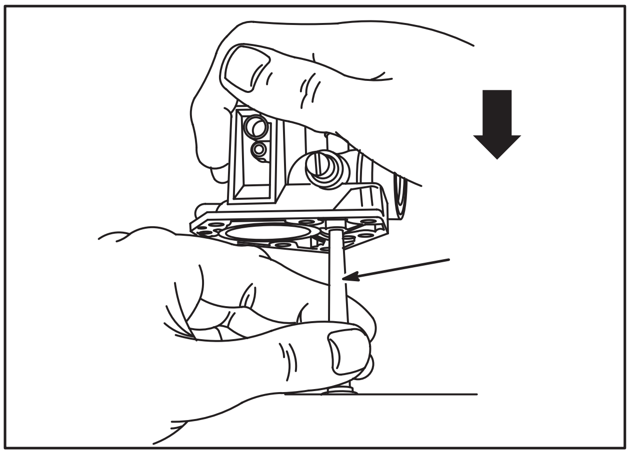


Fig. 35

Install Throttle Shaft and Plate (Fig. 36)

Insert throttle shaft (1), place throttle plate (2) on flat side of shaft and secure with throttle plate screw (3), Fig. 36. Pencil (4).

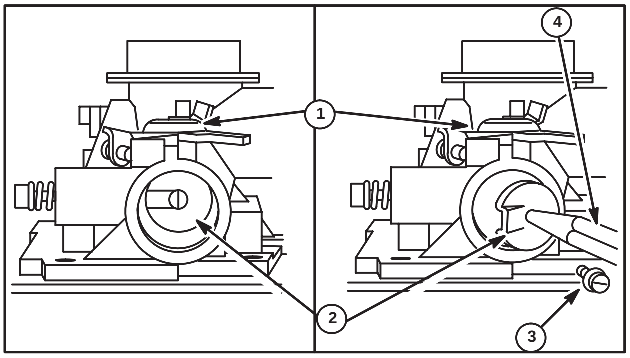


Fig. 36

Assemble Automatic Choke (Fig. 37)

1. Place choke plate in throat of carburetor placing short shaft (1) in hole (2) next to breather inlet.
2. Insert choke shaft (3) into choke shaft bore with automatic choke link hole (4) positioned as shown in Fig. 37.

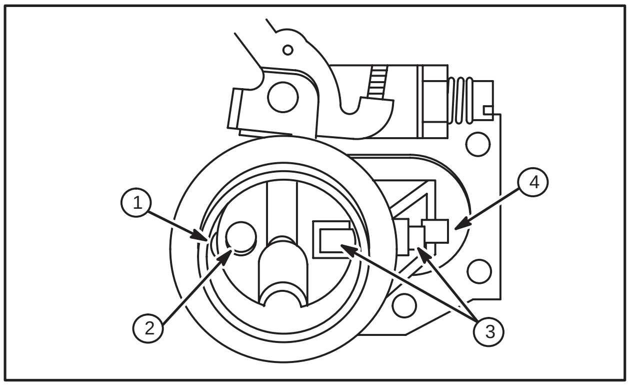


Fig. 37

Assemble Choke Plate (With Poppet Valve)

Do not reseal parts on assembly. When replacing choke plate and shaft, install choke plate on short shaft side (1) so poppet valve spring is visible when valve is in full choke position on carburetors using poppet valve (2), Fig. 38.

NOTE: All-Temperature Automatic choke plates are supported by the bimetal spring assembly on the breather tube side of the carburetor. See next paragraph for installation.

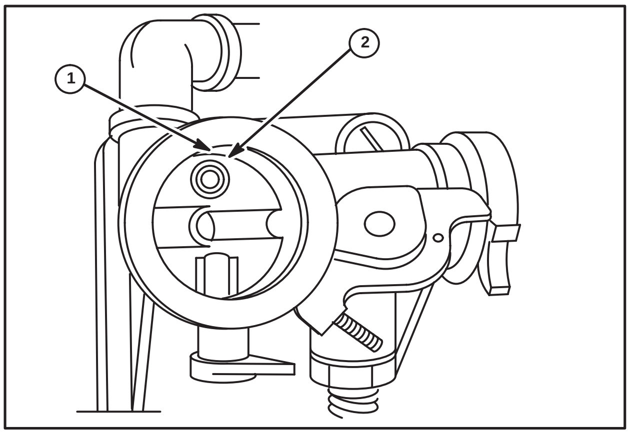


Fig. 38

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Assemble Bimetal Spring

After cleaning, repairing and assembling of other carburetor parts, bimetal spring and shaft assembly may be installed.

1. Place choke plate (1) in choke (closed) position.
2. Position notch of shaft assembly so that free end of spring loop will be within shaded area of cavity (5), Fig. 39.

Fig. 39 – A: Spring position when ambient temperature is 80-120° Farenheit (27-49° Celsius).

Fig. 39 – B: Spring position when ambient temperature is 40-80° Fahrenheit.

3. Insert shaft into carburetor until notch just slides on choke plate.
4. Place spring loop (2) on anchor post (3).
5. Slide shaft on choke plate until it locks in position.

NOTE (Vacu-Jet): Some Minlon™ type carburetors with short spring posts must be flared on end to retain spring. Slightly flare with a WARM soldering gun.

6. If a new diaphragm (1) is being installed, assemble choke spring to diaphragm, as shown in Fig. 40. See Table No. 4, specifications for correct spring usage. Be careful not to bend or distort spring.

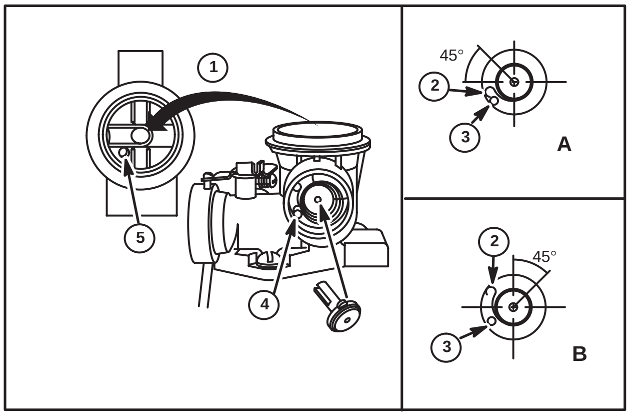


Fig. 39

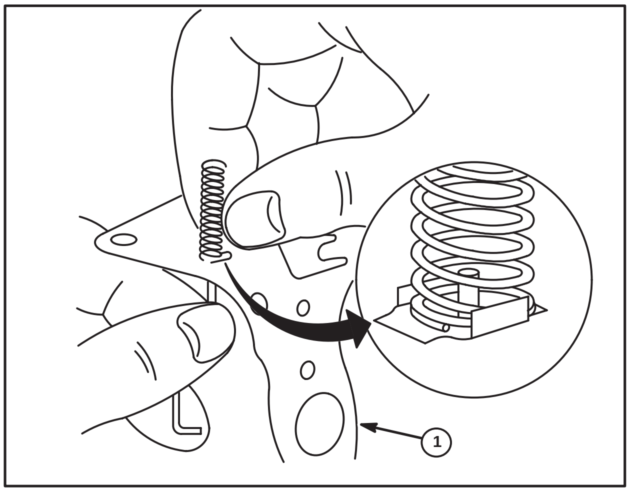


Fig. 40

Assemble Carburetor Choke Shaft Choke-A-Matic® Model Series 92000

1. When assembling carburetor, use new "O" rings, gaskets, and/or diaphragms.
2. Install choke plate and choke shaft.
3. Choke shaft lever should be as shown in Fig. 41.
4. If a new diaphragm is being installed, assemble choke spring to diaphragm, as shown in Fig. 40. See Table No. 2, specifications, for correct spring usage. Be careful not to bend or distort spring.

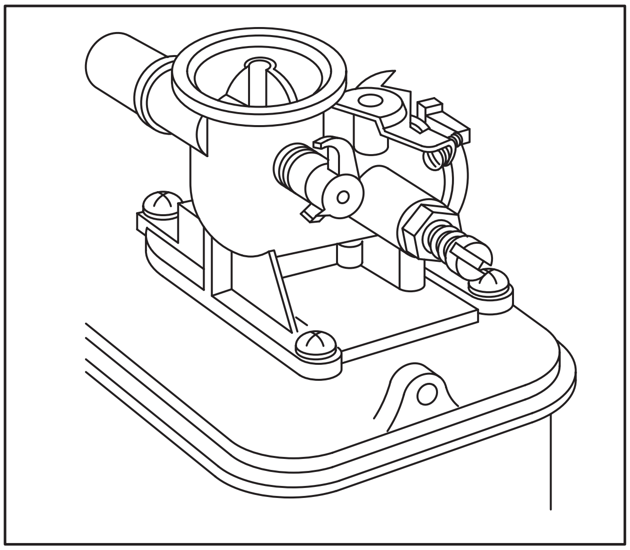


Fig. 41

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Assemble Carburetor to Fuel Tank Pulsa-Jet (except Model Series 113900, Type #2999), and Vacu-Jet (except Choke-A-Matic®)

1. Place "O"-ring (1) in groove in throttle bore, (Vacu-Jet) Fig. 42. Cross section (2), new "O" ring (3), Fig. 42.

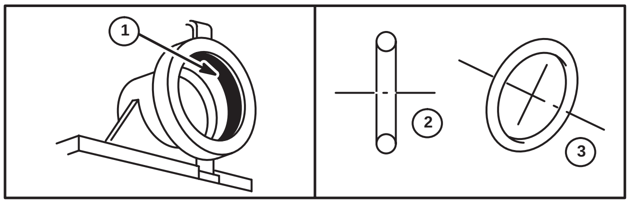


Fig. 42

2. Holding carburetor body upside down, place diaphragm on body while guiding choke link thru link hole for link. Be sure that pump spring and cap (1) are in fuel pump well, (Pulsa-Jet) Fig. 43.

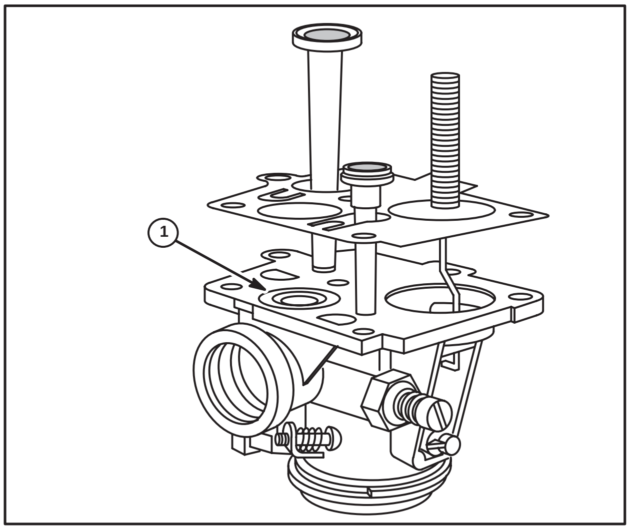


Fig. 43

3. Lower tank down onto carburetor, while guiding choke spring into spring well, Pulsa-Jet shown, Fig. 44.
4. While holding carburetor and body together, turn assembly right side up.
5. Thread carburetor mounting screws into tank top about two turns. DO NOT TIGHTEN.

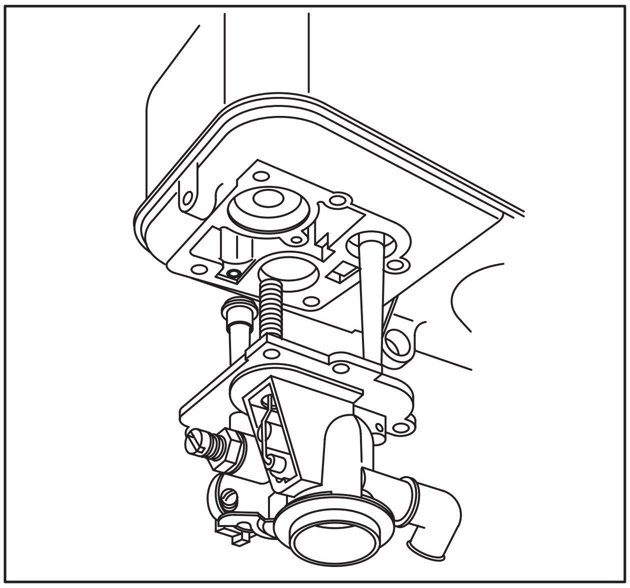


Fig. 44

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

6. Close choke plate (1). Insert choke link (3) into choke shaft (2) as shown, Fig. 45.
7. Install rubber elbow and assemble carburetor to fuel tank including pre-loading automatic choke diaphragm, see below.

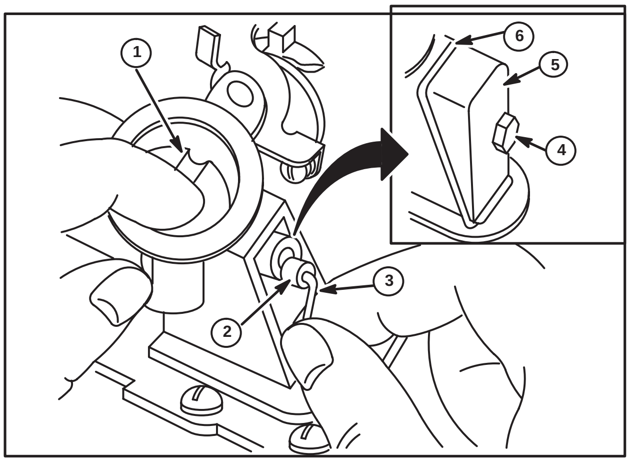


Fig. 45

Pre-Load Diaphragm

1. Move choke plate to an over center position as shown in Fig. 46.
2. Hold choke while tightening carburetor mounting screws in a staggered sequence.

NOTE: Opening choke to an over center position places diaphragm in a pre-loaded condition.

3. Move choke plate to normal closed position. Choke plate should now remain fully closed, Fig. 45.
4. If choke plate is not fully closed, check to be sure choke spring is properly assembled to diaphragm, and also properly inserted in its pocket in tank top.
5. Install choke link cover (5) and gasket (6) with screw (4), Fig. 45.

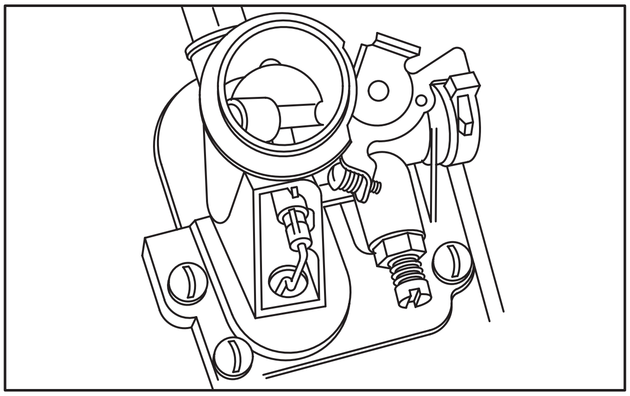


Fig. 46

Pulsa-Jet
Model Series 113900
Type #2999

1. Place two fuel tank mounting gaskets on fuel tank.
2. Lower carburetor onto fuel tank.
3. Rotate choke plate until plate is wide open.

NOTE: Use air cleaner stud to locate and hold choke plate.

4. With choke lever in wide open position, place choke lever bracket on fuel tank and engage bottom tooth of choke lever in top tooth slot on lever (1), Fig. 47.
5. Install three mounting screws and tighten securely.

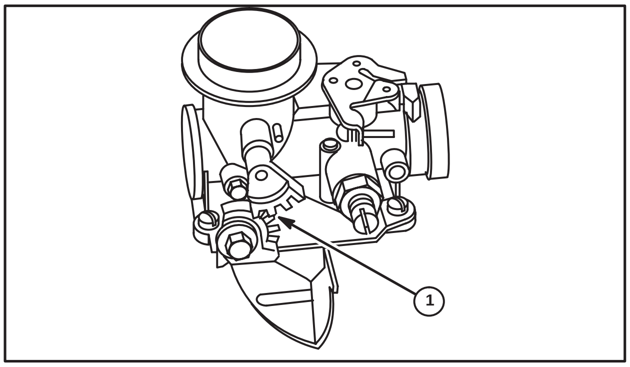


Fig. 47

Assemble Vacu-Jet Choke-A-Matic® Carburetor to Fuel Tank

1. Place new tank mounting gasket on tank top.
2. Lower carburetor onto tank top.
3. Install two mounting screws and tighten.

Install Needle Valve Assembly, Screw-in Type (Fig. 48)

1. Install needle valve seat (1) being sure not to cause burrs in slot.
2. Insert needle valve into threaded nut assembly. Turn clockwise 1–2 turns.
3. Install needle valve assembly (2), Fig. 48.

NOTE: On zinc carburetor bodies that use pressed-in type Minlon™ needle valve assembly, see next.

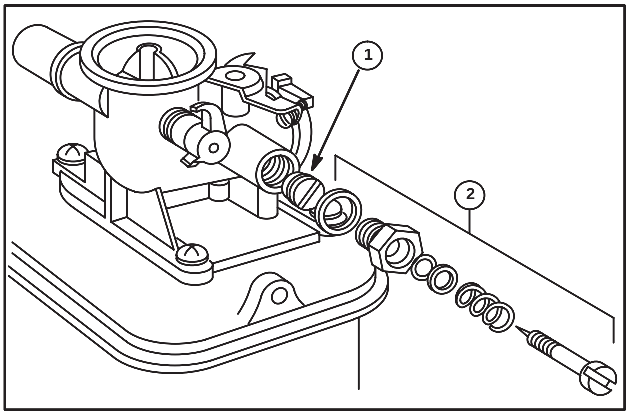


Fig. 48

Pressed-In Type (Fig. 49)

1. To install pressed-in type needle valve assembly, place "O" ring (2) on shoulder of needle seat (3).
2. Turn needle in until large seal washer (5) just touches needle seat, Fig. 49.
3. Assemble needle valve assembly (4) and turn screw until it just touches spring.
4. Install needle valve as an assembly being sure flat on valve seat lines up with flat in carburetor body (1), Fig. 49.

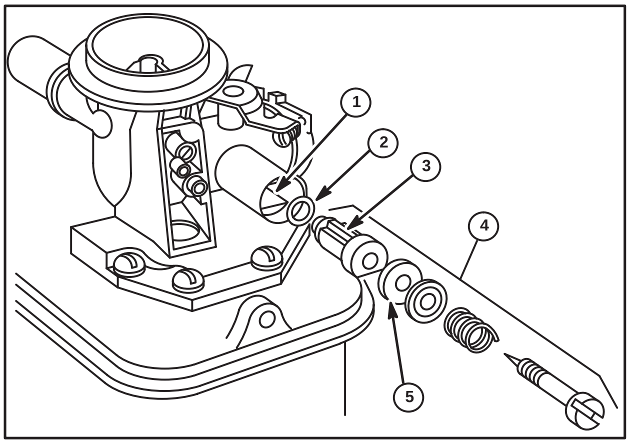


Fig. 49

NOTE: On later carburetors, a slot was added to top of needle valve assembly bore to line up with rib on needle valve assembly.

5. Oil fill tube, Part #280131 (1) will help firmly seat valve assembly, Fig. 50.

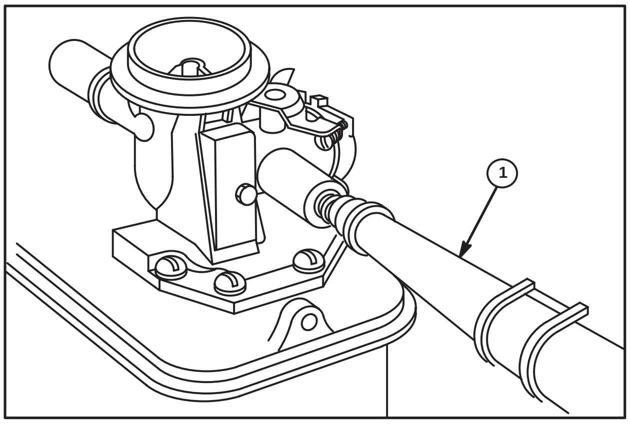


Fig. 50

Install Carburetor and Tank Assembly Automatic Choke Model Series 92000, 92500, 93500, 94000, 95000, 110900, 111900, 112900, 113900 (except Type #2999), 114900

1. Apply light film of oil to "O" ring in throttle bore. Then hook governor link (3) to governor blade (1) (Pulsa-Jet), or bell crank into governor lever rod (Vacu-Jet).
2. Align carburetor with intake tube (6) and breather tube grommet (2).
3. Be sure "O" ring does not distort when fitting carburetor to intake tube, Fig. 11. Install governor spring as shown in Section 4, page 8.

3

Pulsa-Jet, Vacu-Jet, Choke-A-Matic® Model Series 92000

1. Put a light film of oil on “O” ring in throttle bore.
2. With governor link (3) hooked to governor blade (1), connect link to throttle (4) and slip carburetor into place.
3. Align carburetor with intake tube and breather tube grommet.
4. Hold choke lever (5) as shown in Fig. 51, so it does not catch on control plate.
5. Do not distort “O” ring when fitting carburetor to intake tube.

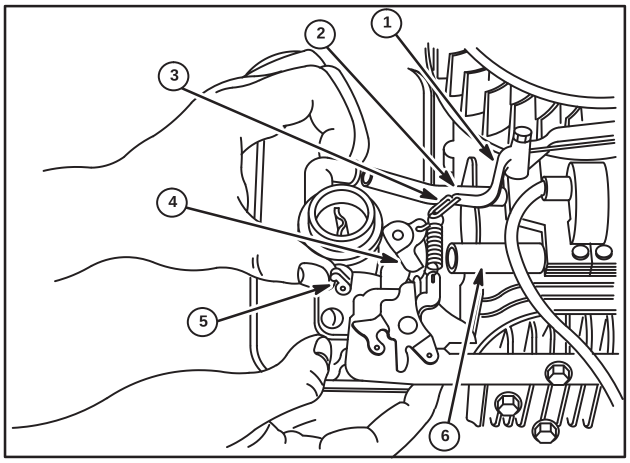


Fig. 51

6. Install mounting bolts. Fig. 52 shows routings of stop switch wires (1).

NOTE: Route stop switch wire under and away from governor spring.

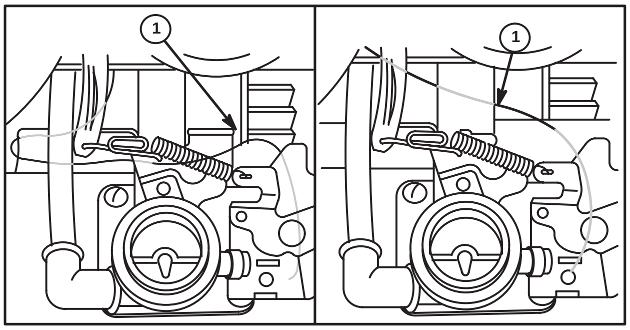


Fig. 52

Model Series 100900, 113900, 130900 Type #2999, 131900, and 132900

1. Assemble carburetor and new gasket (3) to tank.
2. Hook throttle link (1) to throttle lever (2), Fig. 53.
3. Slip carburetor over notch in cylinder shield (5) and around intake tube (6).
4. Oil seal (4) in carburetor body to prevent damage when installing.
5. Mount carburetor and tank assembly to cylinder.
6. Torque two head bolts to 140 in. lbs. (16 Nm). Install rear tank mounting screw.

NOTE: Model Series 113900, Type #2999 has a stud and a tank mounting screw. Torque stud and screw to 140 in. lbs. (16 Nm).

7. Connect stop switch wire and governor spring.

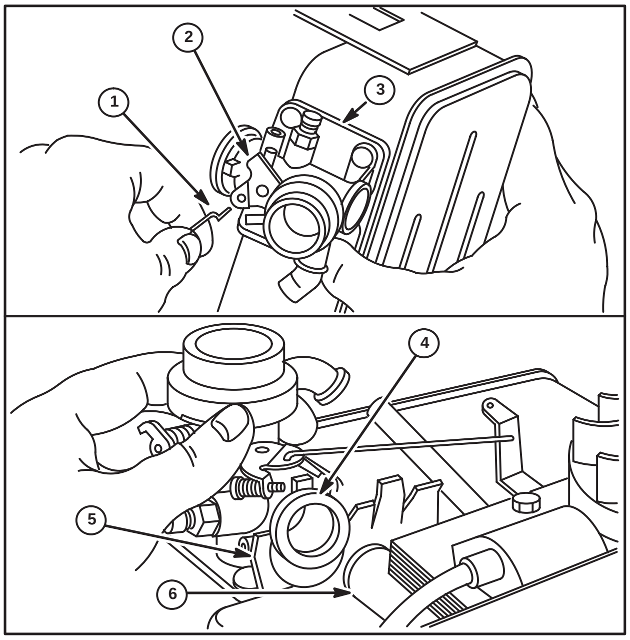


Fig. 53

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Adjust Choke-A-Matic® Model Series 92000

Choke-A-Matic® is standard on Model Series 92900 (type nos. lower than 0500), and Series 92500 (type nos. lower than 600) engines. Remote control must be of type in which control wire moves 2-1/8” (54 mm) (A) out of casing when control lever is moved from “STOP” position (2) to “CHOKE” or “START” position (1) A minimum travel of 1–3/8” (35 mm) (B) is required when remote control is mounted, Fig. 54.

1. Remove air cleaner and move control lever to a position about midway between idle and fast.
2. Mount remote control with casing clamp as shown in Fig. 55.

To adjust remote control assembly proceed as follows:

3. Place control lever on equipment in “FAST” (high speed) position (5), Fig. 55.

   NOTE: Control must be mounted on equipment to make an accurate adjustment.

4. Lever (1) on carburetor should be just touching choke shaft at (2), Fig. 55.
5. Move casing (4) forward or backward until correct position is obtained.
6. Tighten screw (3). Recheck operation of controls after adjustment, Fig. 55.

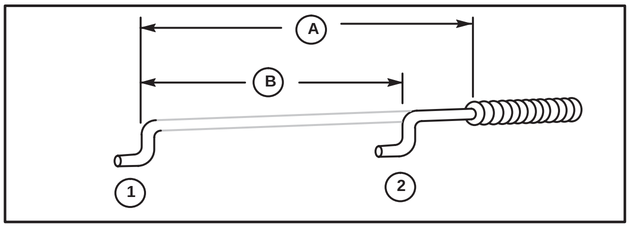


Fig. 54

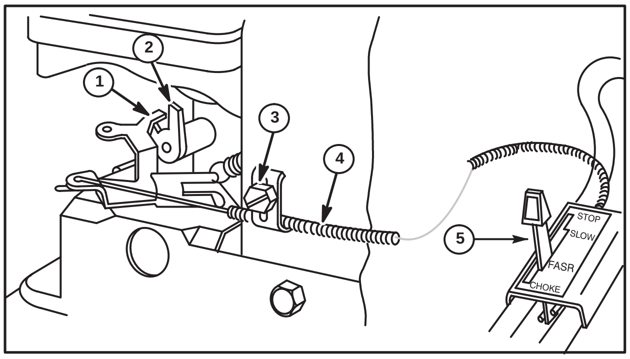


Fig. 55

Choke-A-Matic® Linkage Model Series 100900, 130900, 131900, 132900

Manual or remote control for choke and stop is done by a lever on control plate mounted to carburetor by two screws (2) Fig. 56. Lever for remote control has a loose fit; for manual control, a friction fit.

1. To check lever action, move lever (1) to left until it snaps into “RUN” detent.
2. Lever (3) should just touch choke lever at (4).
3. If it does not, loosen screws (2) slightly and move control plate to right or left until lever just touches choke lever at (4).
4. Tighten screws.

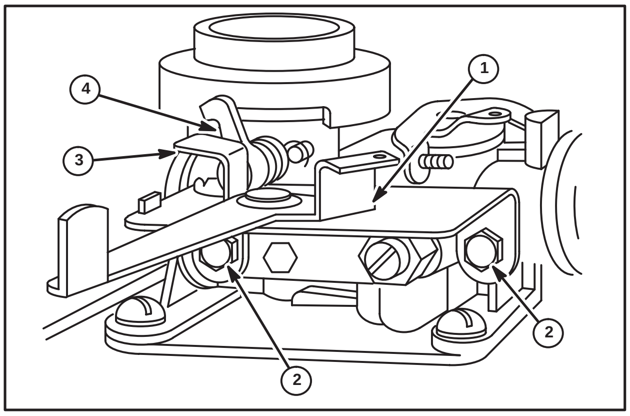


Fig. 56

Carburetor Adjustment Pulsa-Jet

NOTE: When making carburetor adjustments on Pulsa-Jet carburetors, air cleaner and stud must be installed on carburetor.

Model Series 92500, 93500, 94500 and 95500 engines should be adjusted with fuel tank one-quarter (1/4) full of gasoline.

Initial Adjustment

1. Using tool #19263 (4), turn needle valve (5) clockwise until the needle lightly contacts the seat.
2. Then open 1-1/2 turns. This initial adjustment will permit engine to be started and warmed up before making final adjustment.

Final Adjustment

1. Place governor speed control (6) lever in “FAST” position.
2. Using tool (4), turn needle valve (5) in until engine misses (clockwise – lean mixture) then turn needle valve out (counterclockwise) 3/8 turn, Fig. 57.
3. Rotate throttle (1) counterclockwise and hold against stop.
4. Adjust idle speed adjusting screw (2) to obtain 1750 RPM.
5. Release throttle – engine should accelerate without hesitation or sputtering.
6. If engine does not accelerate properly, carburetor should be re-adjusted, usually to a slightly richer mixture.

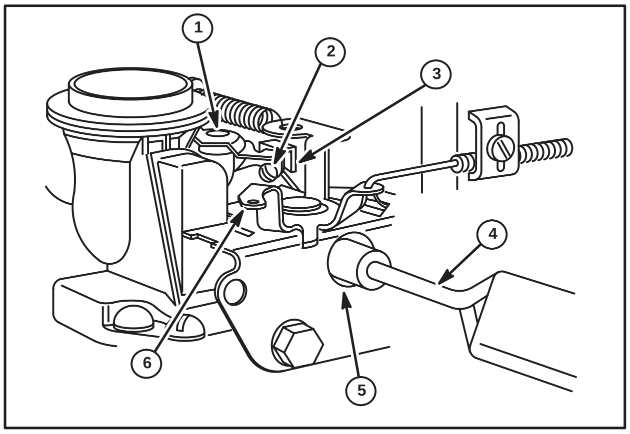


Fig. 57

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

In case of flooding, move throttle control to “STOP” position and pull starter rope at least six times. (Crank electric starter models for at least 5 seconds.)

When control is placed in “STOP” position governor spring holds throttle in a closed (idle) position. Cranking engine with a closed throttle creates a higher vacuum which opens choke rapidly, permitting engine to clear itself of excess fuel. Check paragraph No. 2 – A, B and C on page 11.

Then move control to “FAST” position and start engine. If engine continues to flood, lean carburetor needle valve – 1/8 to 1/4 turn clockwise.

TANK MOUNTED CARBURETORS HORIZONTAL CRANKSHAFT ENGINES

NOTE: Pulsa-Jet and Vacu-Jet carburetors for horizontal crankshaft models are combined in this section. Issues specific to individual models or types will be noted in the text and corresponding illustrations.

Pulsa-Jet, Fixed Jet – Pilot Jet Model Series 80200, 82200, 90200, 91200, 92200, 94200, 112200, 130200, 132200, 135200, 136200, 137200

Fixed jet Pulsa-Jet carburetors have been made in three versions. Current version is small well, bottom fixed jet (1), A. (Low emission carburetors have a filter screen surrounding the small well and a fixed pilot jet) (non-emission carburetors have an adjustable idle mixture screw [2]); second version is small well, fixed side jet, B; and third version is large well, fixed side jet, C, Fig. 58.

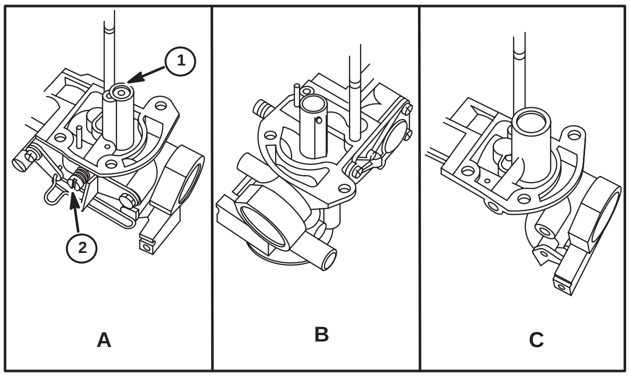


Fig. 58

Adjustable Pulsa-Jet Carburetors with Choke-A-Matic®, Manual or Remote Choke Model Series 60000, 80000, 90000, 100000, 110000, 130000

These Pulsa-Jet carburetors all have a combined idle and main jet adjustment needle, integral fuel pump and have either manual rotary (2) or slide choke in manual (3), remote or Choke-A-Matic® (1), Fig. 59.

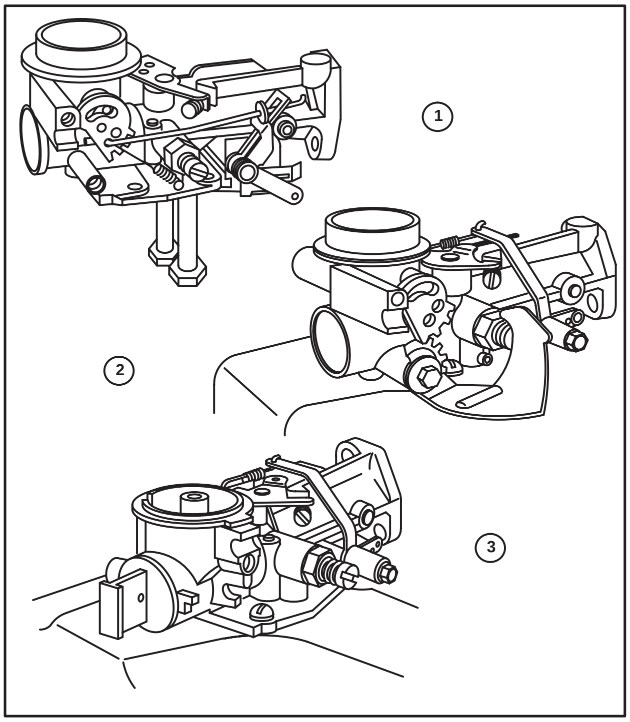


Fig. 59

Model Series 91200, 92200, 94200 (Fig. 60)

1. Remove air cleaner assembly.
2. Move throttle (top) lever to idle position.

   NOTE: On fixed adjustable control panels, bend tang down to move throttle lever to idle position.

3. Move choke (bottom) lever to full choke position, Fig. 60.
4. Use a T-20 Torx® driver to remove two screws holding control panel to fuel tank and carburetor.
5. Remove control panel and disconnect choke rod and stop wire from stop switch (when used).

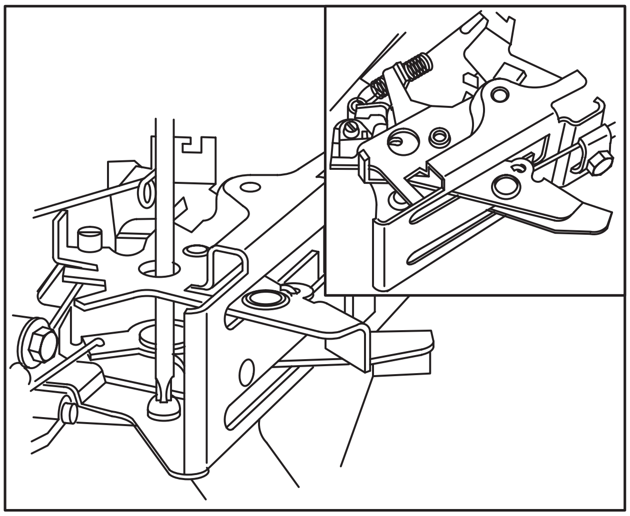


Fig. 60

Model Series 80200, 82200, 90200, 91200, 92200, 112200, 130200, 132200, 135200, 136200, 137200 (Fig. 61)

1. Remove air cleaner assembly.
2. Disconnect choke link (1) from control panel lever, when used.
3. Remove two screws (2) holding control panel and remove control panel.
4. Disconnect stop switch wire from stop switch and set control panel aside.

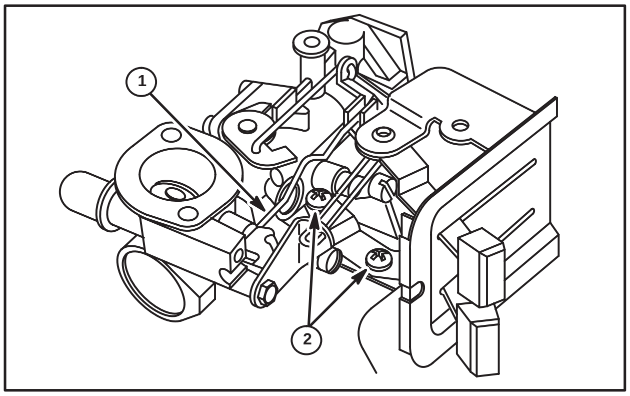


Fig. 61

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Remove Fuel Tank from Carburetor (Fig. 62)

1. Remove remaining screws holding fuel tank onto carburetor. (Install [1] first).
2. Remove screw holding fuel tank bracket to cylinder base.
3. Separate fuel tank from carburetor and remove fuel tank gasket (2) and discard.
4. Disconnect governor linkage and spring from carburetor.

Remove Carburetor (Pulsa-Jet and Vacu-Jet)

1. Using Tool #19305 Offset Screwdriver, Tool #19391 Torx® Wrench, Tool #19442 Torqux Star bit set or open end wrench, remove two screws holding carburetor to cylinder.
2. Remove assembly while disconnecting throttle linkage or governor rods.

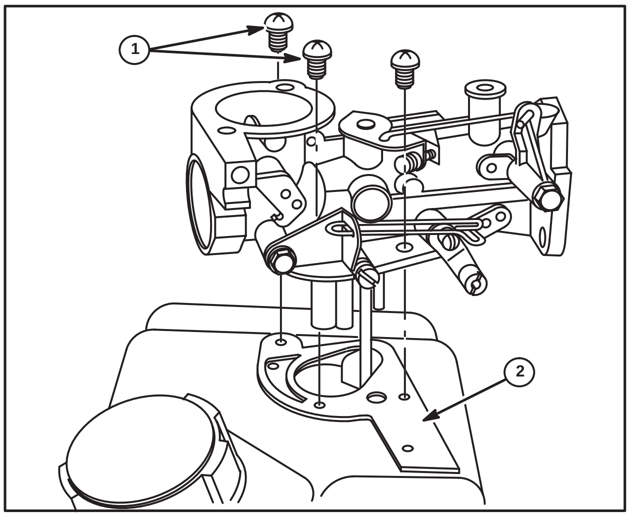


Fig. 62

Disassemble Carburetor

Remove Throttle Plate and Shaft

1. Remove throttle plate screw (2) and throttle plate (3), Fig. 63. Illustration of throttle shaft and lever, Fig. 64.
2. After removal of throttle plate, throttle shaft (1) and dust seal may be lifted out, Fig. 63.
3. Disassemble valve (4) by removing Philips head screw (6), then use pencil (5) or similar tool to lift out valve.

NOTE: Some Pulsa-Jet carburetors have a throttle shaft seal in addition to the dust seal. Remove, discard and replace.

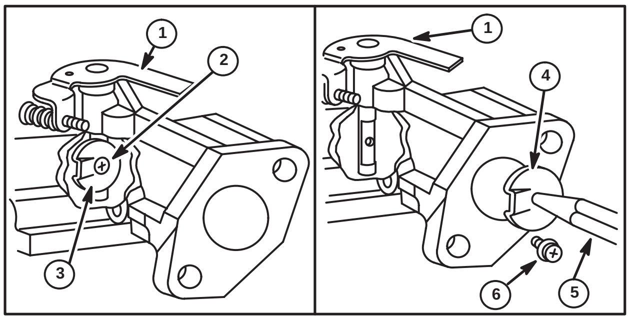


Fig. 63

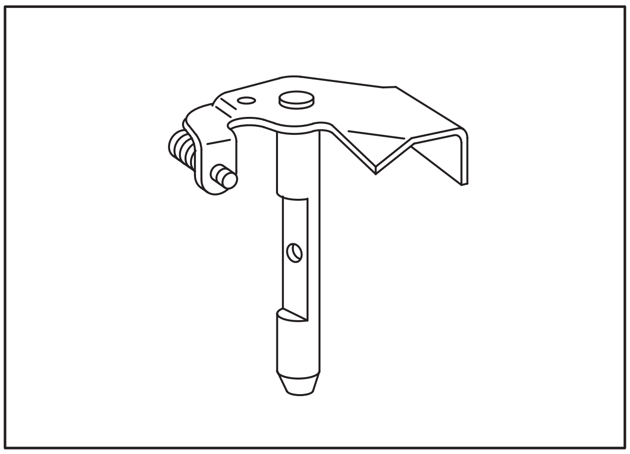


Fig. 64

Pulsa-Jet

1. Remove idle mixture needle and spring.

   NOTE: Low emissions carburetors use a pilot jet instead of an idle mixture needle and spring. Remove pilot jet.

2. Snap out choke plate and remove choke shaft.
3. Remove filter screen from well, when used.
4. With a modified 1/4 inch (3.9 mm) pin punch, remove welch plug(s) (1) from carburetor body, Fig. 65. DO NOT remove fixed jet.

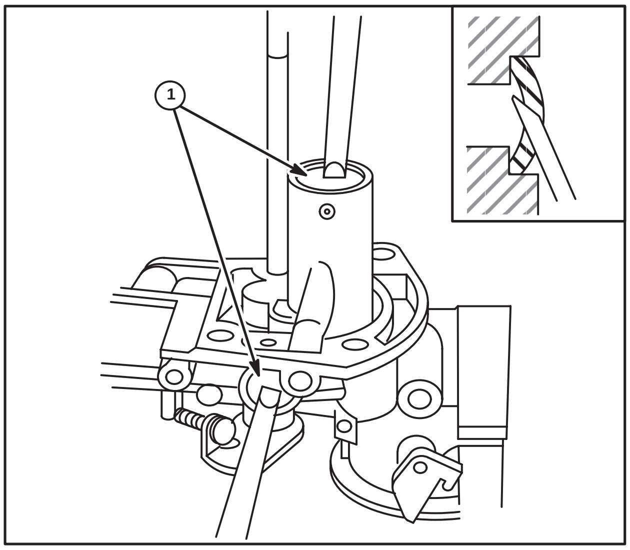


Fig. 65

Remove Needle Valve and Seat

1. Remove needle valve (1) to inspect.
2. Replace needle valve if needle is bent (2), grooved (3), or broken, Fig. 66.
3. If carburetor is gummy or dirty, remove seat to allow better access to metering holes (1).
   Choke (2)
   Throttle (3)
   Needle valve (5)
   Fig. 67.
4. Use only compressed air or solvents to clean metering holes.

   NOTE: Do not change metering hole sizes.

5. Replace seat (4) if screwdriver slot is damaged.

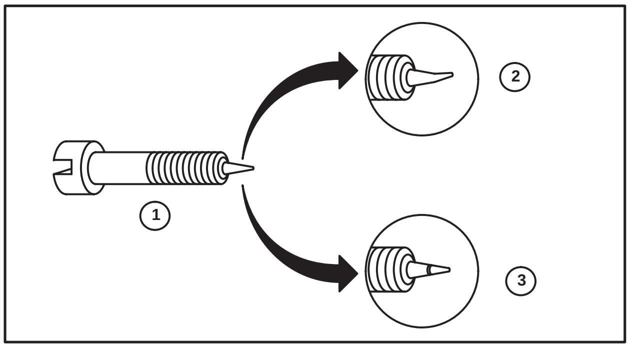


Fig. 66

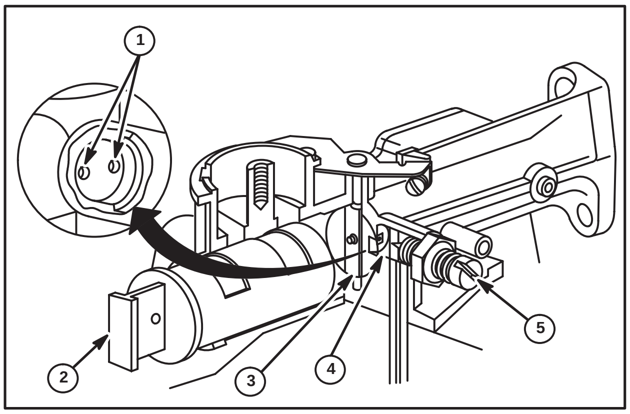


Fig. 67

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Remove Fuel Pick-Up Tube Pulsa-Jet

1. To remove screen housing or nylon pipe from brass pipe, slide retaining clip (2) up onto brass pick-up tube (1).
2. Cut end of nylon tube where tube connects to brass tube and remove tube.
3. Slide off old retaining clip and discard, Fig. 68.

NOTE: Do not remove brass pipe.

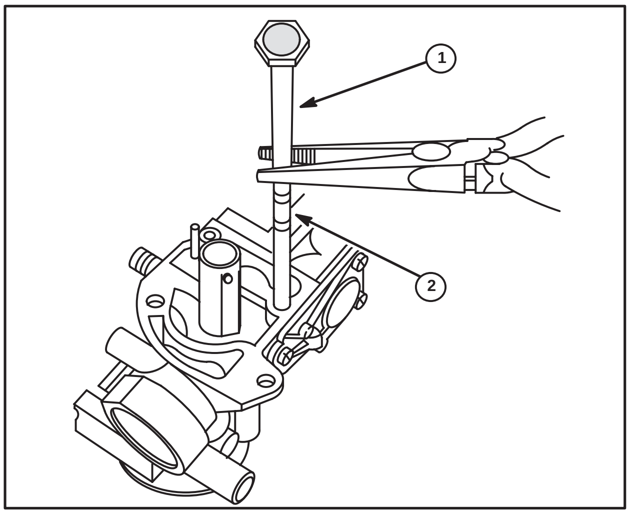


Fig. 68

Remove Fuel Pick-Up Tube Vacu-Jet

Nylon fuel pick-up tubes are removed and replaced with a 6 point 9/16” (1) socket, Fig. 69.

The fuel pick-up tube contains a check ball and a fine mesh screen. To function properly, screen must be clean and check ball free, Fig. 69. Replace pick-up tube if screen and ball cannot be satisfactorily cleaned in carburetor cleaner.

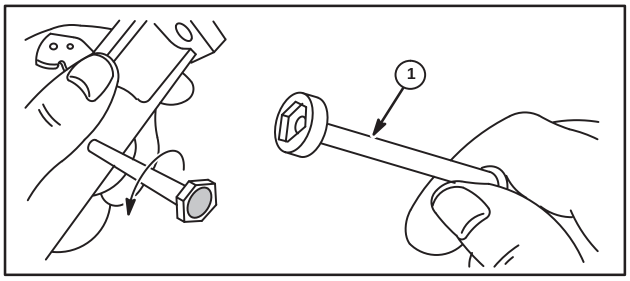


Fig. 69

Remove Spiral

NOTE: Some carburetor models have a spiral (1) in carburetor bore.

1. To remove, clamp carburetor in a vise (2) with smooth jaws about half an inch below top of jaws.
2. Grasp spiral firmly with a pair of pliers, as shown, Fig. 70.
3. Place a screwdriver under ledge of pliers.
4. Using edge of vise, push down on screwdriver handle to pry out spiral.
5. Inspect gasket surface of carburetor. Repair if mounting surface is damaged.

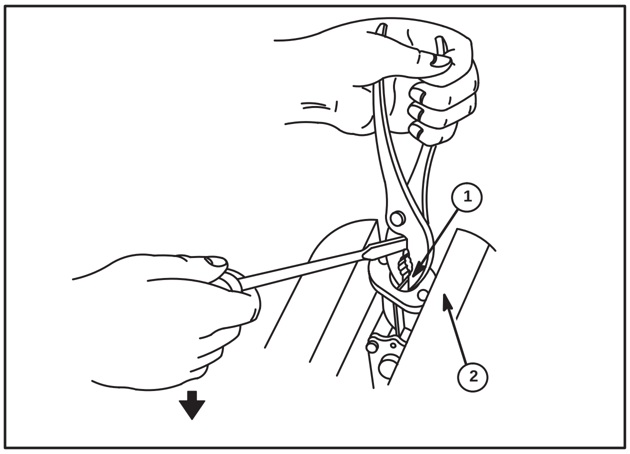


Fig. 70

Disassemble Fuel Pump (Pulsa-Jet)

1. Remove fuel pump cover (5), diaphragm (3), spring (1) and cup (2), Fig. 71.
2. Inspect diaphragm for punctures, cracks and fatigue. Replace if damaged. Inspect all sealing surfaces for nicks or damage and repair or replace as required.

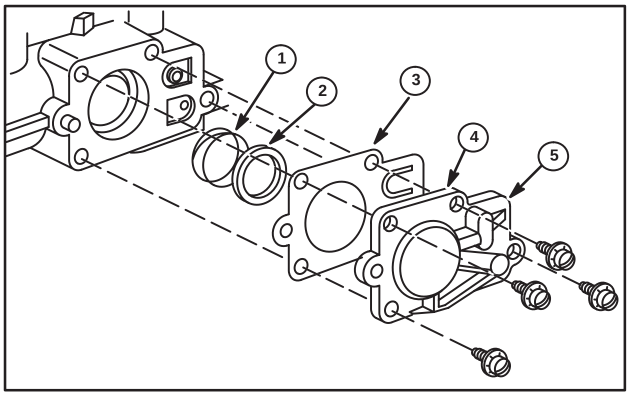


Fig. 71

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Disassemble Choke-A-Matic® Linkage Slide Choke, (Except Model Series 100900, 130900, 131900, 132900)

1. To remove choke link (2), remove speed adjustment lever (3) and stop switch insulator plate (4).
2. Remove speed adjustment lever from choke link.
3. Then pull out choke link through hole in choke slide (6), Fig. 72.
   Washers (5)
   Choke return spring (1)
   Choke slide (6)

   NOTE: On some horizontal crankshaft Pulsa-Jet carburetors, Tool #19305, Offset Screwdriver, or Tool #19391, Torx® Wrench, or open end wrench can be used.

4. On models equipped with a stop switch, remove stop switch wire.

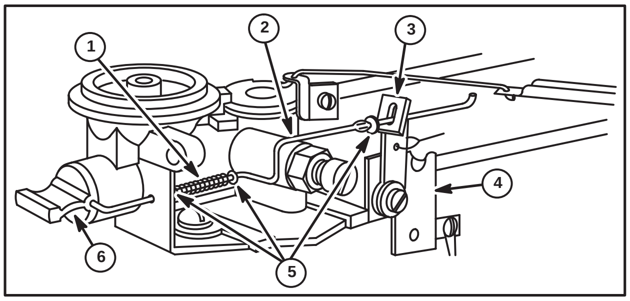


Fig. 72

Disassemble Choke-A-Matic® Linkage Rotary Choke (Pulsa-Jet)

1. To remove choke link (2), remove speed adjustment lever (3) and stop switch insulator plate (4).
2. Work link out through hole in choke shaft (1), Fig. 73.

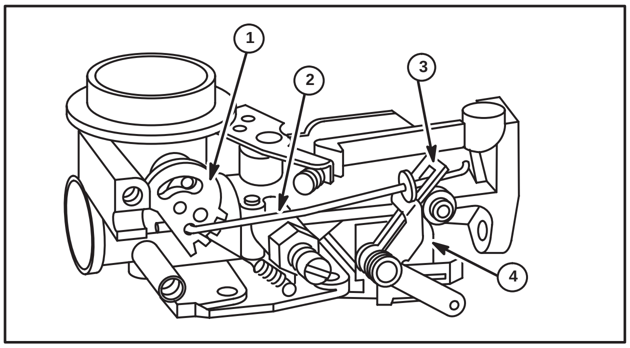


Fig. 73

Remove Nylon Choke and Shaft Pulsa-Jet Rotary Choke-A-Matic®, Manual, and Remote Model Series 80000, 110000, 130000

1. Pull nylon choke shaft (2) sideways to separate choke shaft from choke plate.
2. Remove spring (Choke-A-Matic® only), felt washer (3), and metal washer (1) from choke shaft, Fig. 74.

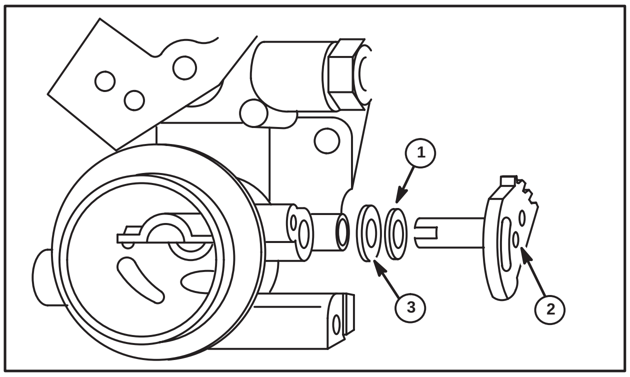


Fig. 74

Inspect Carburetor

After cleaning, inspect for wear, damage, cracks, or plugged openings. Replace body if any of above conditions exist. Use only compressed air to clear plugged openings. Inspect idle mixture needle for bent needle point or a groove in tip of needle, Fig. 66. Replace if bent or grooved. On Pulsa-Jet low emission carburetors, inspect pilot jet for dirt and sealing in seat area. Do not use drills or wire when checking pilot jet.

Check all parts for wear and replace as needed. Examine fuel pick-up tube screens for gum deposits and dirt. Replace if dirty. Replace diaphragm if worn, torn, punctured or stiff.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

High Altitude Compensation (Pulsa-Jet)

NOTE: If engine is operated at high altitudes, performance may decrease. If poor performance is experienced remove main air bleed jet (1), Fig. 75.

NOTE: For low emission carburetors (type numbers ending in A1 through A9 or E1 through E9) use the following procedure:

1. Remove end welch plug.
2. Using a #3-48 UNC tap, tap into main air bleed jet, Fig. 75.
3. Clamp square end of tap in vise and turn carburetor body clockwise to pull air bleed jet.
4. Press new high altitude air bleed jet in until flush with boss.
5. Remove original pilot jet and install new high altitude pilot jet.

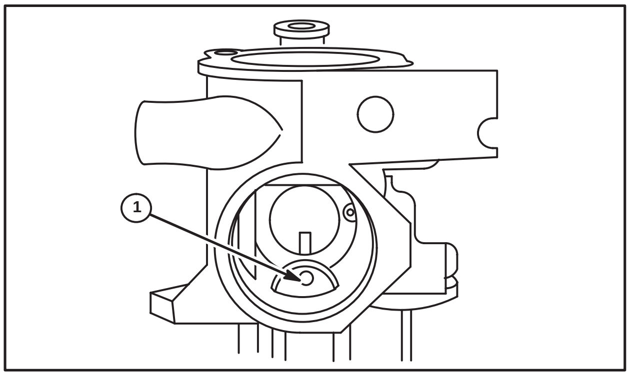


Fig. 75

Assemble Carburetor

Install Welch Plug(s) (Pulsa-Jet)

1. Place a small amount of non-hardening sealant such as Permatex® II or nail polish around outside edge of welch plug(s) and place plug in metering or bottom well.
2. With a 1/4” dia. (.64 mm), or larger, pin punch (1), set welch plug with pin punch in center of plug. Do not collapse plug, Fig. 76.

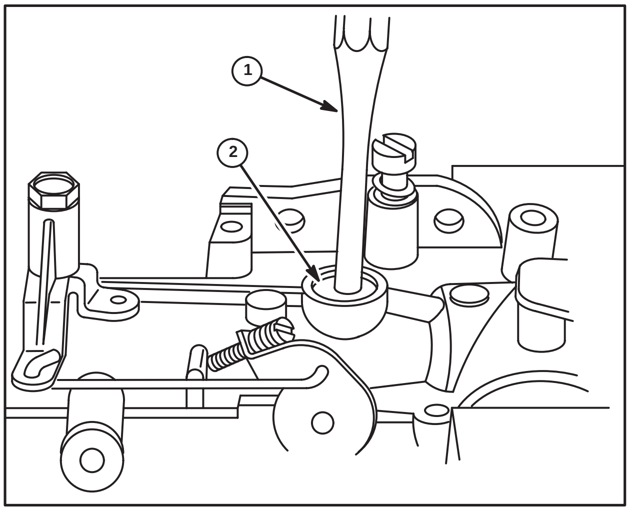


Fig. 76

Assemble Fuel Pump (Pulsa-Jet)

1. Smooth side of cup (1) must rest against diaphragm (6), Fig. 77. This prevents spring (1) from cutting diaphragm.
2. When installing pump cover (2), tighten screws evenly in staggered sequence to ensure a good seal.
3. Inspect all sealing surfaces for nicks or damages and repair or replace as required. Long pump pipe (3), bottom housing (4), short carburetor pipe (5), Fig. 77.

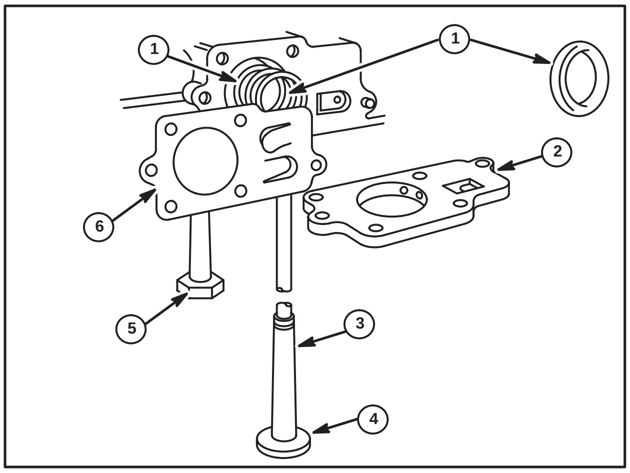


Fig. 77

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

PULSA-JET LOW EMISSION CARBURETORS: (Engines with type numbers ending in A1 through A9 or E1 through E9):

1. Install choke shaft as shown in Fig. 78.
2. Install pilot jet until it seats firmly.

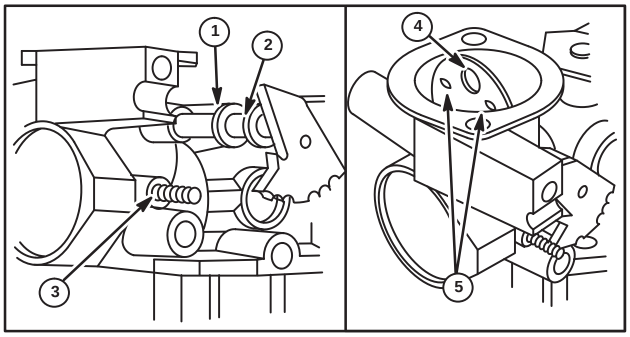


Fig. 78

Assemble Choke-A-Matic® Linkage Rotary Choke (Pulsa-Jet)

1. Insert “Z” bend of Choke-A-Matic® linkage (1) into same hole (6) as return spring (2).
2. Slide washer on the end of linkage and then slide Choke-A-Matic® lever onto shaft (3).
3. Install lever assembly and stop switch (4) on carburetor, Fig. 79.

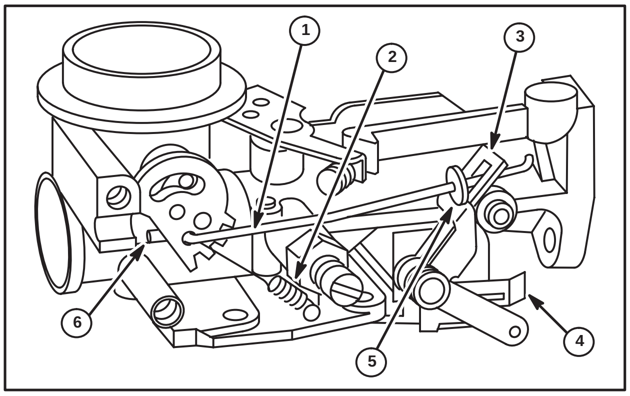


Fig. 79

NOTE: Hook small end of spring (3) on spring post (2) and long hook in bottom hole of choke shaft (1), Fig. 80.

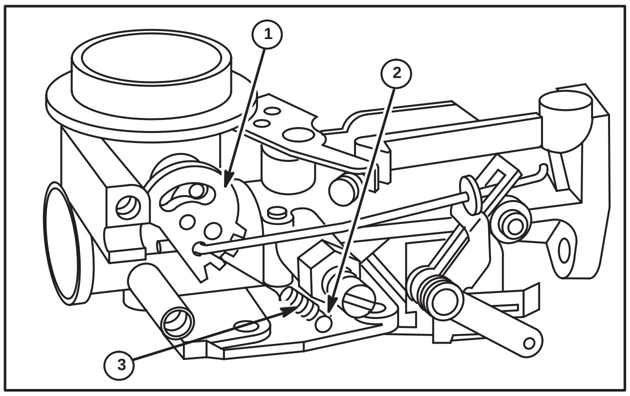


Fig. 80

Slide Choke

1. To assemble, slip washers (2) and spring (1) over choke link, Fig. 81.
2. Hook choke link through hole in choke slide. Place other end of choke link through hole in speed adjustment lever.
3. Mount lever and stop switch insulator plate to carburetor.

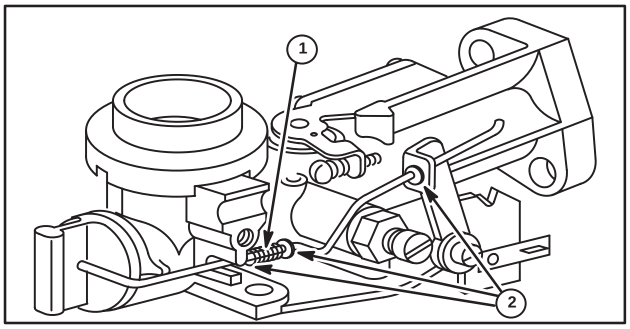


Fig. 81

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Manual Choke

Note: Bottom tooth of choke shaft (1) should engage top tooth on manual choke lever (2), Fig. 82.

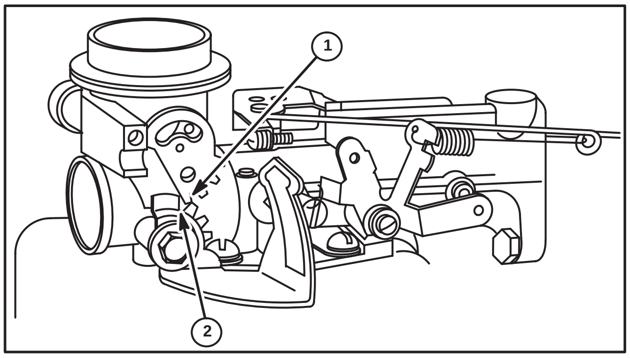


Fig. 82

Install Spiral

When inserting spiral, top must be flush to 1/32" (.8 mm) below carburetor flange (1), and spiral parallel with fuel tank mounting surface, Fig. 83.

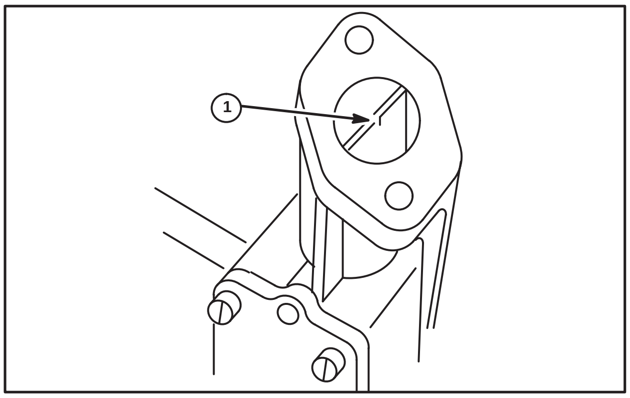


Fig. 83

Install Throttle Shaft and Plate
Cast Throttle Shaft

1. If Pulsa-Jet carburetor body had a throttle shaft seal, install new seal with sealing lip up.
2. Place new dust seal on throttle shaft (1) and install in carburetor body.
3. Install throttle plate (3) in carburetor body and install throttle plate screw (2), Fig. 84.
4. With pencil or similar tool (5), insert valve (4) and tighten Philips head screw (6), Fig. 84.

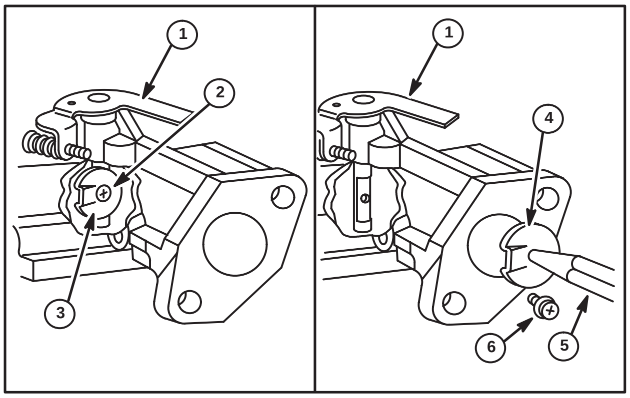


Fig. 84

Stamped Throttle Shaft

1. Press in new rubber throttle shaft seal with sealing lip down until seal bottoms.
2. Place new foam seal on throttle and insert shaft in carburetor body. Throttle plate is chamfered and has an identification letter stamped on one side of valve (1).
3. Place throttle plate in carburetor with stamped letter as shown in Fig. 85, and install throttle plate screw.

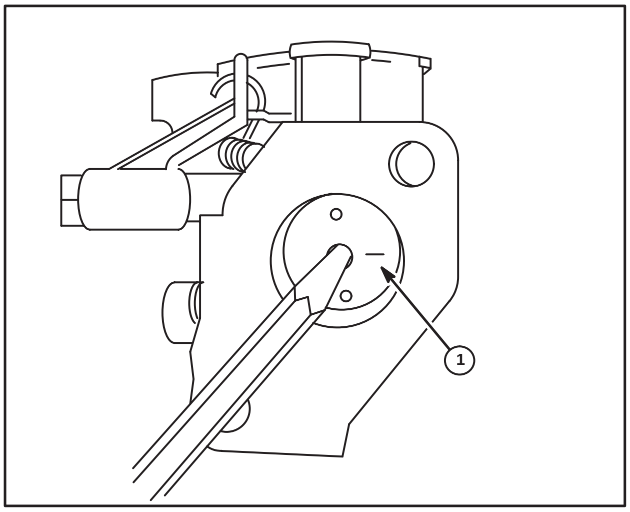


Fig. 85

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Vacu-Jet

1. Place new dust seal on throttle shaft and install in carburetor body.
2. Install throttle plate in carburetor body and install screws.

Install Choke Shaft and Plate (Pulsa-Jet)

1. Place metal washer (2) next to choke lever and then foam washer (1).
2. Insert shaft assembly in carburetor body with stop against remote control boss (3).
3. Insert choke plate in shaft with hole up (6) and indentations towards large welch plug (7), Fig. 86.

NOTE: On Choke-A-Matic® carburetors, be sure that both ends of choke spring are engaged before sliding shaft all the way into carburetor. Lever end (4), body end (5), Fig. 86.

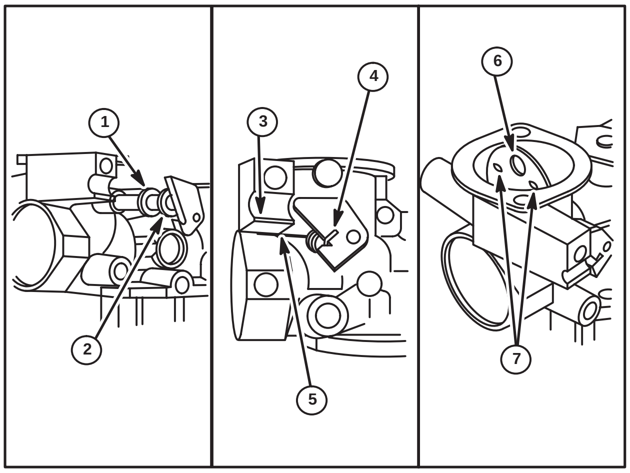


Fig. 86

Install Fuel Pick-Up Tube

Pulsa-Jet

Slide new retainer clip (1) onto brass pipe. Heat small end of new nylon tube in hot water and push onto brass pipe. Slide retaining clip onto nylon tube over groove (2) on brass pipe, Fig. 87.

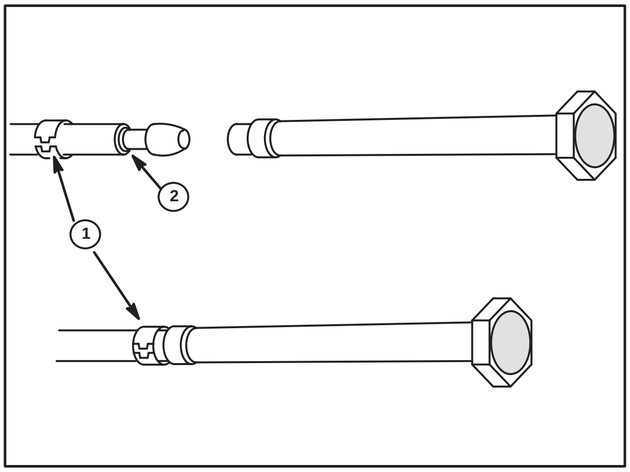


Fig. 87

Vacu-Jet

Thread fuel pick-up tube into carburetor body using a 9/16” wrench or socket (1), Fig. 88. No sealant is required on threads.

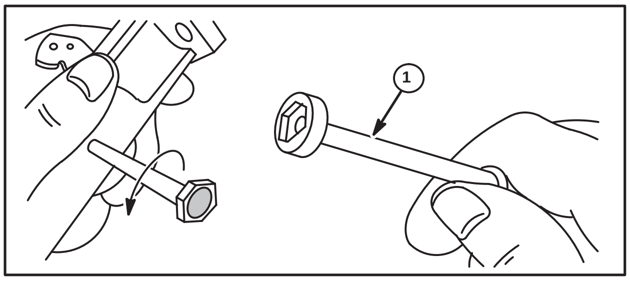


Fig. 88

Assemble Carburetor to Fuel Tank

1. Place new tank gasket on fuel tank.
2. Lower carburetor into fuel tank and install mounting screws closest to choke plate first. Fig. 62, Pulsa-Jet shown.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

3

Install Carburetor and Fuel Tank Rotary Choke (Pulsa-Jet)

1. Connect governor linkage to carburetor linkage and using Tool #19305, Offset Screwdriver, Tool #19391, Torx® Wrench, or open end wrench (2), install two screws (1) holding carburetor to engine, Fig. 89.
2. Install screw to bottom of fuel tank bracket (3).

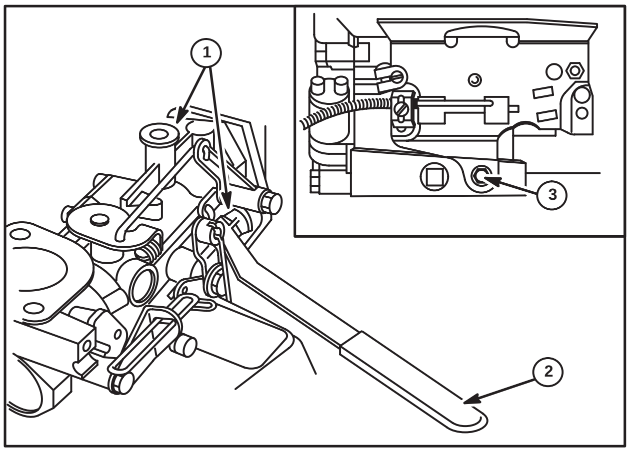


Fig. 89

Choke-A-Matic® with Slide Choke (Pulsa-Jet)

1. Install carburetor and tank as one assembly.
2. Hook throttle link (1) into carburetor throttle and governor blade.
3. Raise carburetor into place, insert a new gasket and fasten with mounting screws.
4. Install governor spring (2), Fig. 90.

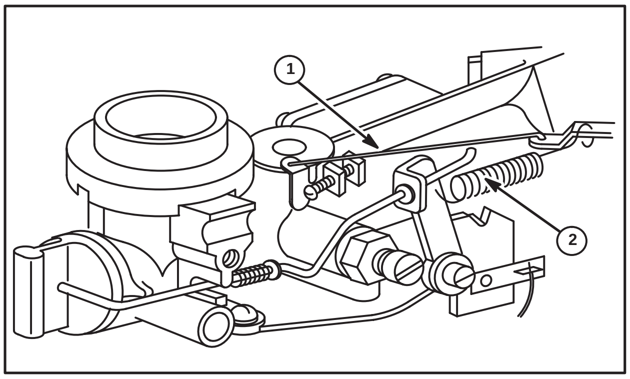


Fig. 90

5. If choke slide does not fully close (1), replace link or use flat nose pliers to bend choke link (2), Fig. 91 (do not over bend).
6. Speed adjustment lever must make good contact against stop switch (3) when moved to stop position.

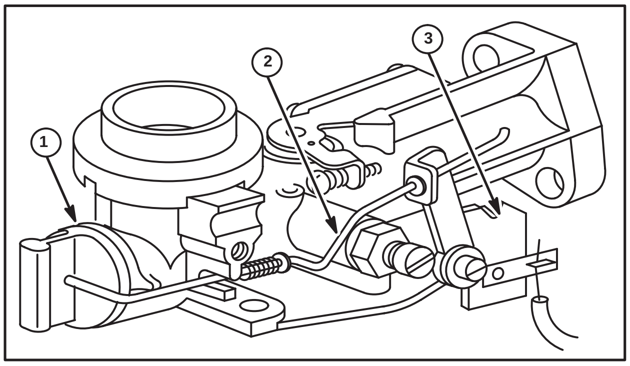


Fig. 91

Install Carburetor and Tank Assembly Model Series 60000, 80000, 110000, 130000 (Pulsa-Jet)

1. Install carburetor and fuel tank as an assembly.
2. Hook throttle link into carburetor throttle and governor lever. (For various hook-ups, see Remote Control, Section 4.)
3. Raise carburetor into place, insert a new gasket and fasten with mounting screws.
4. Install governor spring (1). Install stop wire (2) and remote control where used, Fig. 92.

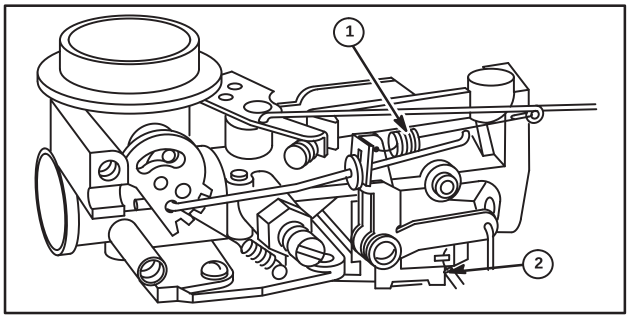


Fig. 92

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Vacu-Jet

1. Place new carburetor to cylinder gasket on carburetor and install carburetor on cylinder with two mounting screws.
2. Place new carburetor to fuel tank gasket on fuel tank and lift tank up against bottom of carburetor. Install two screws in carburetor and fuel tank.

Choke-A-Matic® Linkage

Adjust Choke-A-Matic® Linkage
Slide Choke

The following covers Choke-A-Matic® parts installed as a part of carburetor assembly. See Section 4 for Choke-A-Matic® remote controls.

1. To check operation of Choke-A-Matic® linkage, move speed adjustment lever to "CHOKE" position.
2. Install stop switch wire and remote control where used.

Install Control Panel
Model Series 91200, 92200, 94200
(with Type Numbers ending in A1 through A9 or E1 through E9)

1. Move throttle lever (top) to idle position and move choke lever (bottom) to full choke position, Fig. 93.
2. Install stop switch wire. Install choke link in choke lever and control panel choke (lower) lever.
3. Move choke shaft to full choke position.
4. Install governor spring on governor tang, Fig. 93.
5. Install control panel on fuel tank and carburetor assembly. Install two screws using T-20 Star Bit from Tool #19442, Star Bit Kit.

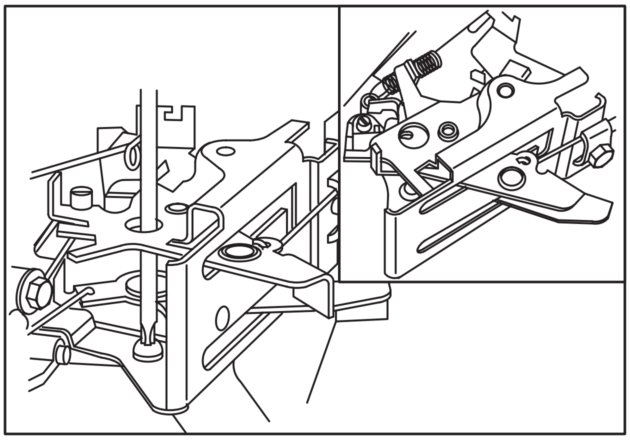


Fig. 93

NOTE: If engine is used with fixed adjustable controls, move throttle lever to TOP-NO-LOAD position and bend tang up to hold throttle lever.

Install Control Panel
Model Series 80200, 82200, 90200, 91200, 92200, 112200, 130200, 132200, 135200, 136200, 137200

1. Connect control linkage to control panel, when used and place control panel on fuel tank and carburetor.
2. Install and tighten two screws securely.

Carburetor Adjustment

NOTE: On low emission carburetors (engine with date codes ending in A1 through A9 or E1 through E9), only idle RPM adjustment is possible.

Initial Adjustment
(except Low Emissions Carburetors)

1. Turn needle valve clockwise until it makes light contact with the seat. DO NOT FORCE.
2. The initial setting of needle valve is made by turning out (counterclockwise) 1-1/2 turn. Final adjustment is made with engine running.
3. Install complete air cleaner assembly.

NOTE: When starting a Pulsa-Jet engine for first time, fill fuel tank completely full. This eliminates priming the fuel pump, thus ensuring a quick start.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

3

Final Adjustment

1. Start and run engine at half throttle for five minutes to bring engine up to operating temperature.
2. Place governor speed control lever in “FAST” position.
3. Turn needle valve in until engine misses (clockwise – lean mixture) then turn it out past smooth operation point until engine runs unevenly (counterclockwise – rich mixture).
4. Turn needle valve to midpoint between rich and lean so engine runs smoothly.

Final Adjustment, except Low Emissions Carburetors

1. Place equipment control lever in “SLOW” position.
2. Turn needle valve in until engine slows (clockwise – lean mixture).
3. Turn needle valve out past smooth operating point until engine runs unevenly (rich mixture).
4. Turn needle valve to midpoint between rich and lean so engine runs smoothly.
5. Adjust idle RPM. Rotate throttle shaft counterclockwise and hold against idle stop while adjusting idle speed adjusting screw to obtain 1750 RPM.
6. Hold throttle shaft in the idle position. Move speed control to fast position.
7. Release throttle shaft. Engine should accelerate without hesitation or sputtering.
8. If engine does not accelerate smoothly, carburetor should be readjusted, usually to a slightly richer mixture.

Final Adjustment, Low Emissions Carburetors (with Type Numbers ending in A1 through A9 or E1 through E9)

1. Start and run engine for five minutes to warm up engine before making final adjustments.
2. Place speed control in slow position.
3. Adjust idle RPM. Rotate throttle counterclockwise and hold against the idle stop while adjusting idle speed adjusting screw to obtain 1500 RPM.

   NOTE: Current production carburetors have a pilot jet. These can be identified by not having an idle mixture needle spring.

4. Release throttle and bend governed idle bracket (1) to obtain 1750 RPM, Fig. 94.

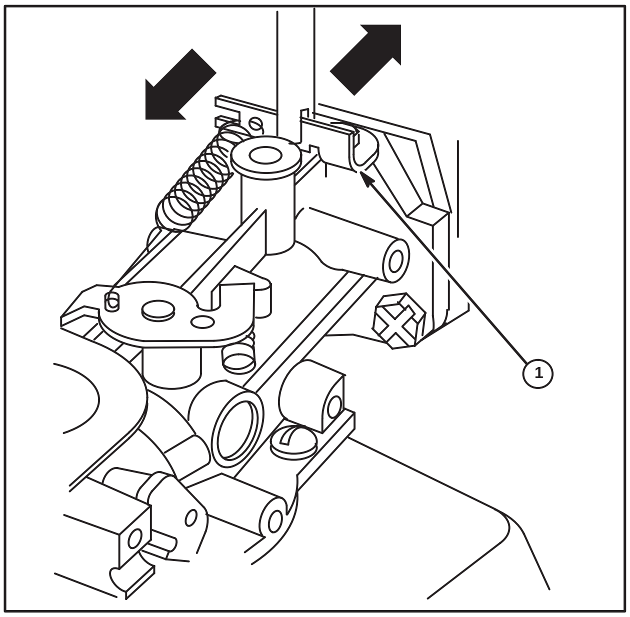


Fig. 94

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

LMS FLO-JET CARBURETORS (LMS, LMT)

NOTE: LMS and LMT Flo-Jet carburetors are combined in this section. Issues specific to individual models or types will be noted in the text and corresponding illustrations.

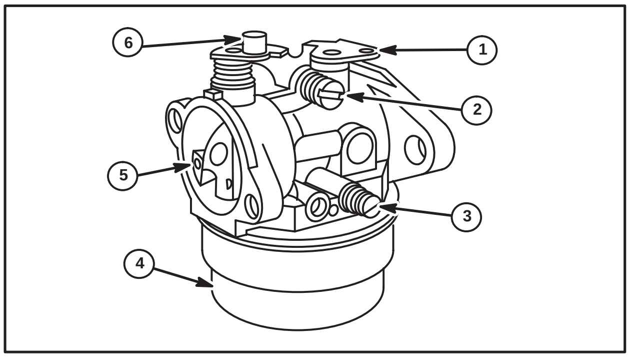


Fig. 95

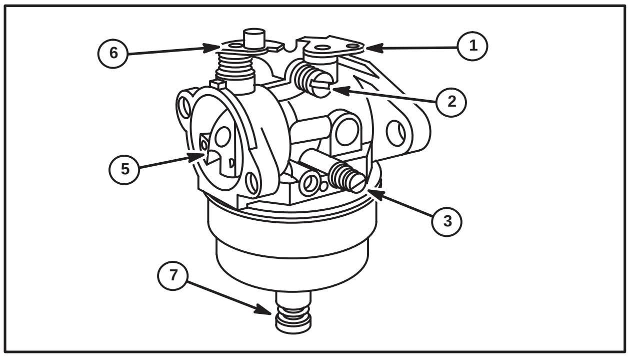


Fig. 96

LMS FLO-JET

Model Series 83400, 93400, 133400 Horizontal Crankshaft

Model Series 90700, 91700, 100700, 110700, 111700, 112700, 114700, 12A700 through 12W800, 121700 through 129800, 130700, 131700, 133700, 135700 Vertical Crankshaft

LMS Flo-Jet carburetors are made in three basic types: Fixed Orifice Main Jet (Fig. 95), Adjustable Main Jet (Fig. 96), and Fixed Main Jet with Dry Bulb Primer Systems, (Fig. 97).

Figs. 95, 96, and 97
Throttle lever (1)
Idle speed adjustment screw (2)
Idle mixture screw (3)
Float bowl (4)
Choke plate (5)
Choke lever (6)
Adjustable main jet (7)

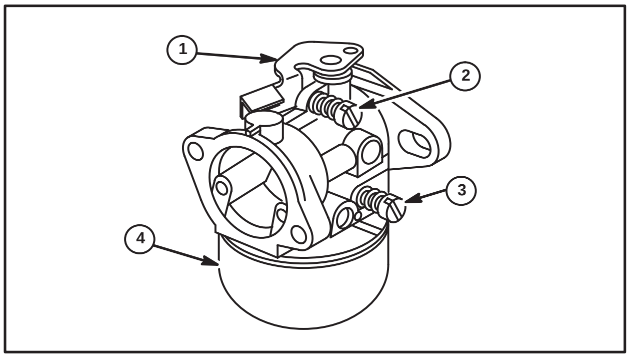


Fig. 97

LMT FLO-JET

Model Series 176400, 196400, 226400, 250400, 256400 Horizontal Crankshaft

Model Series 194700, 195700, 196700, 254700, 257700, 258700, 259700, 28A700 through 28M700 and 28R700, 28V700, 282700, 283700, 284700, 285700, 286700, 288700, 289700 Vertical Crankshaft

LMT carburetors have a Fixed Orifice Main Jet with Adjustable Idle Jet, Fig. 98. The different carburetors are identified as LMT 1 and up or by six (6) digit number. The letters LMT are cast into the body of the carburetor while the numbers are stamped into carburetor mounting flange next to idle mixture screw.

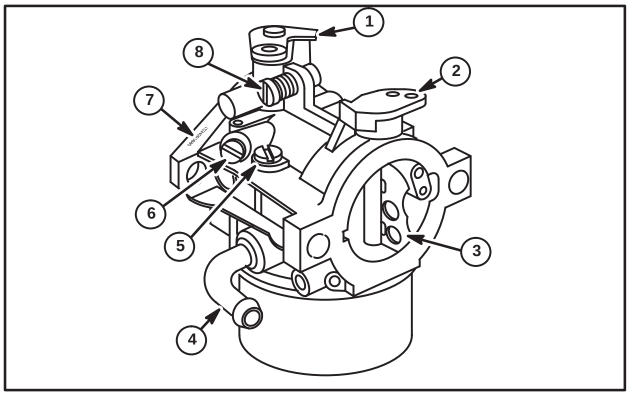


Fig. 98

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Disassemble Carburetor

NOTE: Low emission carburetors do not have an idle mixture needle valve and spring.

1. Remove main jet/fuel bowl nut and fiber washer.
2. Remove float bowl and bowl gasket from carburetor.

NOTE: On Model Series 120000 engines bowl nut may incorporate the fixed main jet.

3. Remove float hinge pin, float, and inlet valve (4).
4. Remove idle mixture screw with spring (6) and idle speed screw with spring (8). (Remove mixture screw limiter cap, if so equipped.) Fig. 98. Pilot jet (5), I.D. number (7), Fig. 98.
5. Rotate throttle shaft (1) to closed position and remove throttle plate screw(s).
6. Remove throttle plate and throttle shaft with foam seal.
7. Remove rubber throttle shaft seal from carburetor body. (LMT)
8. With a modified 5/32 inch (9.39 mm) pin punch (2), remove welch plug(s) (1) from carburetor body, Fig. 99.

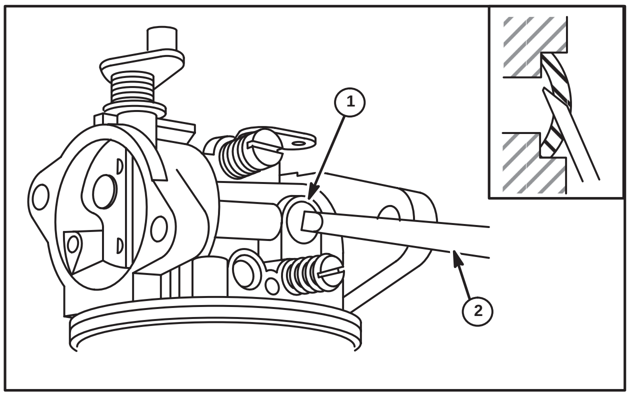


Fig. 99

Choke Shafts

LMS, LMT Flo-Jet carburetors are equipped with two styles of choke shafts:

a. Plastic shaft (2) with snap in choke plate (3)
b. Metal shaft (2) with screw mounted choke plate (3), Fig. 98.

Remove Plastic Choke Shaft and Plate (LMS, LMT)

1. Pull choke plate out of choke shaft and lever.
2. Remove choke shaft and lever, return spring, and foam washer.

Remove Metal Choke Shaft and Plate (LMT)

1. Rotate choke shaft and lever to closed position.

NOTE: Service replacement carburetors may have a spring detent that will hold choke in closed position.

2. Hold choke closed and remove two screws holding choke plate.
3. Release tension on choke shaft and remove choke shaft and lever, return spring and seal assembly.

Remove Fuel Inlet Seat

LMS, LMT Flo-Jet Carburetors were manufactured with two basic types of fuel inlet seats. One type featured a replaceable Viton seat used with a metal-tipped float needle. The other type featured a pressed-in metal seat used with a Viton-tipped float needle.

To remove the replaceable Viton seat, use a small crochet hook (or similar tool), and hook/lift out the old seat. Some carburetor models equipped with a Viton seat also have a serviceable metal pressed-in seat beneath. Consult Illustrated Parts List for application and service as below.

To remove the pressed-in metal seat:

1. Use self-threading screw Part #93029 from Tool #19165, Flywheel Puller, or 1/4-20 tap.
2. Thread screw or tap into fuel inlet seat 3-4 turns and remove tool (1), Fig. 100.

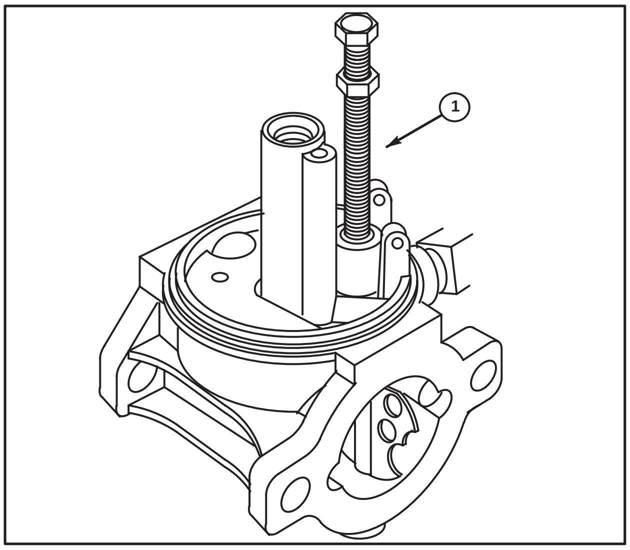


Fig. 100

3. Place 1/4” x 20 nut (1), Part #92278, and washer (2), Part #224061 from 19332, Tool Kit, onto puller screw.
4. Place a 1/4” drive 3/8” socket (3) over fuel inlet seat.
5. Insert puller screw through socket into tapped inlet seat and turn in until screw bottoms.
6. Thread nut against washer/socket and tighten nut to pull out seat, Fig. 101.

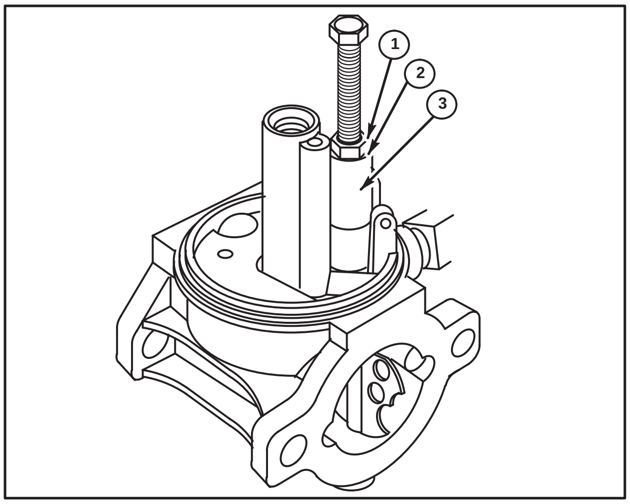


Fig. 101

Remove Pilot Jet Threaded Style (LMT)

Using a flat blade screwdriver, remove brass pilot jet (1) from carburetor body, Fig. 102.

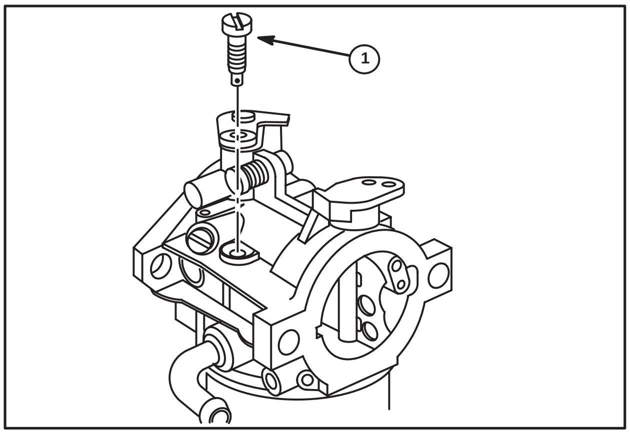


Fig. 102

3

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

NOTE: Some Low Emission LMT carburetors have pressed in pilot jets (1) that are not removable. DO NOT remove the pressed in style pilot jet, Fig. 103.

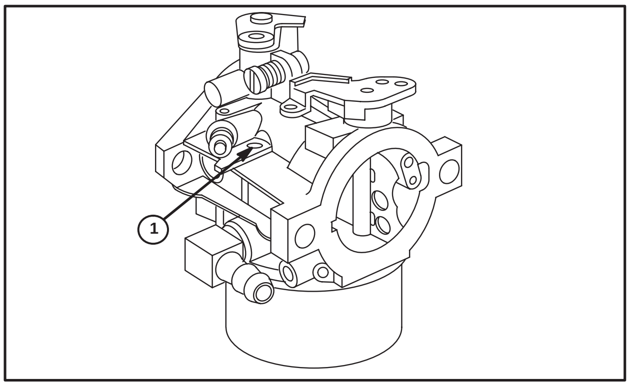


Fig. 103

3

Remove Emulsion Tube (LMT)

Using Tool #19280, Carburetor Screwdriver, remove main carburetor emulsion tube (1), Fig. 104.

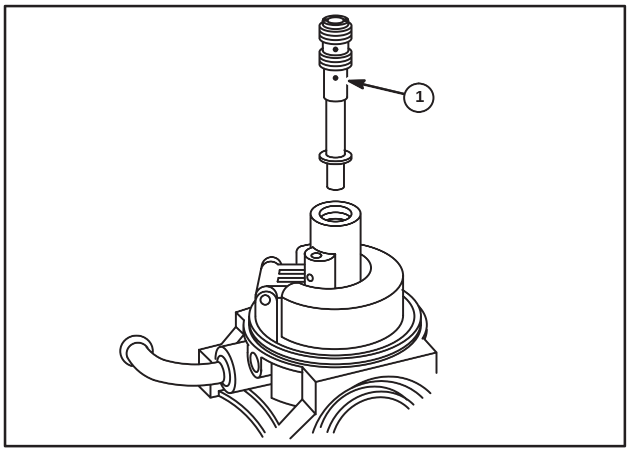


Fig. 104

Inspect Carburetor

Inspect all components for wear, damage, cracks, or plugged openings. Replace components if any of the above conditions exist. Use only compressed air and solvents to clear plugged openings.

Inspect idle mixture needle for bent needle point or a groove in tip of needle. Replace if bent or grooved.

Inspect threaded type pilot jet and passages for debris and dirt (LMT).

High Altitude Compensation

Engines set up for low altitude operation may experience a decrease in performance if operated at high altitudes.

For Engines:
LMS 1 through LMS-15, LMS-21, 22, 24, 28, 29, 30, 36
LMS 25, 26, 27, 31, 32, 34, 35, 37 and up

If poor performance is experienced refer to Table No. 5, Page 64 or Table No. 6, Page 65, Specifications, by basic Model Number and carburetor I.D. number, and remove main air bleed jet (1), Fig. 105, or fixed main jet (2), Fig. 106. If carburetor I.D. number is not found, go to "Illustrated Parts List" by Model and Type number.

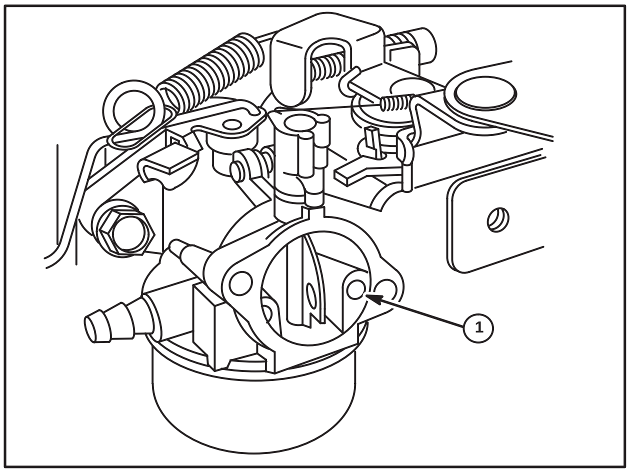


Fig. 105

LMT

High altitude kits are available, consisting of a new pilot jet, emulsion tube and side main jet, or a new emulsion tube with main jet. See "Illustrated Parts List" by Model Series and type for correct kit part number.

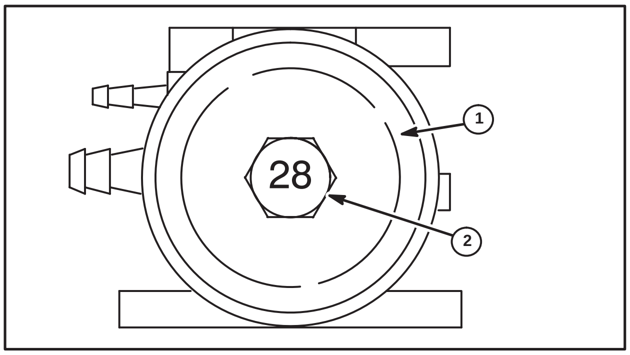


Fig. 106

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Assemble Carburetor

Install Welch Plug

1. Install welch plug(s) (1) with pin punch (2) slightly smaller than outside diameter of plug.
2. Press in until plug is flat. DO NOT cave in plug.
3. After plug is installed, seal outside edge of plug with fingernail polish or non-hardening sealant, Fig. 107.

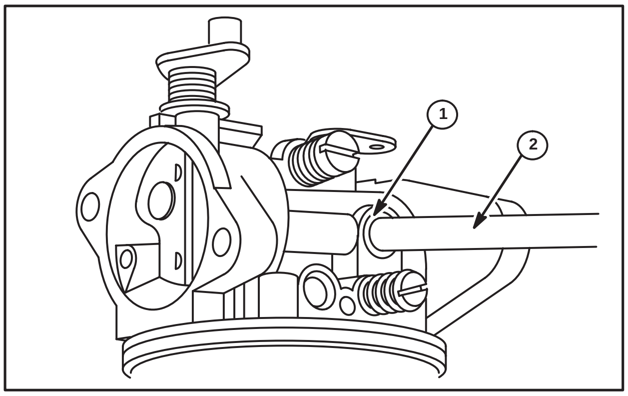


Fig. 107

Install Fuel Inlet Seat

Viton Seat

These carburetors are equipped with a tan or black inlet valve seat for gravity feed fuel systems and a brown inlet valve seat for fuel pump feed fuel systems. Both seats are installed the same way.

1. Be sure inlet valve seat area is clean.
2. Install inlet needle seat with GROOVE DOWN using Tool #19057, Bushing Driver (1), until seated in groove (2), LMS shown, Fig. 108.
3. Check to be sure that inlet seat is fully seated.

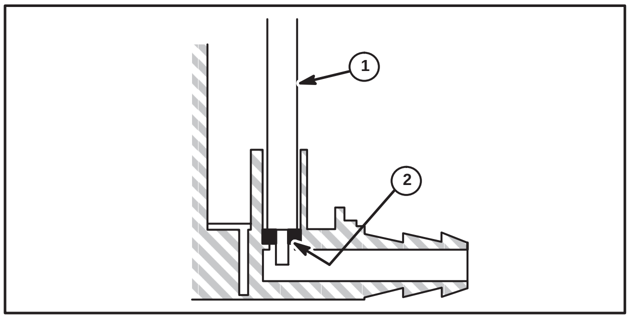


Fig. 108

Replaceable Metal Seat

Press fuel inlet seat (1) in until flush with surface shown in (2), Fig. 109.

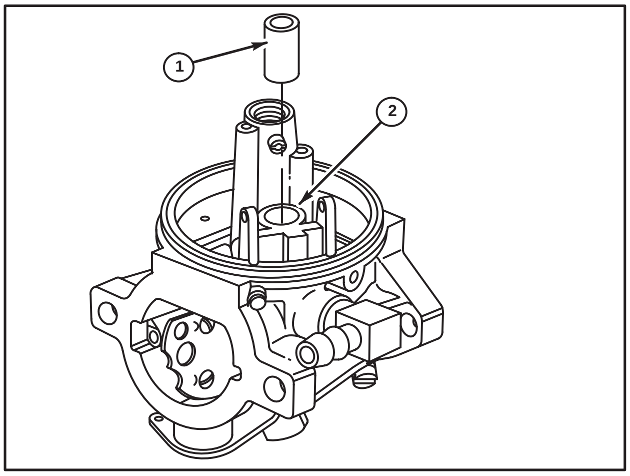


Fig. 109

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

3

Install Choke Shaft and Plate LMS Models (Return Spring on Lever)

1. Install choke shaft (1) and felt washer (2).
2. Rotate choke shaft lever as shown in Fig. 110.
3. Insert choke plate in slot of choke shaft until valve is centered on choke shaft with dimples (3) toward main air jet (4).

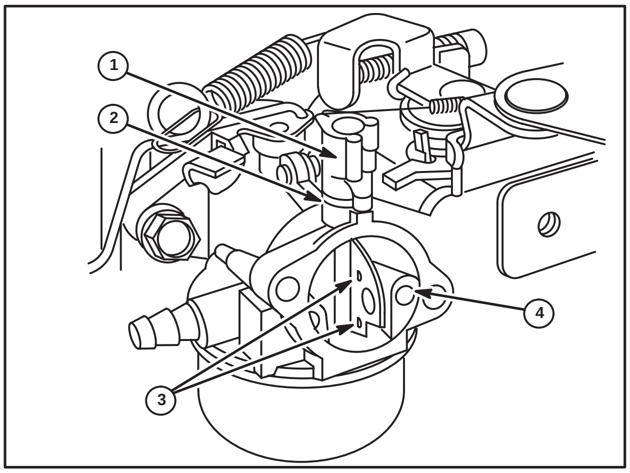


Fig. 110

(Return Spring on Shaft)

1. Install choke shaft, return spring (1), and felt washer (3).
2. Rotate choke shaft counterclockwise until arm on shaft is approximately 90° to carburetor bore.
3. Insert choke plate so numbers will be visible when choke is closed, (2), Fig. 111.

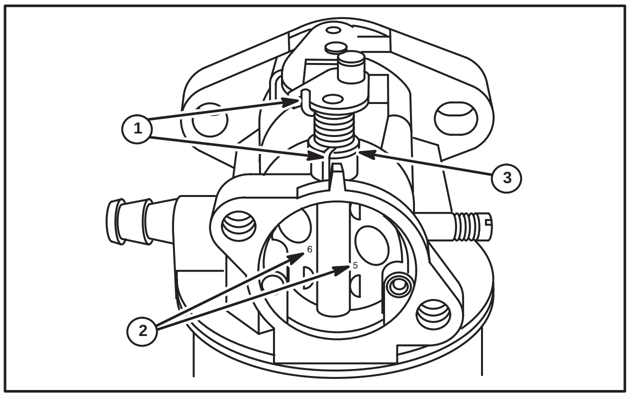


Fig. 111

(Manual Choke, Typical)

Install foam seal and choke shaft in carburetor body with choke plate detent (1) against detent spring (2), (Low Emissions type shown) Fig. 112.

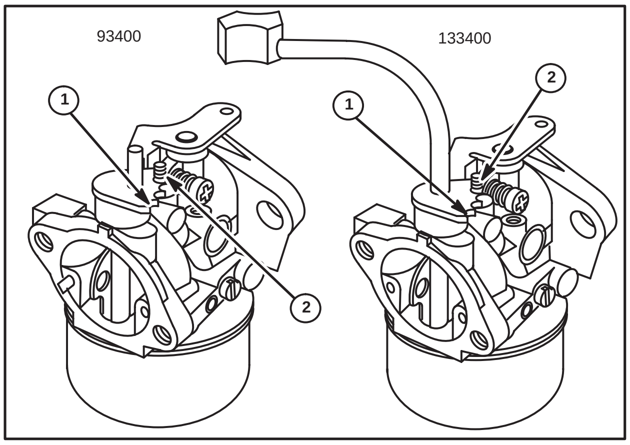


Fig. 112

LMT Models
(Plastic Choke Shaft and Plate)

1. Insert spring inside large foam seal and slide seal and spring onto choke shaft with straight end of spring up toward choke shaft lever (3).
2. Insert choke shaft into carburetor body until hook of spring hooks on spring anchor (1).
3. Lift choke shaft and lever up slightly and turn counterclockwise until stop on lever (2) clears spring anchor (1) and push shaft down, Fig. 113.
4. Insert choke plate (4) into choke shaft and lever with dimples (5) toward fuel inlet (6) side of carburetor. Dimples help to hold and align choke plate on shaft.

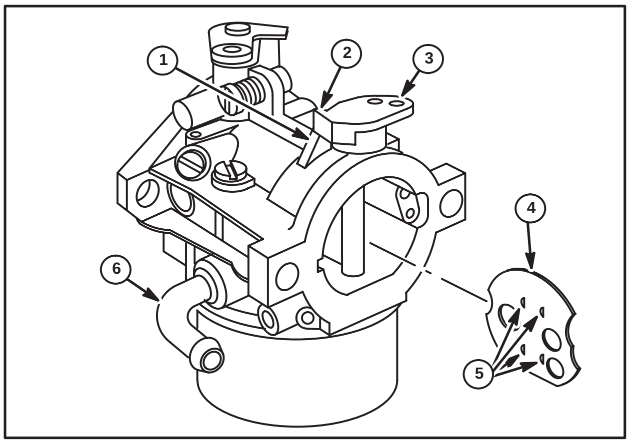


Fig. 113

(Metal Choke Shaft and Plate)

1. Install foam seal and return spring on choke shaft hooking small hook (1) in notch on choke lever, Fig. 114, inset.
2. Insert choke shaft assembly into carburetor body and engage large end of return spring on boss.
3. If carburetor has spring detent, guide detent spring (2) into slot on choke shaft lever (4).
4. Place choke plate (5) on shaft with single notch on edge towards fuel inlet. Two half moon dimples will help to position valve on shaft.

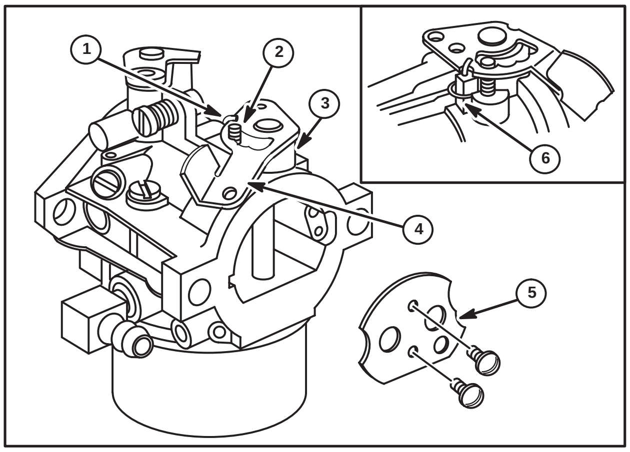


Fig. 114

Install Throttle Shaft

1. Install throttle shaft seal (2) with sealing lip down in carburetor body until top of seal is flush with top of carburetor (LMT), Fig. 115.
2. Install throttle shaft and small foam washer (1).
3. Turn shaft until flat is facing out.
4. Lay throttle plate (3) on shaft with numbers (4) facing out and install screw (LMS).
5. Lay throttle plate on shaft with numbers (4) toward idle mixture screw and dimples facing in, resting on edge of shaft. Install two screws (LMT shown), Fig. 115.

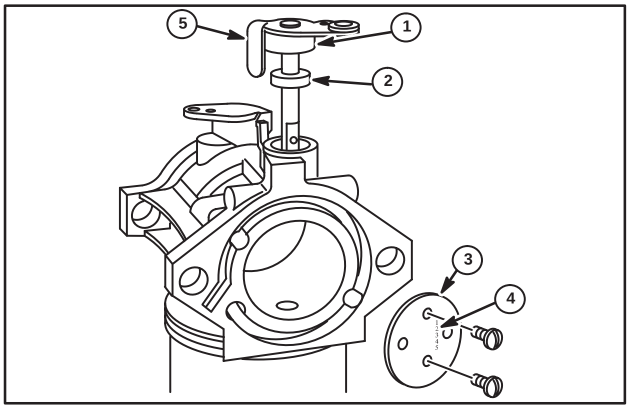


Fig. 115

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

3

Install Emulsion Tube

1. Install emulsion tube (1) using Tool #19280, Carburetor Screwdriver, until emulsion tube seats, Fig. 116. Float (2), hinge pin (3), Fig. 116.
2. After installing emulsion tube, use compressed air to blow out any chips or debris that may have been loosened while installing emulsion tube.

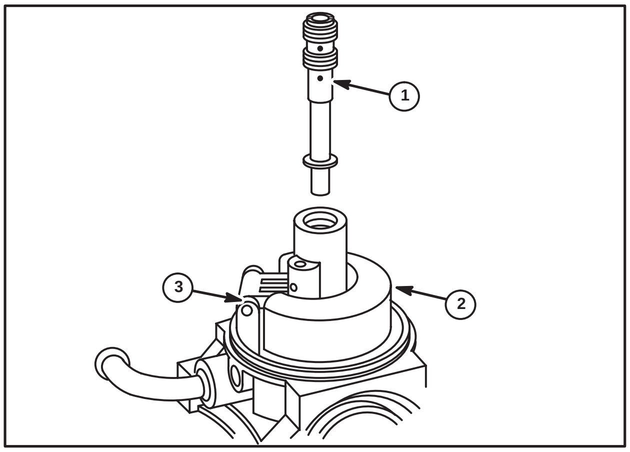


Fig. 116

Install Inlet Needle and Float

1. Insert inlet needle on float and install assembly on carburetor body.
2. Insert float hinge pin and center pin. Float height is non-adjustable.
3. Install rubber gasket on carburetor and lay float bowl on body.
4. Place fiber washer over bowl nut hole and install main jet/bowl nut or bowl screw.
5. Tighten nut to 50 in. lbs. (6 Nm) torque (LMS).
6. Tighten screw to 40 in. lbs. (4.5 Nm).

Install Pilot Jet Threaded Style (LMT)

Install pilot jet until it seats securely, Fig. 102.

Install Carburetor Elbow (LMT)

- If carburetor elbow was removed, place new gasket and elbow on intake port and torque screws to 100 in. lbs. (11 Nm).

Install Carburetor to Elbow (LMT)

1. Place two studs on carburetor and new gasket on studs with long edge on side of gasket opposite fuel inlet.
2. Hook governor link spring in throttle lever hole without grommet.
3. Hook governor link in throttle lever hole with grommet, with link on top of lever.

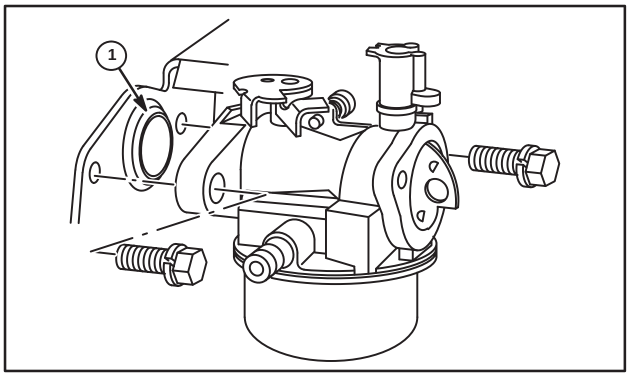


Fig. 117

Install Carburetor (LMS)

Place fuel intake pipe seal in chamfer of carburetor (1) and install carburetor with two mounting screws torquing screws to 75 in. lbs. (9 Nm), Fig. 117.

Install Air Cleaner (LMS)

1. Install carburetor back plate with two sealant coated screws (1) into carburetor. Do not tighten at this time.
2. Then install third screw (2) but do not tighten.
3. Torque two screws into carburetor to 40 in. lbs. (5 Nm).
4. Torque remaining screw to 40 in. lbs. (5 Nm), Fig. 118.

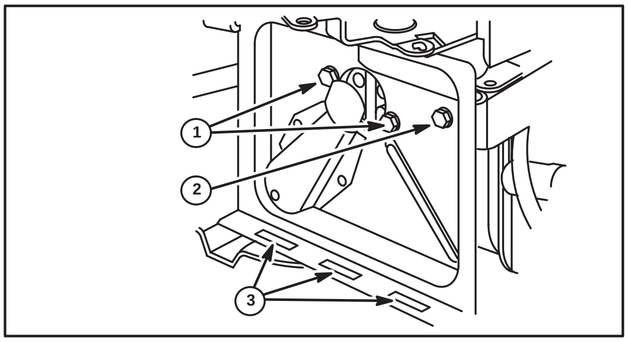


Fig. 118

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

NOTE: On Choke-A-Matic® carburetors install spring on choke shaft as shown in Fig. 110.

5. Install air cleaner cartridge, Pre-Cleaner (optional) and cover making sure that three tabs engage three slots in back plate.

Install Choke-A-Matic® Link (LMT) Horizontal Control Plate

1. Insert “Z” bend of link (2) in outer hole of choke lever from bottom of lever (4).
2. Slide “U” bend of link (1) into slot on governor control bracket and place carburetor on intake elbow.
3. Torque studs(3) to 65 in. lbs. (7 Nm), Fig. 119.

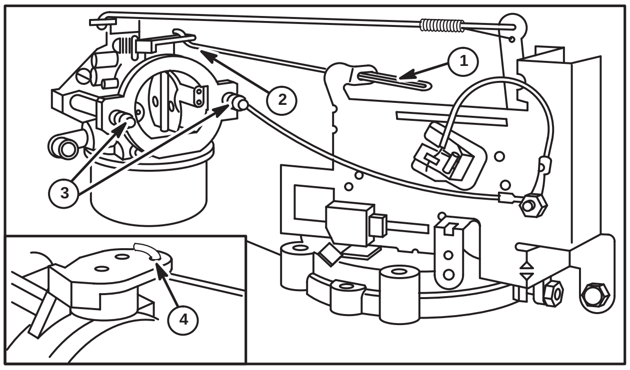


Fig. 119

Vertical Control Plate

1. Insert “Z” bend of link (1) in inner hole of choke lever from bottom of lever (3), Fig. 120.
2. Slide “U” bend of link into slot on governor control bracket and place carburetor on intake elbow.
3. Torque studs to 65 in. lbs. (7 Nm), Fig. 120.
4. Install air cleaner body and torque nuts to 55 in. lbs. (6 Nm).
5. Be sure breather tube is on air cleaner body opening.
6. Install air cleaner brace.

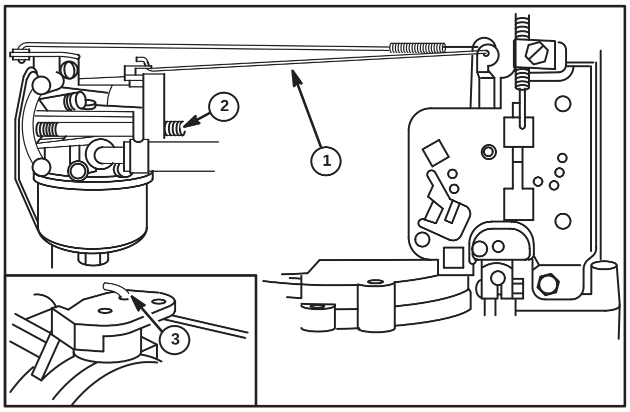


Fig. 120

Carburetor Adjustment

Initial Adjustment

1. Install idle mixture screw and spring.
2. Turn screw in until it just touches needle seat.
3. Back out (counterclockwise) 1-1/4 to 1-1/2 turn.

NOTE: On carburetors with adjustable main jet needle, turn main jet adjustment needle clockwise until it just touches needle seat. Then back off 1-1/4 turn.

Final Adjustment

NOTE: On carburetors with an adjustable main jet, move speed control to fast position. Adjust main jet mixture needle same as idle mixture screw.

1. Start and run engine for 5 minutes at 1/2 throttle to bring engine up to operating temperature.
2. Move equipment speed control to idle position.

3. Turn idle speed screw to obtain 1750 RPM minimum.
4. Turn idle mixture screw clockwise slowly until engine just begins to slow.
5. Then turn screw opposite direction until engine just begins to slow.
6. Turn screw back to midpoint.
7. Install limiter cap (1) at midpoint position, when used, Fig. 121.
8. Move equipment speed control from idle to high speed position.
9. Engine should accelerate smoothly.
10. If the engine stumbles or hesitates, open idle mixture needle screw 1/8 turn.

NOTE: If engine is equipped with a governed idle system, reset idle speed screw to 1200 RPM.

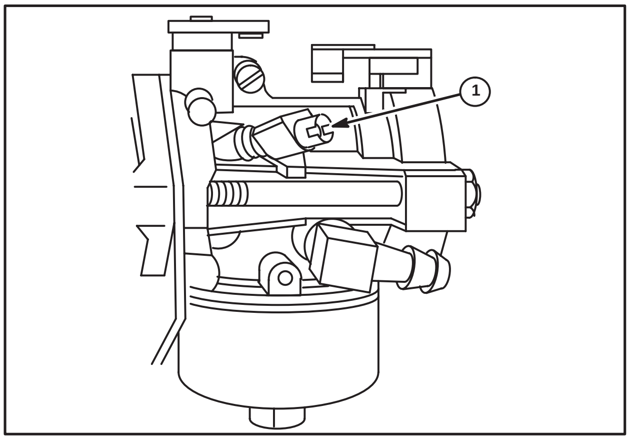


Fig. 121

FLO-JET CARBURETORS (ONE-PIECE, TWO-PIECE AND CROSSOVER)

NOTE: One-Piece, Two-Piece and Cross-Over Flo-Jet carburetors carburetors are combined in this section. Issues specific to individual models or types will be noted in the text and corresponding illustrations.

ONE-PIECE FLO-JET
Vertical Crankshaft

The small One-Piece Flo-Jet carburetor is illustrated in Fig. 122 and was used on early Model Series 170700. These are float feed carburetors with adjustable orifice main jet needle valve and adjustable idle circuit needle valve located on top of carburetor.
Main jet needle valve (1)
Idle mixture needle valve (2)
Throttle lever (3)
Idle speed adjusting screw (4)
Fuel inlet (5)
Choke lever (6)
Fig. 122

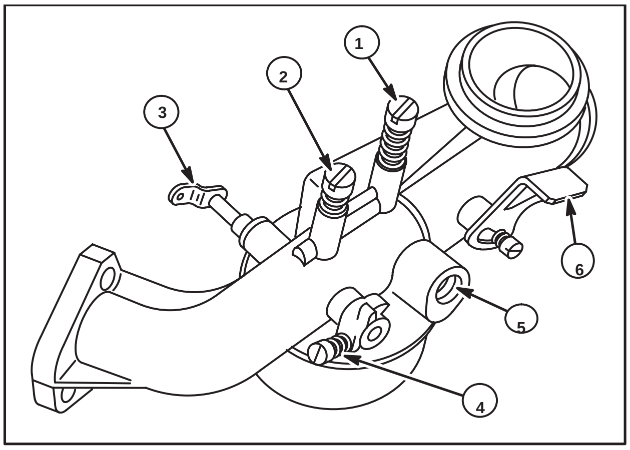


Fig. 122

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

The large One-Piece Flo-Jet carburetor is similar to the small One-Piece Flo-Jet. The main difference is that the main jet needle valve (1) is below fuel bowl, Fig. 123.

Repair procedures for small and large One-Piece Flo-Jet carburetors are similar except for location of adjusting needles.

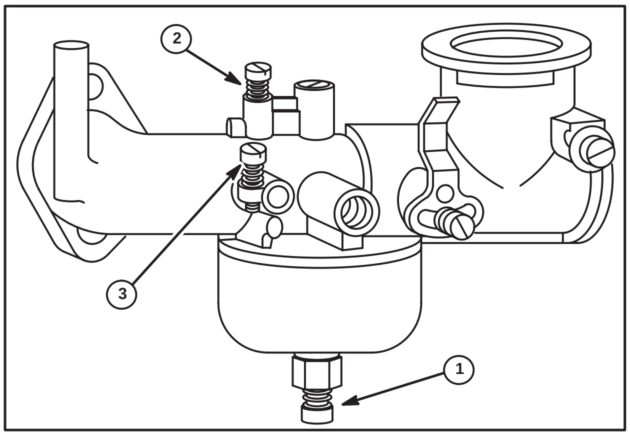


Fig. 123

TWO-PIECE FLO-JET (SMALL, MEDIUM AND LARGE)

Figs. 124, 125, and 126 illustrate the three sizes of Two-Piece Flo-Jets used on Briggs & Stratton engines.

Fig. 124
Main jet needle valve (1)
Idle speed adjustment screw (2)
Idle circuit needle valve (3)
Choke lever (4)

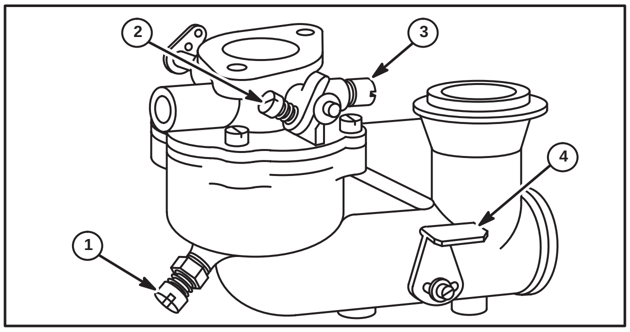


Fig. 124

Fig. 125
Main jet needle valve (1)
Idle speed adjustment screw (2)
Idle circuit needle valve (3)
Choke lever (4)

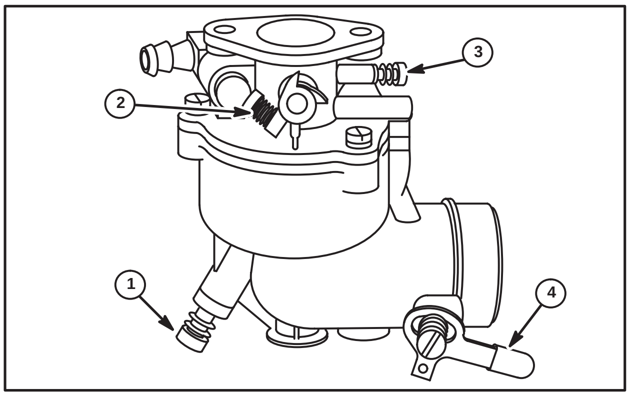


Fig. 125

Fig. 126
Main jet needle valve (1) – (turn as directed to richen)
Idle speed adjusting screw (2)
Idle mixture screw (3) – (turn as indicated to open)
Choke (4)

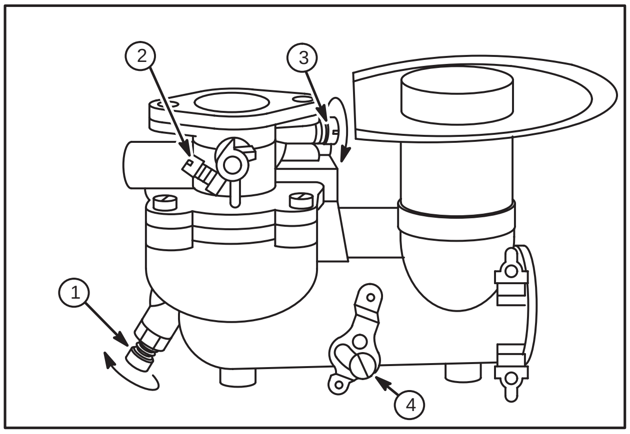


Fig. 126

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

CROSS-OVER FLO-JET HORIZONTAL CRANKSHAFT ENGINES

The cross-over Flo-Jet carburetor is used on Model Series 253400, 255400 engines and is a float type carburetor with idle circuit and main jet adjustment needles. This carburetor also has an integral fuel pump. All adjustments can be made from top of carburetor, Figs. 127 and 128.

Fig. 127
Main jet needle valve (1)
Idle needle valve (2)
Idle speed adjustment (3)
Throttle lever (4)

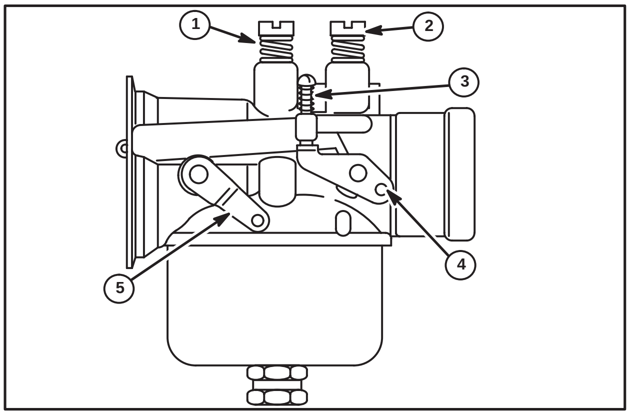


Fig. 127

Disassemble Cross-Over Flo-Jet (Fig. 128)

Fig. 128 (Sectional view)
Main jet needle valve (1)
Venturi (2)
Choke plate (3)
Float (4)
Main emulsion tube (5)
Float bowl nut (6)
Float bowl (7)
Throttle plate (8)
Idle mixture needle (9)

1. Remove idle and main jet adjustment needle valves.
2. Remove float bowl mounting screw, washer and float bowl.
3. Using a large blunt screwdriver, remove emulsion tube.
4. Use screwdriver to remove two screws from choke shaft.
5. Use screwdriver to remove screw from throttle shaft.
6. Remove throttle plate and throttle shaft.
7. Remove fuel pump from carburetor taking care not to lose pump flapper valve springs.
8. Use screwdriver to remove three screws from fuel pump body.

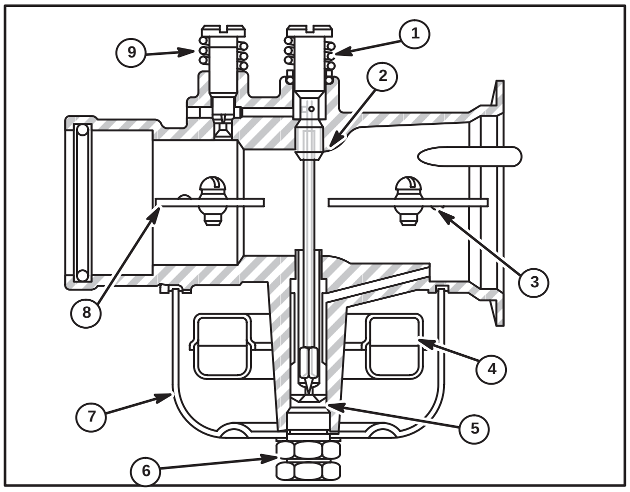


Fig. 128

Disassemble Carburetor Small One-Piece Flo-Jet

1. Remove idle (2) and main jet needle valves (1), Fig. 129.
2. Remove bowl nut (7) and fuel bowl (8).
3. Remove float pin to remove float and inlet needle
4. Use a large wide screwdriver to remove inlet valve seat.

Fig. 129
Throttle plate (3)
Gaskets (4)
Float (5)
Emulsion tube (6)
Choke plate (9)
Venturi (10)

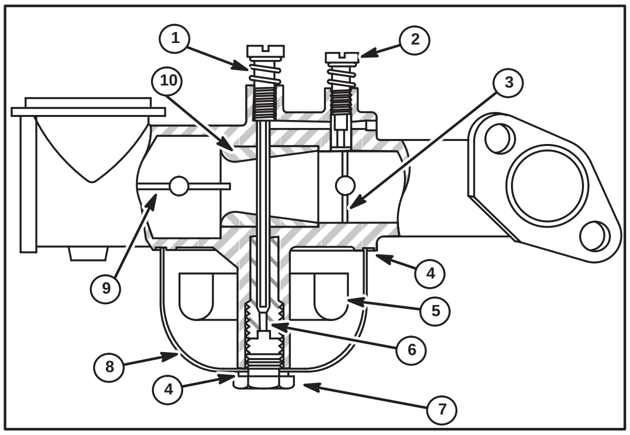


Fig. 129

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

5. Small one-piece Flo-Jet (A): Use Tool #19280, Carburetor Screwdriver, to remove emulsion tube (3), Fig. 130 A.

Fig. 130
Main jet needle (1)
Venturi (2)
Emulsion tube (3)

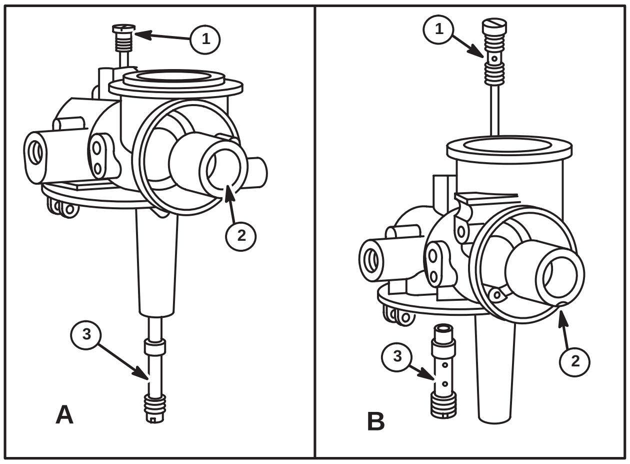


Fig. 130

Large One-Piece Flo-Jet

1. Remove idle circuit needle valve (1), Fig. 131.
2. Remove main jet needle valve assembly (4) from float bowl and remove fuel bowl.
3. Use Tool #19280, Carburetor Screwdriver, to remove emulsion tube (5), then remove jet from top of carburetor.
4. Remove float pin to remove float (6) and inlet needle.

Fig. 131
Throttle plate (2)
Gaskets (3)
Choke plate (7)
Venturi (8)
Idle circuit emulsion tube (9)

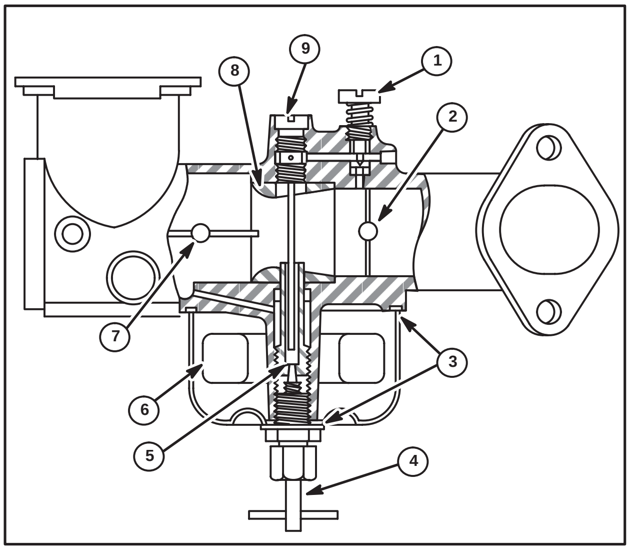


Fig. 131

Small and Large One-Piece Flo-Jet

If necessary to remove choke shaft, venturi, or throttle shaft, proceed in following sequence, Fig. 132.

1. Pry out welch plug (A, 1).
2. Insert sharp tool under choke shaft (B, 2), then pull out choke valve with pliers, remove screw, spring, and washer, and pull out nylon choke shaft (3).
3. Venturi can now be removed, Fig. 130. (Large One-Piece Choke-A-Matic® carburetors have a choke plate stop pin which must be pulled out to remove venturi.)
4. Remove throttle shaft seals, when so equipped.

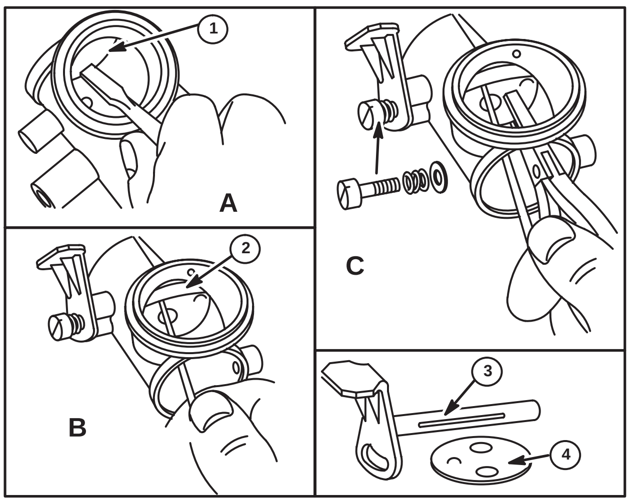


Fig. 132

3

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

3

Disassemble Two-Piece Flo-Jet

1. Remove idle circuit needle valve (2).
2. On early small model, loosen main jet needle valve packing nut (6, 7). Remove packing nut and main jet needle valve together. On all current models, remove main jet needle valve assembly.
3. Remove emulsion tube (8) with Tool #19280, Carburetor Screwdriver. Use of Tool #19280 will help to prevent damage to threads in lower carburetor body.

   NOTE: If threads have been damaged in lower carburetor body, use Tool #19245, Tap Set, to clean threads.
4. Because emulsion tube (8) projects diagonally into a recess in upper body, it must be removed before separating upper and lower bodies, Fig. 133.
5. Remove screws holding upper and lower bodies together and separate the two bodies.
6. Remove float pin and remove float and inlet needle as an assembly (9, 10).
7. With a wide blade screwdriver that completely fills slot, remove inlet seat (11).

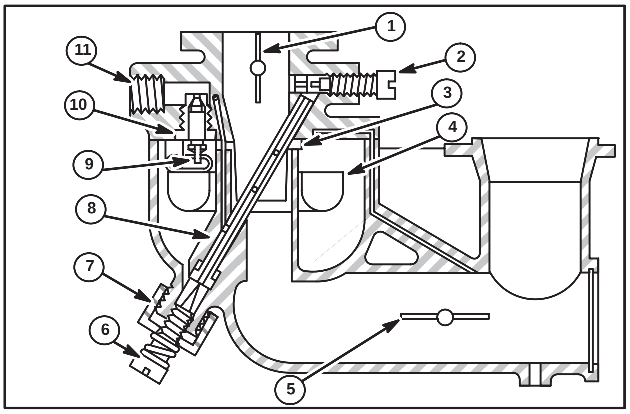


Fig. 133

8. On carburetors with pressed in seats, see “Replacing Pressed in Fuel inlet Seats,” page 42, this Section.
9. Remove float hinge pin, float and inlet needle.
10. Remove choke plate and choke shaft.

On small two-piece Flo-Jets, venturi (3) is a separate part and can be slipped out of lower body.

Some two piece Flo-Jets have a welch plug and it should be removed only if choke shaft or choke plate (5) is going to be removed. Some carburetors have a nylon choke shaft. Remove as shown, Fig. 134 – A. Pry out welch plug. B. Insert sharp tool under choke shaft (2). C. Pull out choke plate (4) with pliers, remove screw, spring, and washer, pull out nylon choke shaft (3).

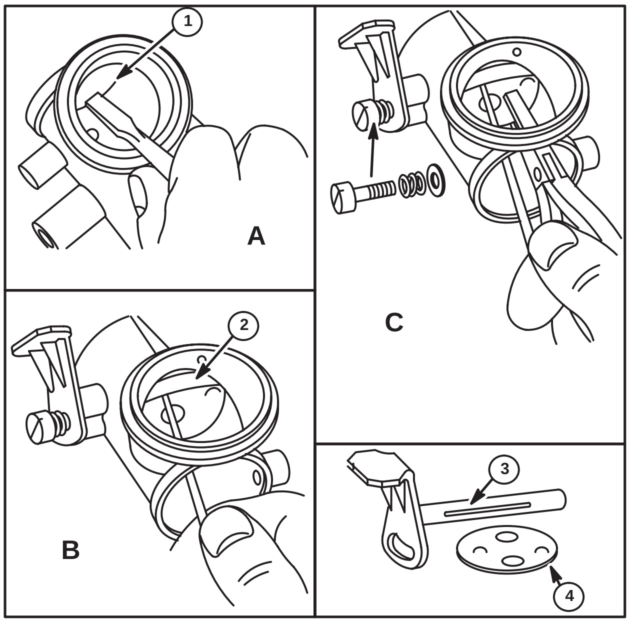


Fig. 134

Inspection

Reject idle and main jet needle valves if damaged (B), Fig. 135.

Check float for leakage. If it contains fuel or is crushed, it must be replaced. Replace float needle, if grooved (4), bent (5) or worn. Replace inlet seat if damaged and serviceable. On Cross-Over Flo-Jet, check pump body for cracks or distortion and replace if damaged.

Fig. 135 – A
Large Flo-Jet main jet (1)
Small Flo-Jet main jet (2)
Idle needle (3)

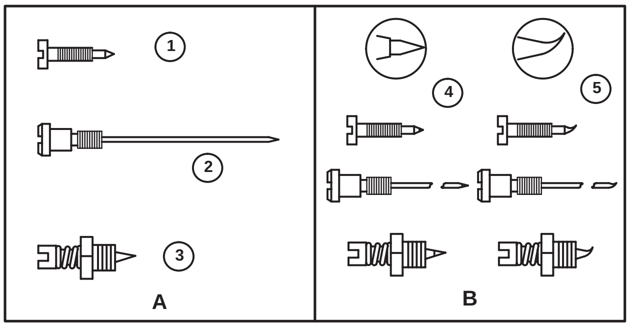


Fig. 135

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Throttle Shaft, Plate and Bushings (Typical)

Excessive wear of the throttle shaft and/or throttle shaft bushings can contribute to poor engine performance.

Check Throttle Shaft and Bushings for Wear

1. Wear between throttle shaft and bushings should not exceed .010” (.25 mm).
2. Check wear by placing a short iron bar on upper carburetor body as shown in Fig. 136.
3. Measure distance between bar and shaft with feeler gauge (1) while holding shaft down and then holding shaft up.
4. If difference is over .010” (.25 mm), either upper body should be rebushed, throttle shaft replaced, or both.
5. Wear on throttle shaft can be checked by comparing worn and unworn portions of shaft.
6. To replace bushings, see next.

Throttle shaft should be removed only when necessary to replace throttle shaft and/or bushings.

To remove throttle shaft, use a thin punch (1) to drive out pin (2) holding throttle stop to shaft, remove throttle plate, then pull out shaft, Fig. 137.

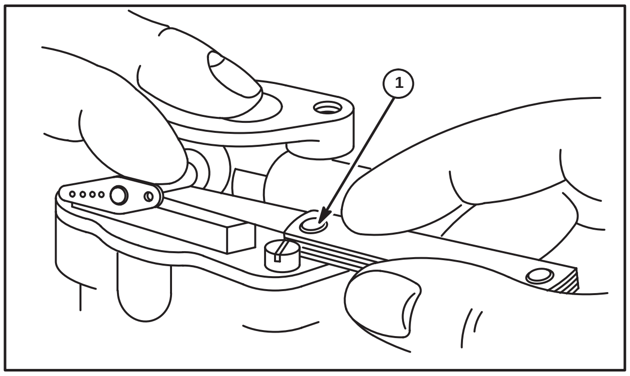


Fig. 136

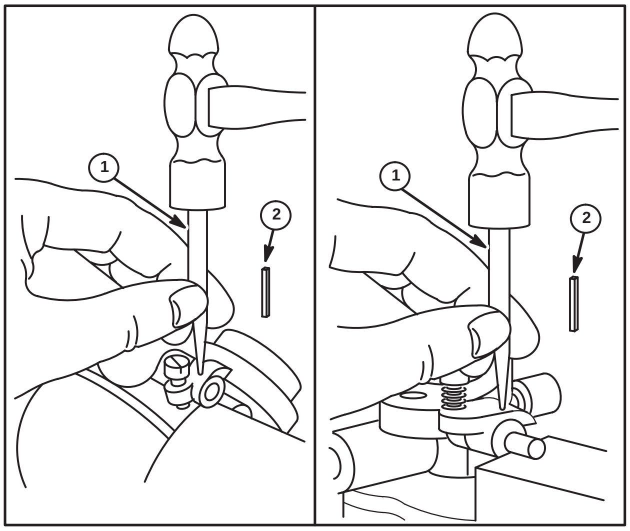


Fig. 137

To Replace Throttle Shaft Bushings

1. Place a 1/4” x 20 tap (1) or an E-Z out in a vise.
2. Turn carburetor body to thread tap or E-Z out into bushings (2) enough to pull bushings out of body, Fig. 138.
3. Press new bushings into carburetor body with a vise.
4. Insert throttle shaft to be sure it is free in bushings.
5. If not, run a size 7/32” drill through both bushings to act as a line reamer.
6. Install throttle shaft, valve and stop.

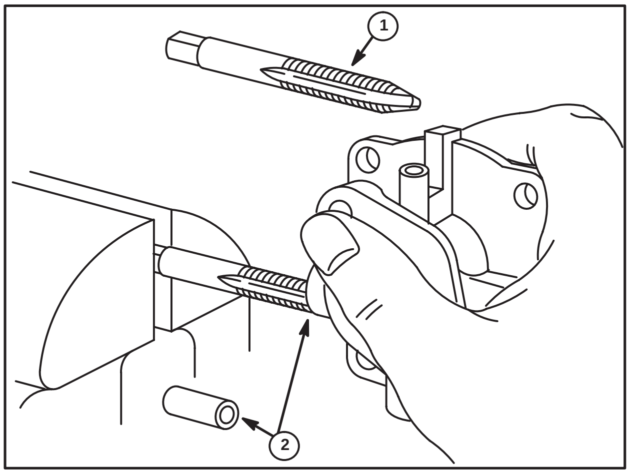


Fig. 138

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

3

Replace Inlet Seat, Pressed In Type

NOTE: Flo-Jet Carburetors were manufactured with two basic types of fuel inlet seats. One type featured a replaceable Viton seat used with a metal-tipped float needle. The other type featured a pressed-in metal seat used with a Viton-tipped float needle.

To remove the replaceable Viton, use a small crochet hook (or similar tool) to hook/lift out the old seat. Some carburetor models equipped with a Viton seat also have a serviceable metal pressed-in seat beneath. Consult Illustrated Parts List for application and service as below.

To remove the pressed-in metal seat:

1. Use a Part #93029 self-threading screw (1) or remove one self-threading screw from Tool #19069, Flywheel Puller, and clamp head of screw in a vise (2).
2. Turn carburetor body to thread screw or screw extractor into seat, Fig. 139.
3. Continue turning carburetor body to draw seat (4) out.
4. Leave screw or screw extractor fastened to seat. Insert new seat from repair kit Part #394682 into carburetor body (seat has chamfer).

   NOTE: If engine is equipped with a fuel pump, (as indicated by letter “P” flange marking) (1), install repair kit Part #394683, Fig. 140.

5. Press new seat flush with body using screw/screw extractor and old seat as driver, Fig. 139.
6. Use care to ensure seat is pressed flush (3), and not pressed below body surface or improper float to float valve contact will occur.

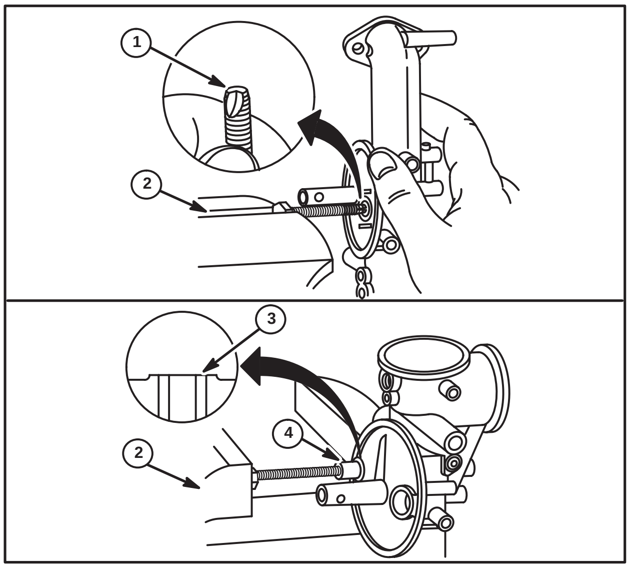


Fig. 139

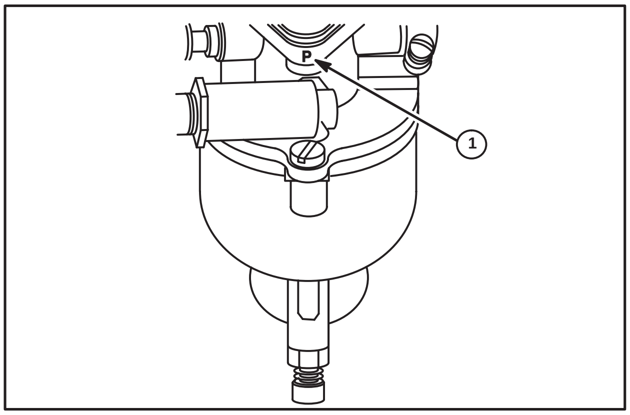


Fig. 140

Threaded Type

1. Remove float bowl nut and float bowl.
2. Remove float hinge pin and float assemble.
3. Remove inlet needle seat and gasket. Discard gasket.
4. Re-install and tighten inlet seat with new gasket in place.

Repair Carburetor

Use new parts where necessary. Always use new gaskets. Carburetor repair kits are available. See Illustrated Parts List for particular model.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Install Float

1. Install inlet needle to float as shown, Fig. 141. Open end of hook on spring must face away from venturi.
2. Install float and inlet needle assembly and center float hinge pin on two on hinge pin bosses.

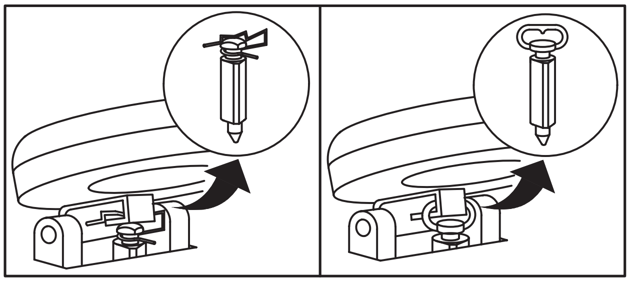


Fig. 141

Check Float Level

1. With body gasket in place on upper body and inlet needle and float installed, float (2) should be parallel to body mounting surface as shown in (1), Fig. 142.
2. If not, bend tang on float (4) with needle nose pliers (3) until surfaces are parallel. DO NOT PRESS ON FLOAT.
3. Install new float bowl gasket and float bowl. Tighten float bowl nut and washer.

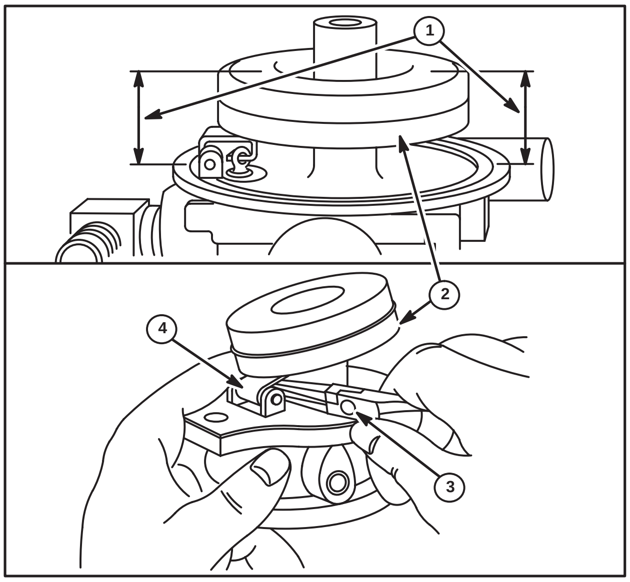


Fig. 142

Assemble One-Piece Flo-Jet

NOTE: On carburetors equipped with throttle shaft seals, rubber lipped seals are installed with lip out on both sides. Foam seals can be installed either way.

1. If throttle shaft and/or venturi have been removed, install throttle and throttle shaft first.
2. Install venturi.
3. Install jet on small One-Piece or emulsion tube on large One-Piece Flo-Jet. The emulsion tube or jet holds venturi in place, Fig. 130.
4. Replace choke shaft and plate.
5. Install new welch plug using sealer around edge of plug.
6. Stake plug in eight places. Sealer is to prevent entry of dirt into engine.
7. Install idle and main circuit adjustment needle valves.

Assemble Two-Piece Flo-Jet

1. Assemble venturi (3) and venturi gasket, when used, to lower body. Be sure holes in venturi and venturi gasket are aligned. Most models do not have a removable venturi.
2. Install choke parts and welch plug if previously removed.
3. Use a sealer around welch plug to prevent entry of dirt.
4. Stake welch plug at least twice on small two-piece Flo-Jets and eight places on large two-piece Flo-Jets.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

3

5. Fasten upper and lower bodies together with mounting screws.
6. Screw in emulsion tube (8) with Tool #19280, Carburetor Screwdriver, being careful that emulsion tube tip enters recess in upper body, Fig. 143. Tighten emulsion tube securely.

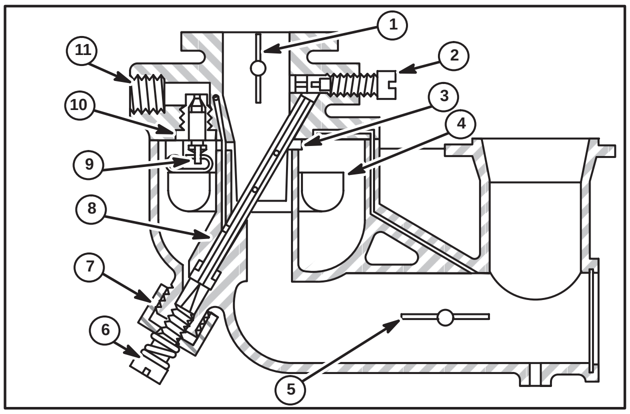


Fig. 143

Assemble Cross-Over Flo-Jet

1. Install main emulsion tube using blunt screwdriver to prevent damage to slot and metering hole.
2. Place bowl on carburetor and install bowl nut and washer.
3. Install one flapper valve spring on spring boss, Fig. 144, and then place diaphragm (2) on carburetor.
4. Place a pump valve spring (1) on spring boss in pump body and place pump body on carburetor.

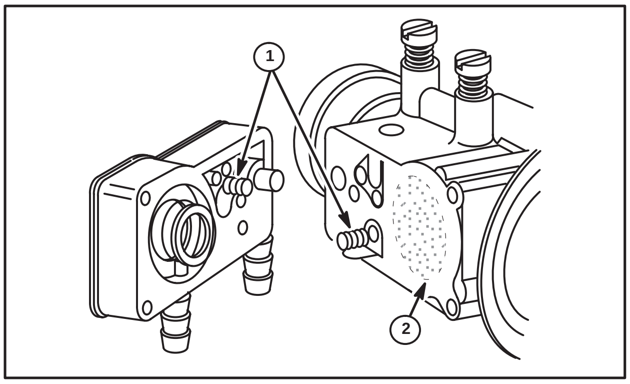


Fig. 144

5. Place damping diaphragm (3), pump gasket (2), and pump cover (1) on pump body (4) and install three screws, Fig. 145. A fuel pump repair kit is available. See Illustrated Parts List for part number.

Fig. 145 – Pump diaphragm (5), pump valve spring (6), spring and cup (7).

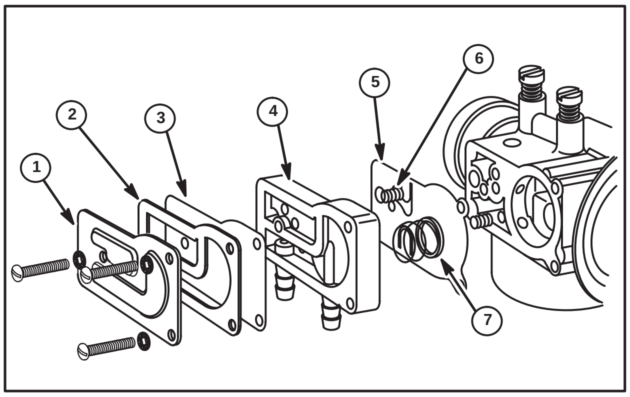


Fig. 145

6. Place choke shaft in carburetor body and slide in choke plate with notch out and dimples (1) down toward float bowl, Fig. 146 – A.
7. Install two screws using a screwdriver.
8. Slide in throttle shaft and then slide in throttle plate with dimples facing toward idle valve.
9. When valve is installed correctly, dimples will be down and number on plate is visible with throttle in closed or idle position, Fig. 146 – B.
10. Install idle and main jet needle valves.

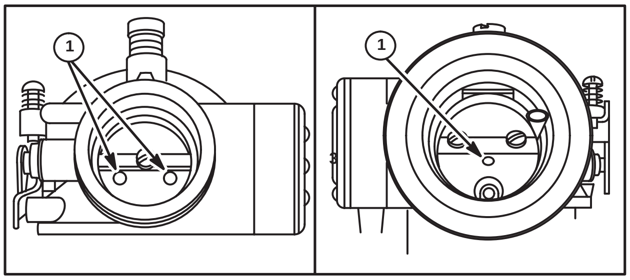


Fig. 146 – A Fig. 146 – B

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Adjust Carburetor – All

Initial Adjustment

1. Turn both idle (1) and main jet needle (2) valves clockwise until they just contact seat, Fig. 147.
2. Turn both needle valves 1-1/2 turns counterclockwise.

These settings will allow engine to start. Final adjustment should be made when engine is running and has warmed up.
Fig. 147
Idle speed adjusting screw (3)
Throttle lever (4)
Choke lever (5)

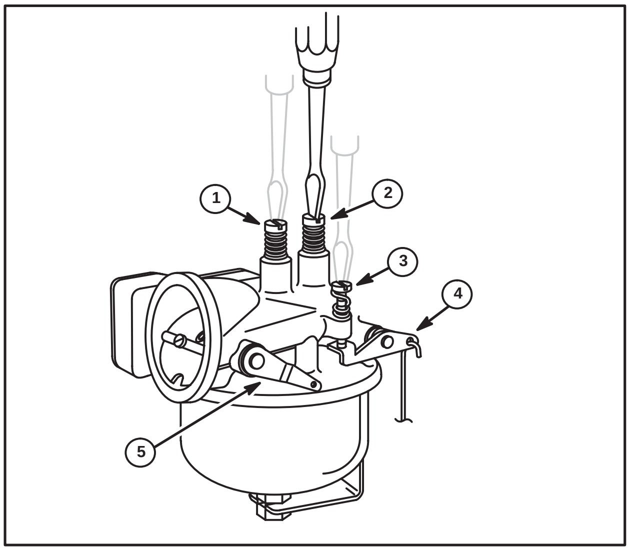


Fig. 147

Final Adjustment – All (Typical)

1. Start engine and run 5 minutes to attain operating temperature.
2. Place governor speed control lever in "FAST" position.
3. Turn main jet needle valve (3) in until engine slows (clockwise – lean mixture).
4. Then turn it counterclockwise past smooth operating point (rich mixture).
5. Turn main jet needle valve to midpoint between rich and lean. After adjusting, tighten packing nut.
6. Rotate throttle counterclockwise and hold against stop.
7. Adjust idle speed adjusting screw (1) to obtain 1750 RPM, aluminum engines; 1200 RPM, cast iron engines, Fig. 148.
8. Holding throttle against idle stop, turn idle mixture needle (2) clockwise (lean) and counterclockwise (rich).
9. Set at midpoint between rich and lean.
10. Recheck idle RPM. Release throttle.
11. If engine will not accelerate properly, carburetor should be readjusted, usually to a slightly richer mixture.

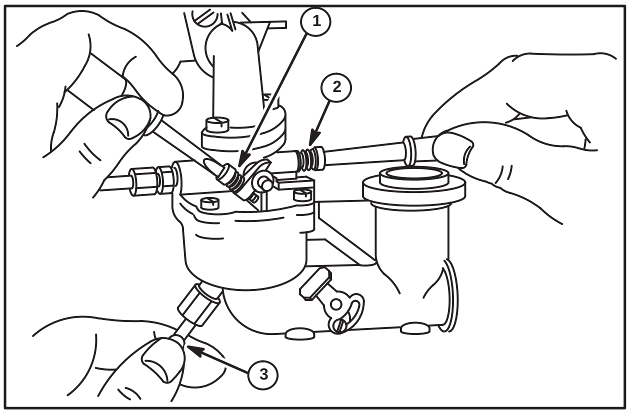


Fig. 148

Choke-A-Matic® Remote Control Adjustment

On Choke-A-Matic® carburetors, remote control must be correctly adjusted in order to obtain proper operation of choke and stop switch. See Section 4 for illustration by engine model.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

3

Idling Device and Throttle Control (Two-Piece Flo-Jet)

A manual friction control (Fig. 149 – A) may be used to limit throttle movement to any pre-set position. It is commonly used for two purposes:

1. To return throttle to a “no-load” position on a pump, generator, etc.
2. For cold weather starting on governed idle engines. Throttle can easily be kept in a “near closed” position while starting, which is most favorable for cold weather starts, Fig. 149 – B.

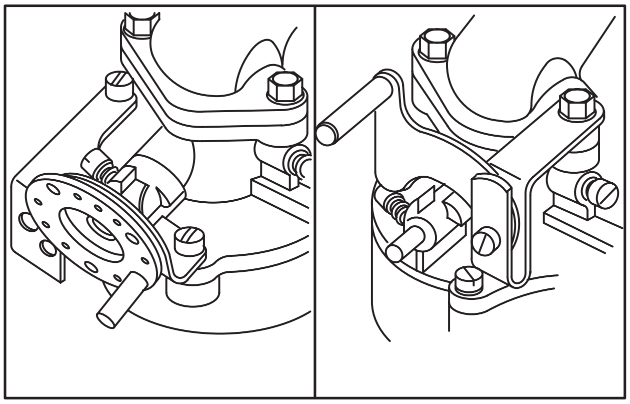


Fig. 149 – A Fig. 149 – B

Remote Throttle Control Two Piece Flo-Jet

The remote throttle control opens carburetor throttle until full governed speed is obtained, at which point governor takes over control of throttle. At any point below governed speed, throttle is held in fixed position and engine speed will vary with load, Fig. 150. Idle screw (1), remote choke control (2), throttle closes in direction shown (3).

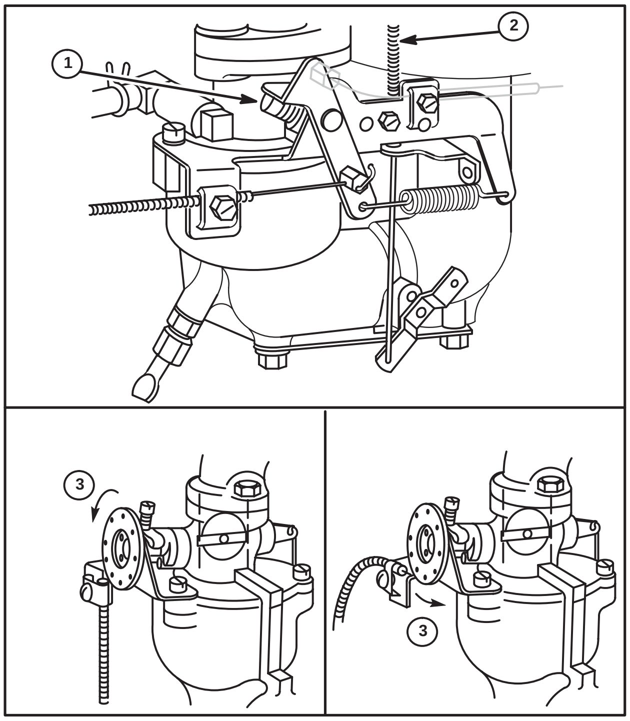


Fig. 150

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Fuel Pumps (Crankcase Vacuum Operated)

Some models are factory or field equipped with fuel pumps operated by crankcase vacuum. Fuel pumps may be mounted on the blower housing, Fig. 151, directly on carburetor, Fig. 152, or on a mounting bracket, Fig. 153. Crankcase vacuum is obtained by a fitting on crankcase cover, Fig. 154, a fitting on dipstick tube, Fig. 153, a hollow bolt and fitting, Fig. 154, or from crankcase breather valve, Fig. 152.

Briggs & Stratton engines have used three types of fuel pump, integral with the carburetor, such as used on Model Series 253400, 255400, page 55 of this section, plastic bodied pumps, page 61, and metal body pumps, page 70.

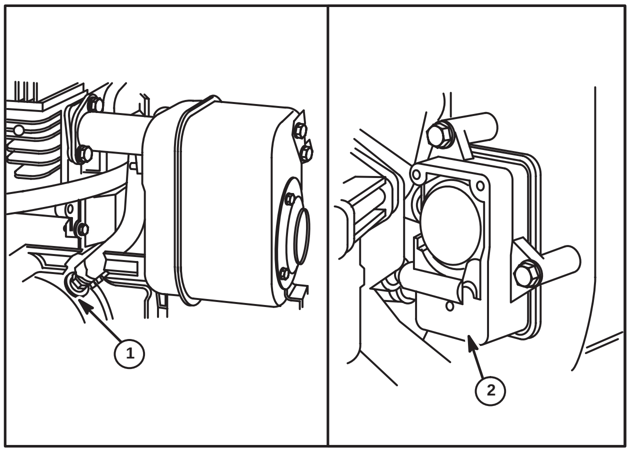


Fig. 151

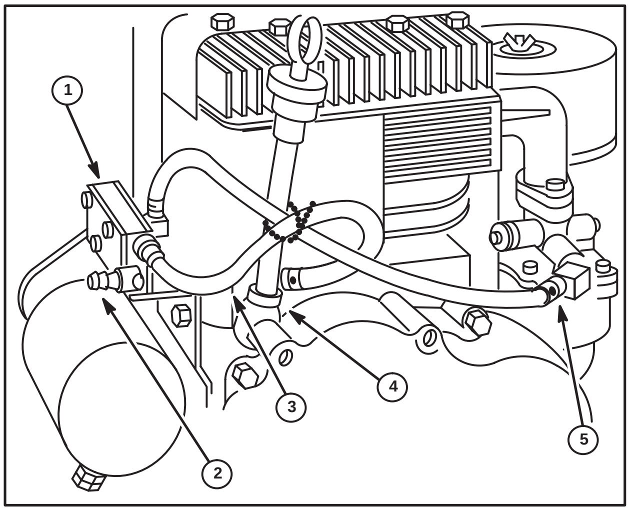


Fig. 153

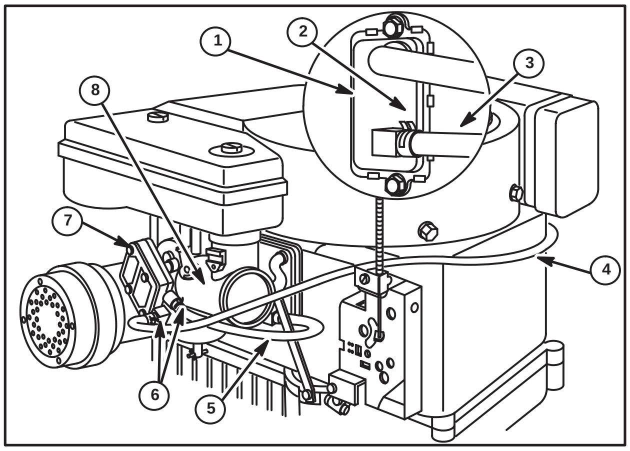


Fig. 152

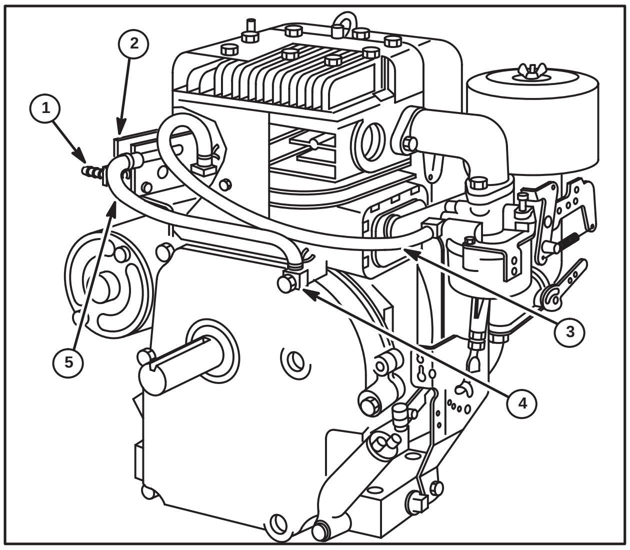


Fig. 154

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

3

Operation

Typical operation of a fuel pump is illustrated in Figs. 155, 156, and 157. Any restriction in fuel or vacuum lines will affect operation. Also any leaks that cause air to get into fuel line or reduce vacuum in vacuum line will reduce performance.

Fig. 155 – Fuel Flow Crankcase Pressure, Typical
Crankcase pressure and flow direction (1)
Atmospheric pressure acting on damping diaphragm (2)
Fuel flow direction (3)

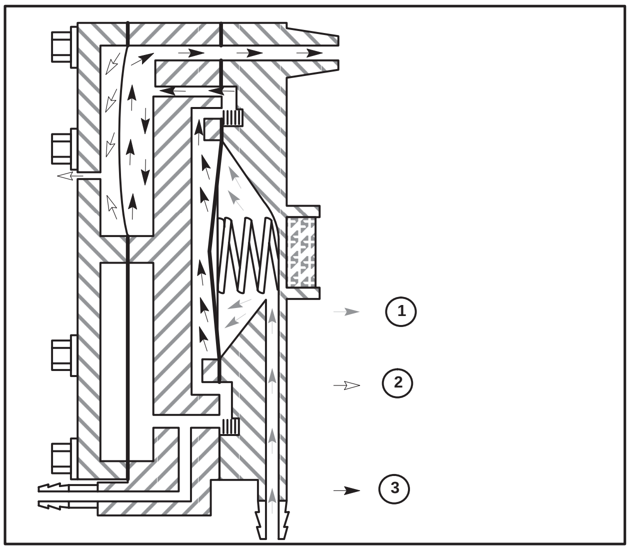


Fig. 155

Fig. 156 – Fuel Flow Crankcase Vacuum, Typical
Crankcase suction and flow direction (1)
Atmospheric pressure acting on damping diaphragm (2)
Suction fuel flow direction (3)
Atmospheric pressure-caused fuel flow (4)

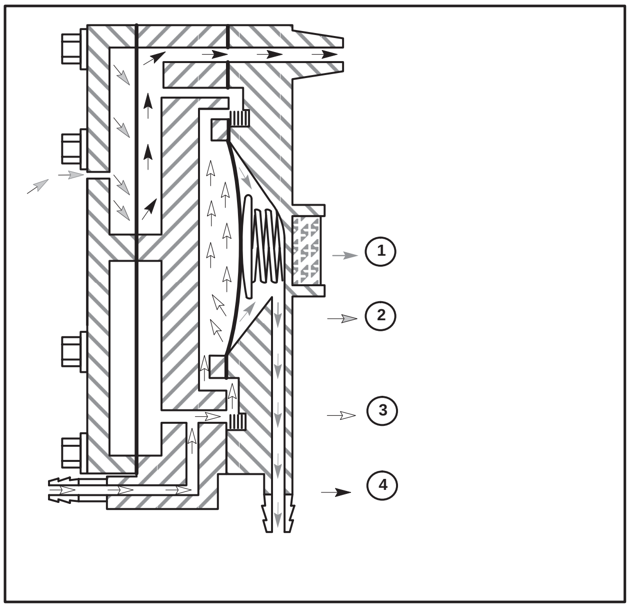


Fig. 156

Fig. 157 – Exploded View – Typical Fuel Pump

Pump cover (1)
Cover gasket (2)
Fuel inlet (3)
Pump chamber body (4)
Pump diaphragm (5)
Pump gasket (6)
Vacuum inlet (7)
Outlet to carburetor (8)
Impulse chamber body (9)
Spring cup (10)
Valve springs (11)
Damping diaphragm (12)

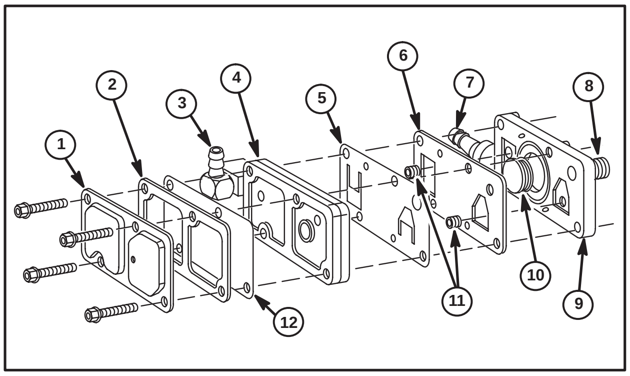


Fig. 157

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

Service Plastic Body Pump,

Disassemble Fuel Pump

1. Remove two screws holding pump to blower housing.
2. Disconnect vacuum (2), fuel inlet (3) and fuel outlet (1) hoses from pump, Fig. 158.
3. Remove three screws holding pump together, Fig. 158.
4. Remove metal pump cover.
5. Remove and discard pump gasket and damping diaphragm.
6. Remove pump body, diaphragm spring and spring cup.
7. Remove pump diaphragm from pump base.

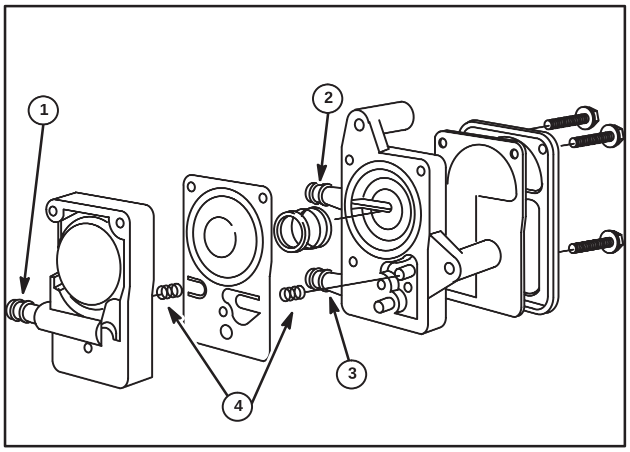


Fig. 158

Inspect Fuel Pump

1. Check pump body and pump base for cracks or distortion of body. Replace if damaged.
2. Check vacuum and fuel hoses for cracks, softening or hardening. Replace, if any of the above are found.

Assemble Pump

1. Place new pump diaphragm on pump base.
2. Place pump cup and spring in center of pumping chamber, Fig. 158.

   NOTE: When doing the next step, hold the pump base with the spring and cup up for ease of assembly.

3. Place pump body on pump base.
4. Place damping diaphragm on pump body and then pump gasket on diaphragm.
5. Install metal pump cover and three screws. Torque screws to 20 in. lbs. (2 Nm).

Service Metal Body Pump

1. To service fuel pump, remove pump from carburetor or mounting bracket.
2. When removing fuel supply line from tank to pump, be sure to plug fuel line or turn off fuel valve, if so equipped.
3. Disassemble fuel pump by removing four 1/4” head cap screws from pump cover.
4. Separate pump cover, pumping chamber and impulse chamber.
5. Discard old gaskets, diaphragms and springs. Clean pump parts in carburetor solvent or lacquer thinner.

A repair kit is available. See Illustrated Parts List. Kit includes all parts needed.

6. Install chamber gasket using locator pins.
7. Place springs (4) in spring recesses and install pump diaphragm on locator pins (Fig. 158).
8. Place pump chamber body on impulse body using locator pins.
9. Place damping diaphragm and cover gasket on pump body.
10. Install cover and four screws.
11. Torque screws to 10 to 15 in. lbs. (1 to 2 Nm). See Fig. 158 for exploded view.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

3

KEROSENE ENGINES

NOTE: Kerosene engines are designed to start on petrol and run on kerosene. Stop kerosene engines by turning the kerosene shut-off to the “off” position to let the engine run out of fuel.

Starting Procedures, Model Series 9K4000, 135400, 13K400 and 19K400

Fig. 159 – To start Model Series 9K4000, 135400, 13K400 and 19K400, set the choke to the start position. Prime the engine with petrol by depressing the primer bulb (1) five times. Start and run the engine. Open the kerosene shut-off valve (2) to continue operation.

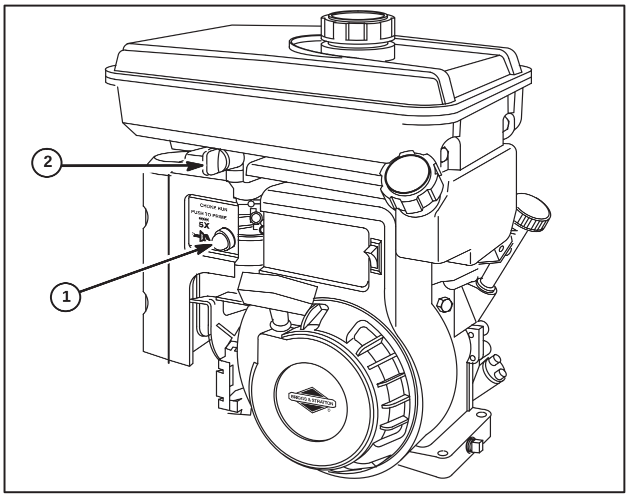


Fig. 159

Fig. 160 – Model Series 9K4000, 135400, 13K400 and 19K400: the petrol is pumped by the primer bulb (4) through the petrol hose from fuel tank (5) and petrol hose to carburetor (3) into the carburetor bowl (2).
kerosene hose shut-off to carburetor (1)

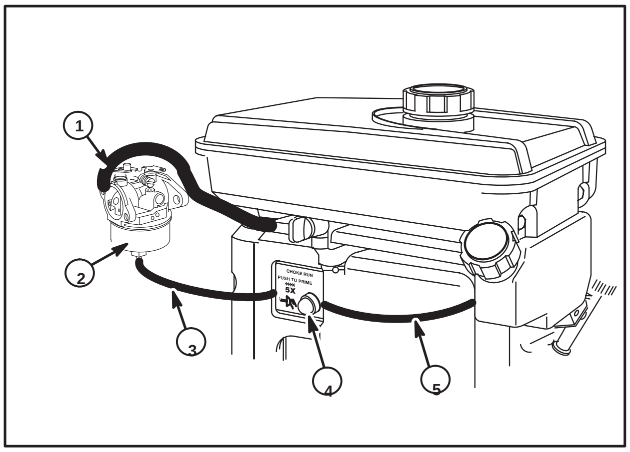


Fig. 160

Starting Procedures, Model Series 32K400

Fig. 161 – To start the engine, open the petrol shut-off valve (7) and set the choke to the start position. Start and run the engine. Close the petrol shut-off valve. Open the kerosene shut-off valve (9) to continue operation.
Kerosene filler (1)
Combination fuel tank (2)
Petrol filler (3)
Carburetor (5)
Fuel hose (6)
Filters (8)

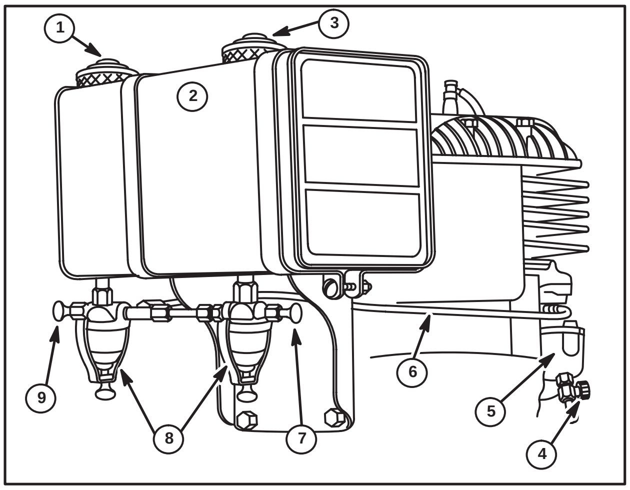


Fig. 161

NOTE: If the stop switch is used to stop the engine before it has stopped from lack of kerosene, the kerosene must be drained from the carburetor fuel bowl by opening bleeder screw (4), (Fig. 161), before restarting engine. Restart using petrol only.

SPECIFICATION TABLES

DIAPHRAGM SPRING LENGTH		
Color	Minimum Length	Maximum Length
None	15/16” (23.8 mm)	1” (25.4 mm)
Red	1–1/8” (28.6 mm)	1–7/32” (30.9 mm)
Blue	1–5/16” (33.3 mm)	1–3/8” (35 mm)
Green	1–7/64” (28.2 mm)	1–3/8” (35 mm)

TABLE NO. 2

DIAPHRAGM SPRINGS WHERE USED BY COLOR		
	Model Series	
Carburetor Type	90000	110000
Pulsa-Jet All Temperature Automatic Choke	BLUE, Standard GREEN, See Service Bulletin #533	BLUE, Standard GREEN, See Service Bulletin #533
Pulsa-Jet Automatic Choke	RED, Standard GREEN, See Service Bulletin #533	BLUE, Standard GREEN, See Service Bulletin #533

TABLE NO. 3

DIAPHRAGM SPRING LENGTH		
Color	Minimum Length	Maximum Length
None	15/16” (23.8 mm)	1” (25.4 mm)
Red	1–1/8” (28.6 mm)	1–7/32” (30.9 mm)
Blue	1–5/16” (33.3 mm)	1–3/8” (35 mm)
Green	1–7/64” (28.2 mm)	1–3/8” (35 mm)

NOTE: If spring length is shorter or longer than specified, replace diaphragm and spring.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

3

TABLE NO. 4

DIAPHRAGM SPRINGS WHERE USED BY COLOR	
	Model Series
Carburetor Type	90000
Vacu-Jet All Temperature, Automatic Choke	Not Colored Standard GREEN See Service Bulletin #533
Vacu-Jet Automatic Choke	Not Colored Standard GREEN See Service Bulletin #533

NOTE: Service Bulletin #533 covered installation of choke plate and choke spring (GREEN) (part #396227) to eliminate problems with hot starting.

NOTE: On vertical crankshaft Model Series 92500 (Type Number 0600 and under) hook small loop on post on carburetor body (2) and long hook on choke shaft lever (1), Fig. 162.

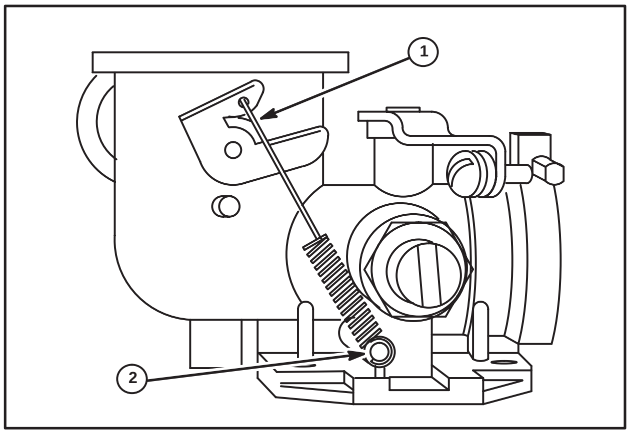


Fig. 162

HIGH ALTITUDE COMPENSATION CHART (REMOVE AIR JET)
TABLE NO. 5

Model Series	Carburetor Identification #
83400	LMS-22 LMS-30
90700	LMS-3 LMS-10 LMS-13 LMS-14
91700	LMS-3 LMS-14
100700	LMS-5 LMS-15
110700	LMS-1 LMS-10 LMS-11
111700	LMS-2 LMS-7 LMS-12
112700	LMS-1 LMS-3 LMS-11 LMS-14
114700	LMS-1 LMS-2 LMS-4 LMS-7 LMS-12
12A700	LMS-5
12A800	LMS-24
121700	LMS-5 LMS-24
121800	LMS-24
122700	LMS-5 LMS-24
122800	LMS-24
123700	LMS-5 LMS-24
123800	LMS-24
124700	LMS-5 LMS-24
124800	LMS-24
125700	LMS-5
126700	LMS-5

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

TABLE NO. 5, (CONT'D.)

Model Series	Carburetor Identification #
127700	LMS-24
127800	LMS-24
128700	LMS-24
128800	LMS-24
129800	LMS-24
130700	LMS-9 LMS-19
131700	LMS-9 LMS-19

MAIN JET HIGH ALTITUDE CHART (CHANGE MAIN JET) TABLE NO. 6

Model Series	Carburetor LMS or I.D. #	Standard Jet # or Letter	High Altitude Jet # or Letter
93400	LMS-38	**M** after Date Code 96032400 **27 or E** before Date Code 96032500	**26** or **D** after Date Code 96032400 **L** before Date Code 96032500
	6244		
93400	9208	**M** after Date Code 96032400 **27 or E** before Date Code 96032500	**L** after Date Code 96032400 **26** or **D** before 96032500
12A800	LMS-25	**28** or **F**	**27** or **E**
	LMS-32		
	LMS-35		
	3862		
	6291		
	7167	**C**	**B**
	7623	**26** or **D**	**C**
	8122	**C**	**B**
	8126	**26** or **D**	**C**

TABLE NO. 6 (CONT'D.)

93400	7011	**M** after Date Code 96032400 **27 or E** before Date Code 96032500	**L** after Date Code 96032400 **26** or **D** before 96032500
12B800	7167	**C**	**B**
	7623	**26** or **D**	**C**
	8122	**C**	**B**
	8126	**26** or **D**	**C**
12C700	6975	**L**	**B**
	8120		
	8124		
	8823	**R**	**B**
12C800	LMS-25	**28** or **F**	**27** or **E**
	LMS-35		
	5849	**C**	**A**
	6291	**28** or **F**	**27** or **E**
	6975	**L**	**B**
	8120	**28** or **F**	**26** or **D**
	8124	**L**	**B**
	8823	**R**	**B**
12D800	LMS-25	**28** or **F**	**27** or **E**
	LMS-35		
	5849	**C**	**A**
	6975		
	8120	**L**	**B**
	8124		
	8823	**R**	**B**
12E700	LMS-31	**28** or **F**	**26** or **D**
	3861		
	7167	**C**	**B**
	8122		
	8124	**L**	**B**

3

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

3

TABLE NO. 6 (CONT'D.)

Model Series	Carburetor LMS or I.D. #	Standard Jet # or Letter	High Altitude Jet # or Letter
12E800	LMS-31	**28** or **F**	**26** or **D**
	3861		
	7167	**C**	**B**
	8122		
	8124	**L**	**B**
12F700	LMS-32	**28** or **F**	**27** or **E**
	3862		
	7167	**C**	**B**
	7623	**26** or **D**	**C**
	8122	**C**	**B**
	8124	**L**	**B**
	8126	**26** or **D**	**C**
	8844	**T**	**M**
12F800	LMS-32	**28** or **F**	**27** or **E**
	3862		
	7167	**C**	**B**
	7623	**26** or **D**	**C**
	8122	**C**	**B**
	8124	**L**	**B**
	8126	**26** or **D**	**C**
	8844	**T**	**M**
12G700	LMS-25	**28** or **F**	**27** or **E**
	LMS-32		
	LMS-35		
	3862		
	5849	**C**	**A**
	6291	**28** or **F**	**27** or **E**
	6975	**L**	**B**
	8120		
	8125	**C**	**A**
	8823	**R**	**B**
	8843	**S**	**T**

TABLE NO. 6 (CONT'D.)

Model Series	Carburetor LMS or I.D. #	Standard Jet # or Letter	High Altitude Jet # or Letter
12G800	LMS-25	**28** or **F**	**27** or **E**
	LMS-32		
	LMS-35		
	3862		
	5849	**C**	**A**
	6291	**28** or **F**	**27** or **E**
	6975	**L**	**B**
	8120		
	8124		
	8125	**C**	**A**
	8823	**R**	**B**
	8843	**S**	**T**
12H700	7623	**26** or **D**	**C**
	8126		
	8844	**T**	**M**
12H800	7163	**26** or **D**	**C**
	7623		
	8121		
	8124	**L**	**B**
	8126	**26** or **D**	**C**
12J700	7623	**26** or **D**	**C**
	8126		
	8823	**R**	**B**
12J800	7163	**26** or **D**	**C**
	7623		
	8121		
	8126		
	8823	**R**	**B**
12M800	6975	**L**	**B**
	7623	**26** or **D**	**C**
	8120	**L**	**B**
	8126	**26** or **D**	**C**

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

TABLE NO. 6 (CONT'D.)

Model Series	Carburetor LMS or I.D. #	Standard Jet # or Letter	High Altitude Jet # or Letter
12S700	LMS-31	**28** or **F**	**26** or **D**
	3861		
	7167	**C**	**B**
	8122		
	8124	**L**	**B**
12S800	LMS-31	**28** or **F**	**26** or **D**
	3861		
	7167	**C**	**B**
	8122		
	8124	**L**	**B**
12T700	LMS-31	**28** or **F**	**26** or **D**
	LMS-32		
	3861		
	3862		
	7167	**C**	**B**
	7623	**26** or **D**	**C**
	8122	**C**	**B**
	8124	**L**	**B**
	8126	**26** or **D**	**C**
	8844	**T**	**M**
12T800	LMS-32	**28** or **F**	**27** or **E**
	3862		
	7167	**C**	**B**
	7623	**26** or **D**	**C**
	8122	**C**	**B**
	8124	**L**	**B**
	8126	**26** or **D**	**C**
	8844	**T**	**M**
12U800	7167	**C**	**B**
	8122		
	8124	**L**	**B**
	8823	**R**	**B**

TABLE NO. 6 (CONT'D.)

Model Series	Carburetor LMS or I.D. #	Standard Jet # or Letter	High Altitude Jet # or Letter
12V800	7163	**26** or **D**	**C**
	8121		
	8124	**L**	**B**
	8823	**R**	**B**
12W800	6975	**L**	**B**
	8120		
	8124		
121700	LMS-25	**28** or **F**	**26** or **D**
	LMS-25	**28** or **F**	**27** or **E**
	LMS-26	**27** or **E**	**26** or **D**
	LMS-31	**28** or **F**	**27** or **E**
	LMS-35		
	LMS-42		
	3466	**28** or **F**	**26** or **D**
	6291	**28** or **F**	**27** or **E**
121800	LMS-25	**28** or **F**	**26** or **D**
	LMS-25	**28** or **F**	**27** or **E**
	LMS-31	**28** or **F**	**26** or **D**
	LMS-35	**28** or **F**	**27** or **E**
	LMS-42		
	3466	**28** or **F**	**26** or **D**
	3861		
	6291	**28** or **F**	**27** or **E**
122700	LMS-25	**28** or **F**	**26** or **D**
	LMS-25	**28** or **F**	**27** or **E**
	LMS-31	**28** or **F**	**26** or **D**
	LMS-35	**28** or **F**	**27** or **E**
	LMS-42		
	3466	**28** or **F**	**26** or **D**
	3861		
	6291	**28** or **F**	**27** or **E**

3

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

TABLE NO. 6 (CONT'D.)

Model Series	Carburetor LMS or I.D. #	Standard Jet # or Letter	High Altitude Jet # or Letter
122800	LMS-25	**28** or **F**	**26** or **D**
	LMS-25	**28** or **F**	**27** or **E**
	LMS-31	**28** or **F**	**26** or **D**
	LMS-35	**28** or **F**	**27** or **E**
	3466	**28** or **F**	**26** or **D**
	3861		
	6291	**28** or **F**	**27** or **E**
123700	LMS-25	**28** or **F**	**26** or **D**
	LMS-25	**28** or **F**	**27** or **E**
	LMS-32	**28** or **F**	**27** or **E**
	LMS-35		
	3466	**28** or **F**	**26** or **D**
	3862	**28** or **F**	**27** or **E**
	6291		
123800	LMS-25	**28** or **F**	**26** or **D**
	LMS-25	**28** or **F**	**27** or **E**
	LMS-32		
	LMS-35		
	3466	**28** or **F**	**26** or **D**
	3862	**28** or **F**	**27** or **E**
	6291		
124700	LMS-25	**28** or **F**	**26** or **D**
	LMS-25	**28** or **F**	**27** or **E**
	LMS-27	**30** or **H**	**29** or **G**
	LMS-32	**28** or **F**	**27** or **E**
	LMS-35	**28** or **F**	**27** or **E**
	3466	**28** or **F**	**26** or **D**
	3862	**28** or **F**	**27** or **E**
	6291	**28** or **F**	**27** or **E**

TABLE NO. 6 (CONT'D.)

Model Series	Carburetor LMS or I.D. #	Standard Jet # or Letter	High Altitude Jet # or Letter
124800	LMS-25	**28** or **F**	**26** or **D**
	LMS-25	**28** or **F**	**27** or **E**
	LMS-32		
	LMS-35		
	3466	**28** or **F**	**26** or **D**
	3862	**28** or **F**	**27** or **E**
	6291		
	5849	**C**	**A**
125700	LMS-27	**30** or **H**	**29** or **G**
	LMS-32	**28** or **F**	**27** or **E**
	3862		
126700	LMS-25	**28** or **F**	**26** or **D**
	LMS-25	**28** or **F**	**27** or **E**
	LMS-27	**30** or **H**	**29** or **G**
	LMS-32	**28** or **F**	**27** or **E**
	LMS-35		
	3466	**28** or **F**	**26** or **D**
	3862	**28** or **F**	**27** or **E**
	6291		
126800	LMS-25	**28** or **F**	**26** or **D**
	LMS-25	**28** or **F**	**27** or **E**
	LMS-32		
	LMS-35		
	3466		
	3862		
	5849	**C**	**A**
	6291	**28** or **F**	**27** or **E**

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

TABLE NO. 6 (CONT'D.)

Model Series	Carburetor LMS or I.D. #	Standard Jet # or Letter	High Altitude Jet # or Letter
127700	LMS-25	**28** or **F**	**27** or **E**
	LMS-32		
	LMS-35		
	3862		
	6291		
	7167	**C**	**B**
	7623	**26** or **D**	**C**
	8122	**C**	**B**
	8124	**L**	**B**
	8126	**26** or **D**	**C**
	8844	**T**	**M**
127800	LMS-25	**28** or **F**	**27** or **E**
	LMS-32		
	LMS-35		
127800	3862	**28** or **F**	**27** or **E**
	6291		
	7167	**C**	**B**
	7623	**26** or **D**	**C**
	8122	**C**	**B**
	8124	**L**	**B**
	8126	**26** or **D**	**C**
	8844	**T**	**M**

TABLE NO. 6 (CONT'D.)

Model Series	Carburetor LMS or I.D. #	Standard Jet # or Letter	High Altitude Jet # or Letter
128700	LMS-25	**28** or **F**	**27** or **E**
	LMS-35		
	LMS-41		
	LMS-40		
	6291		
	6292		
	6293		
	7163	**26** or **D**	**C**
	7623		
	8121		
	8124	**L**	**B**
	8126	**26** or **D**	**C**
	8590	**U**	**C**
	8844	**T**	**M**
128800	LMS-25	**28** or **F**	**27** or **E**
	LMS-35		
	LMS-41		
	LMS-40		
	6291		
	6292		
	6293		
	7163	**26** or **D**	**C**
	7623		
	8121		
	8124	**L**	**B**
	8126	**26** or **D**	**C**
	8590	**U**	**C**
	8844	**T**	**M**

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

TABLE NO. 6 (CONT'D.)

Model Series	Carburetor LMS or I.D. #	Standard Jet # or Letter	High Altitude Jet # or Letter
129700	LMS-25	**28** or **F**	**27** or **E**
	LMS-35		
	LMS-40		
	LMS-41		
	6291		
	6292		
	6293		
	6975	**L**	**B**
	7273	**L**	**B?**
	7288	**27** or **E**	**C**
	7623	**26** or **D**	**C**
	8120	**L**	**B**
	8126	**26** or **D**	**C**
	8823	**R**	**B**
	8843	**S**	**T**

TABLE NO. 6 (CONT'D.)

Model Series	Carburetor LMS or I.D. #	Standard Jet # or Letter	High Altitude Jet # or Letter
129800	LMS-25	**28** or **F**	**27** or **E**
	LMS-35		
	LMS-40		
	LMS-41		
	6291		
	6292		
	6293		
	6975	**L**	**B**
	7273	**L**	**B?**
	7288	**27** or **E**	**C**
	7623	**26** or **D**	**C**
	8120	**L**	**B**
	8126	**26** or **D**	**C**
	8823	**R**	**B**
	8843	**S**	**T**
133400	LMS-34	**33** or **K**	**31** or **I**
	4732		
	7475	**N**	**30** or **H**
133700	LMS-36	**30** or **H**	**29** or **G**
	LMS-39	**29** or **G**	**28** or **F**
	6285		
	8143		
135700	LMS-36	**30** or **H**	**29** or **G**

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 63 OF THIS SECTION.

SECTION 4
Gov. Controls, Carb. Linkage & Flywheel Brakes

4

Section Contents

GOVERNOR CONTROL BRACKET IDENTIFICATION

Horizontal Crankshaft

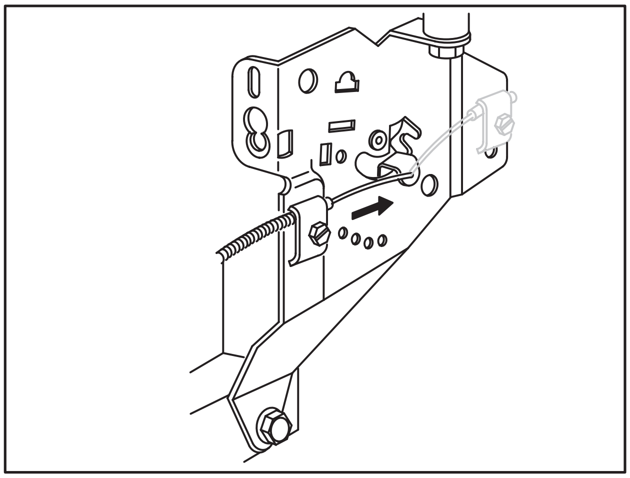


Fig. 1 – 170400, 190400, 195400, 220400, 221400, 251400, 252400 with Swivel Control before Date Code 83121600

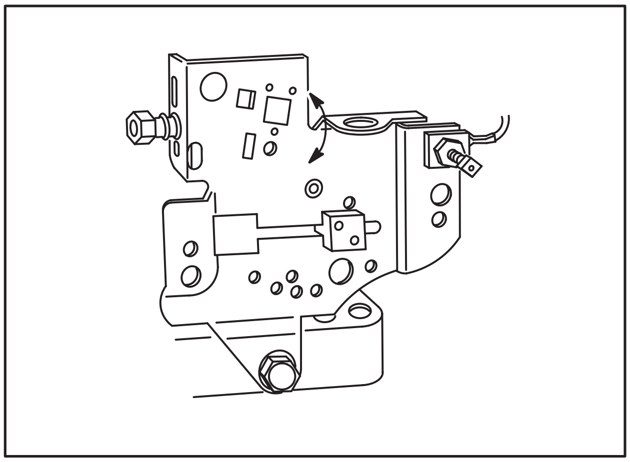


Fig. 2 – 170400, 171400, 190400, 194400, 195400, 221400, 222400, 252400, 254400 with Rack & Pinion Control after Date Code 83121500, except 253400, 255400

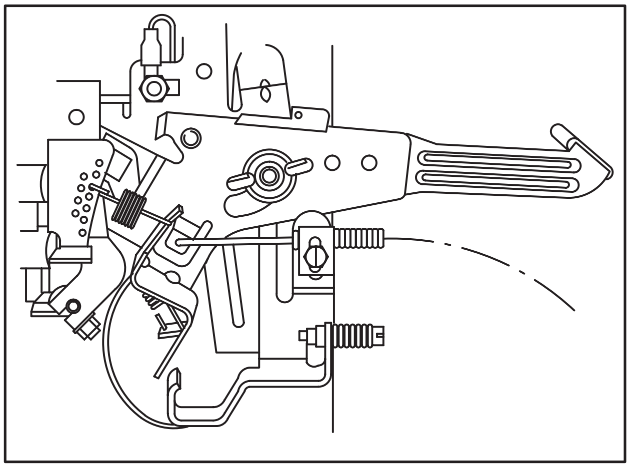


Fig. 3 – 176400, 192400, 226400, 250400, 256400 Lever Control

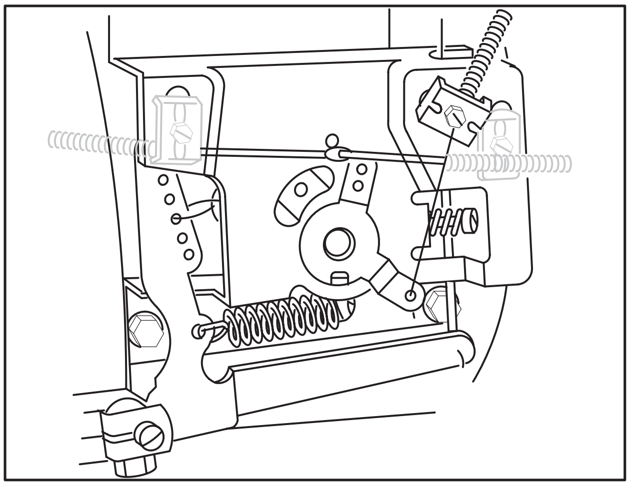


Fig. 4 – 253400, 255400

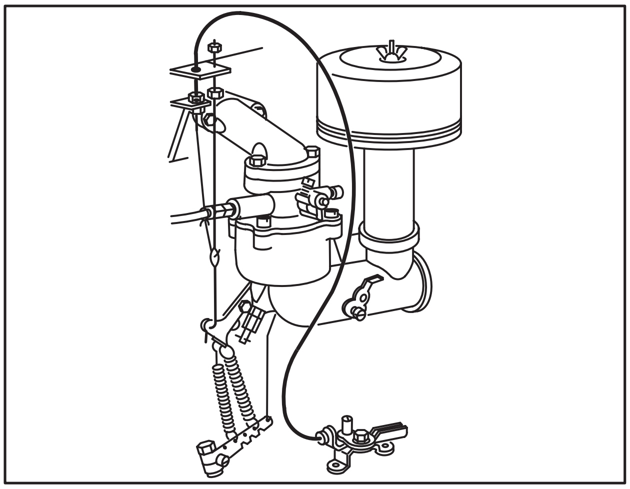


Fig. 5 – 230000, 240000, 300000, 320000

4

GOVERNOR CONTROL BRACKET IDENTIFICATION, (CONT'D)

Vertical Crankshaft

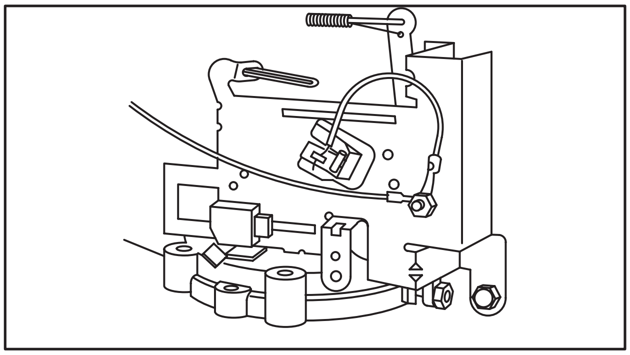


Fig. 6 – 194700, 195700, 196700, 254700, 257700, 258700, 259700, 28A700, 28B700, 28C700, 28D700, 28E700, 28M700, 282700, 283700, 285700, 286700, 288700, 289700 with Horizontal Rack & Pinion control for Briggs & Stratton/Walbro LMT Carburetors

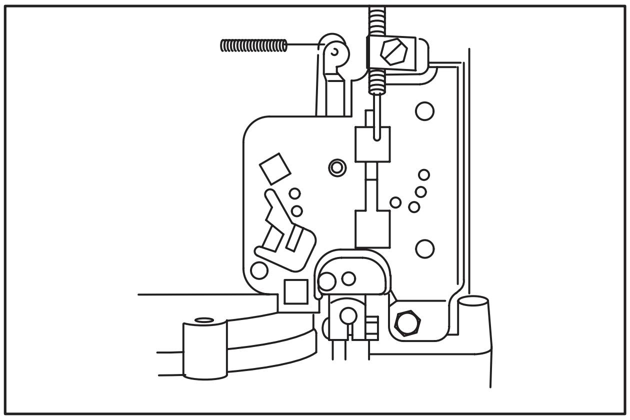


Fig. 7 – 170700, 190700, 191700, 192700, 193700, 194700, 195700, 196700, 220700, 252700, 253700, 254700, 257700, 256700, 258700, 280700, 28A700, 28B700, 28C700, 28D700, 28M700, 283700, 286700, 289700 with Vertical Rack & Pinion Control for Briggs & Stratton/Walbro LMT Carburetors

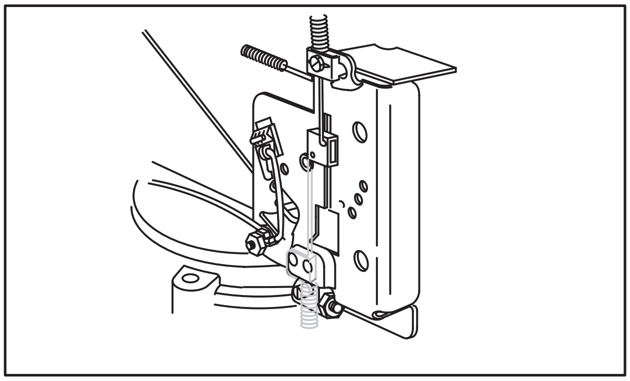


Fig. 8 – 170000, 190000, 220000, 250000, 280000, except 286700, Vertical Rack & Pinion Control for Briggs & Stratton One Piece Flo-Jet Carburetors

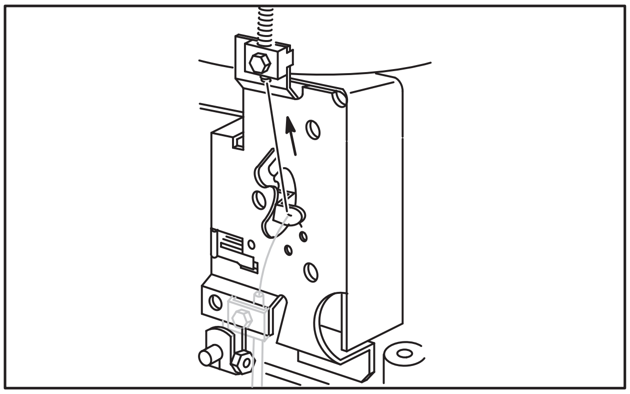


Fig. 9 – Late Style, 170700, 171700, 190700, 191700, Swivel Control Bracket for Briggs & Stratton One Piece Flo-Jet Carburetors

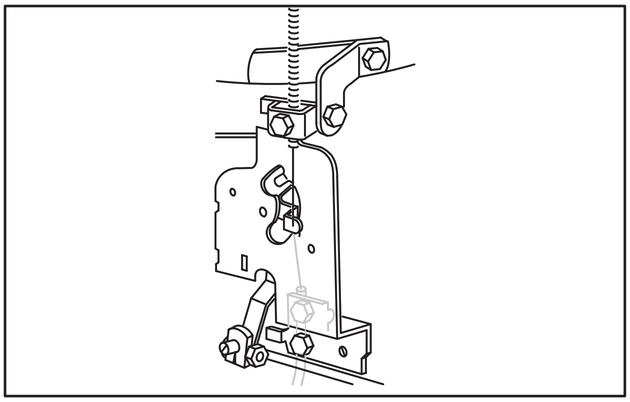


Fig. 10 – Early Style, 170700, 171700, 190700, 191700, Swivel Control Bracket for Briggs & Stratton One Piece Flo-Jet Carburetors

REMOTE CONTROLS

In general, there are three types of remote controls: remote governor control, remote throttle control, and Choke-A-Matic® control. See the carburetor section and 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.

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 RPM.

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 overspeeding 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.

4

CHOKE-A-MATIC® REMOTE CONTROL

On Choke-A-Matic® carburetors, the remote control must be correctly adjusted in order to obtain proper operation of the choke and stop switch. See Carburetor section for details.

Model Series 120000

1. Move control lever until a 1/8” (3.18 mm) dia. rod can be inserted through hole (1) in control plate and control lever, Fig. 11.
2. Place equipment control in “RUN” position and install casing and wire on control lever and control bracket, Fig. 11.

Travel of remote control wire must be a minimum of 1–3/8” (35 mm) (B) in order to achieve full “CHOKE” (1) and “STOP” (2) position, Fig. 12. Distance (A) is 2–1/8” (54 mm).

CHOKE-A-MATIC® DIAL CONTROL ADJUSTMENTS

Dial controls seldom require adjustment unless blower housing has been removed.

1. To Adjust: Place dial control knob in “START” position.
2. Loosen control wire screw (4) – move lever (2) to full choke position (1). Allow a 1/8” (3.18 mm) gap between lever and bracket as shown (3), Fig. 13.
3. While holding lever, tighten screw (4). Stop switch (5).

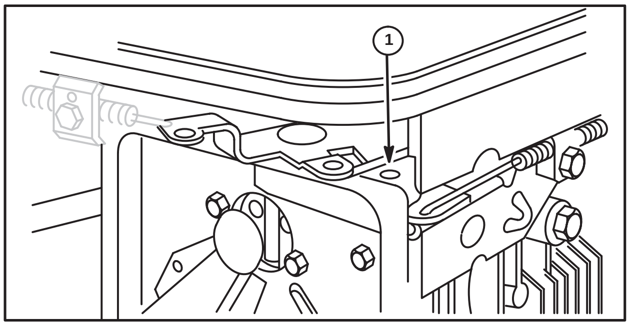


Fig. 11

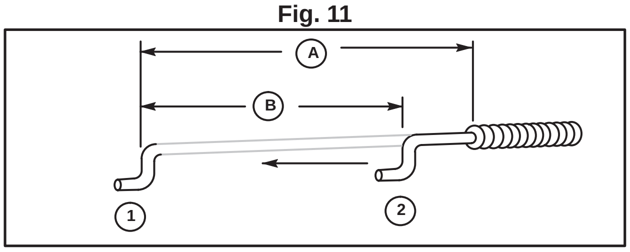


Fig. 12

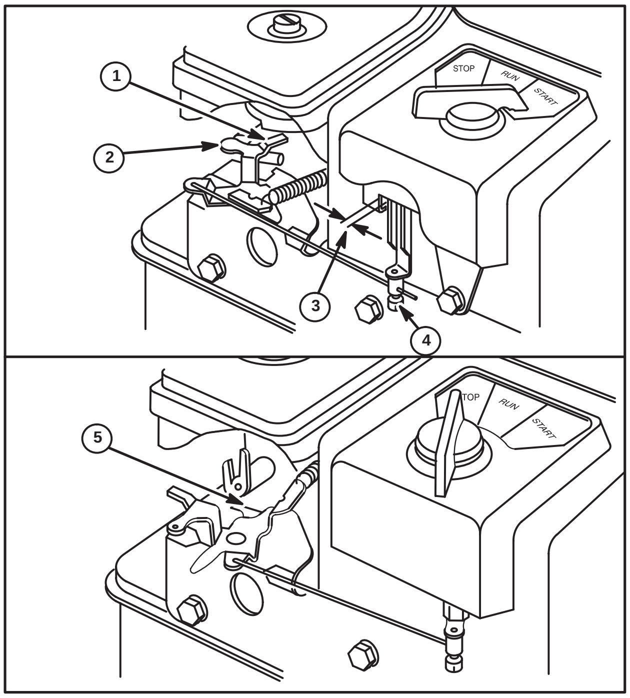


Fig. 13

GOVERNOR BRACKETS, LINKAGES, AND CONTROLS

The following drawings of governor controls (Figs. 14 through 49 and 61 through 136) are to show how governor links and springs are to be installed on carburetors. For governor control adjustments, see Section 5, GOVERNORS. Figs. 14–22 below show Models 60100, 61100, 80100, 81100 Horizontal Crankshaft. **“A” indicates movement of cable or linkage to increase speed, “B” to decrease speed.**

Pull out rod (1) to increase speed. Governor spring hooks in hole (2), Fig. 14.

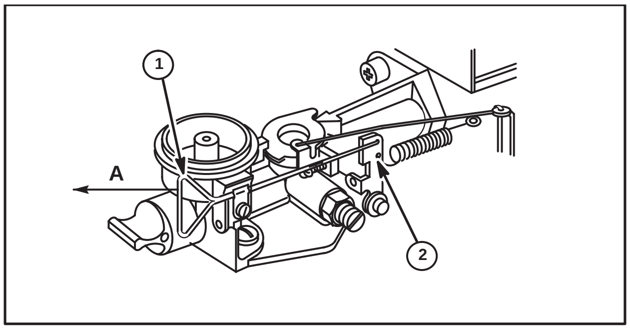


Fig. 14

Remote control assembly – turn screw (1) counter-clockwise to increase speed, Fig. 15.

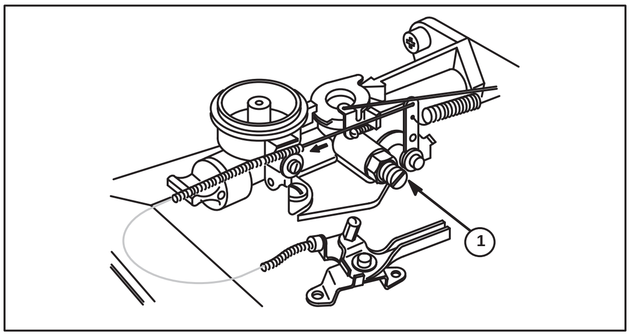


Fig. 15

Speed adjusting lever (1), with spring in #1 hole (2), Fig. 16.

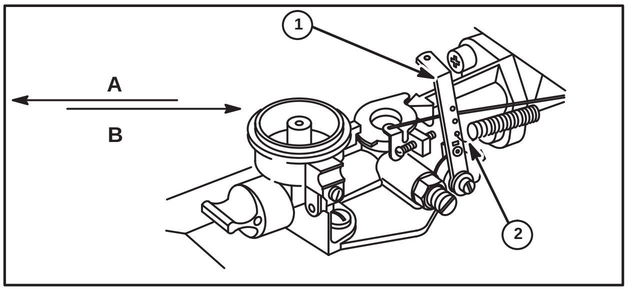


Fig. 16

Hook spring in this hole (1), Fig. 17.

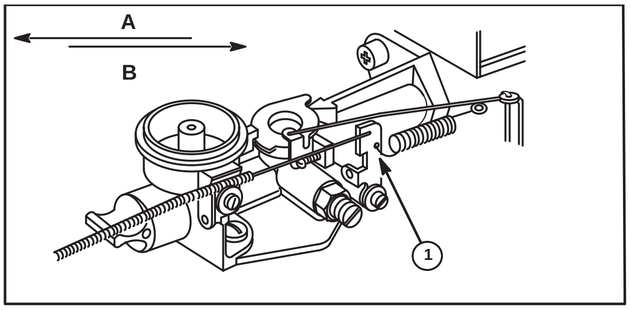


Fig. 17

Place lever in choke detent. If choke is not fully closed, bend link where shown (1) to attain full choke, Fig. 18.

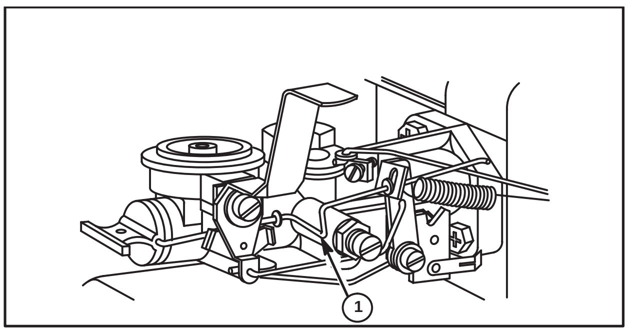


Fig. 18

4

Bell crank (1) and remote control lever (2) move in directions shown to increase (A) or decrease (B) speed, Fig. 19.

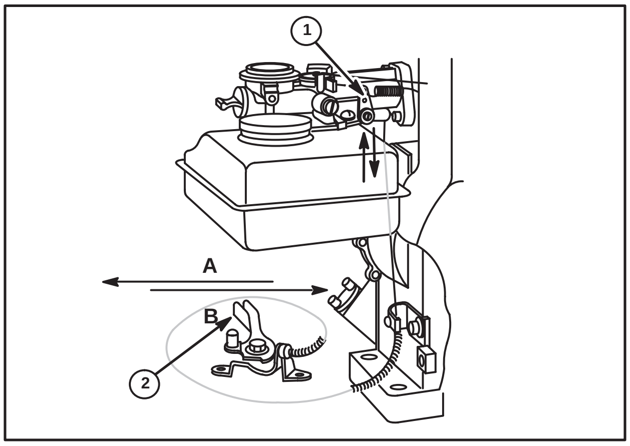


Fig. 19

4

Closed choke position (1)
Stop switch in “run” position (2)
Stop switch in “stop” position (3), inset
Fig. 20

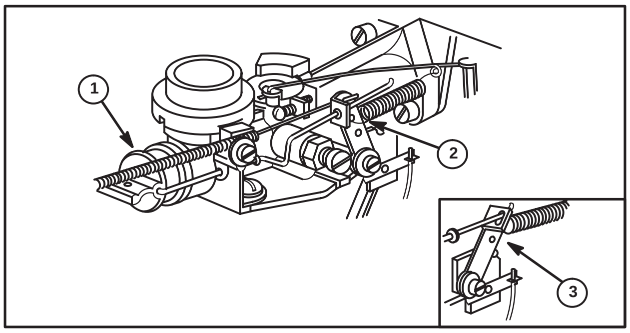


Fig. 20

Idle adjustment screw (1)
Spring hooked in this hole (2)
Speed adjusting screw – turn in to increase speed (3)
Needle valve adjustment (4)
Fig. 21

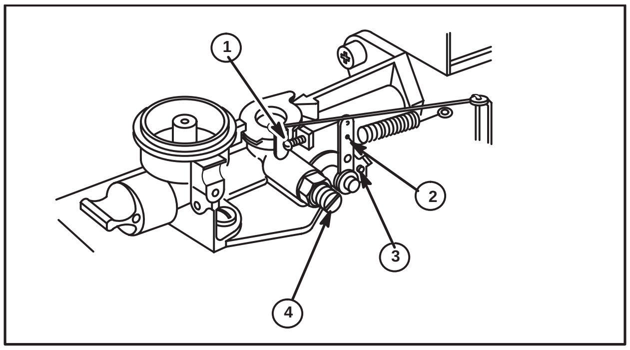


Fig. 21

Model Series 60200, 61200, 80200, 81200, 82200 Horizontal Crankshaft

Typical remote control choke, Fig. 22.

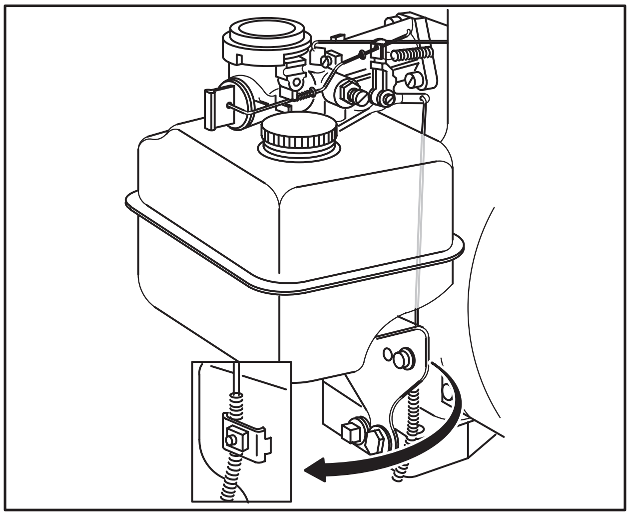


Fig. 22

Turn thumbscrew (1) counterclockwise as shown to increase speed, spring hooked in #4 hole (2), Fig. 23.

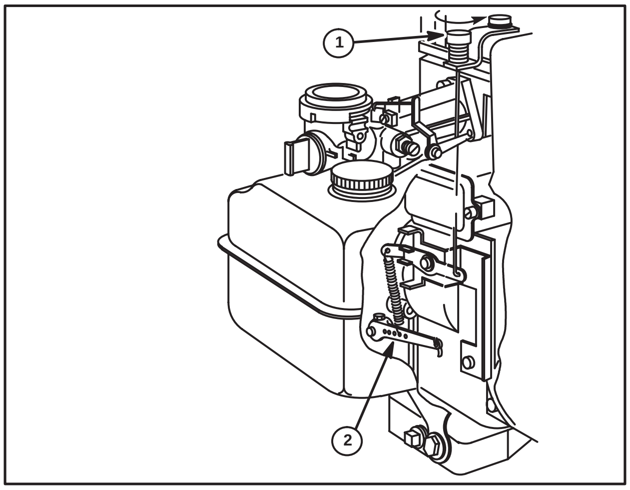


Fig. 23

Pull out rod (1) to increase speed (A), governor spring in this hole (2) in speed adjusting lever, Fig. 24.

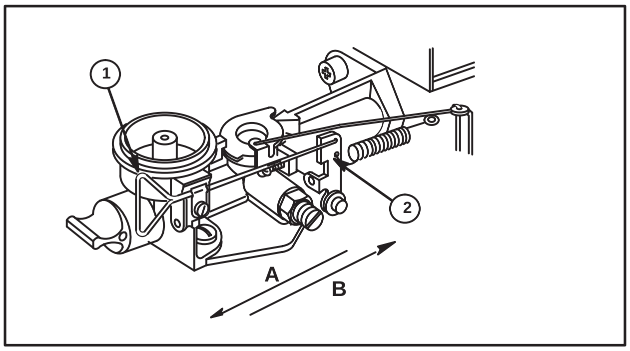


Fig. 24

Turn in speed adjustment screw (2) to increase speed, needle valve (3), idle adjustment screw (1), Fig. 25.

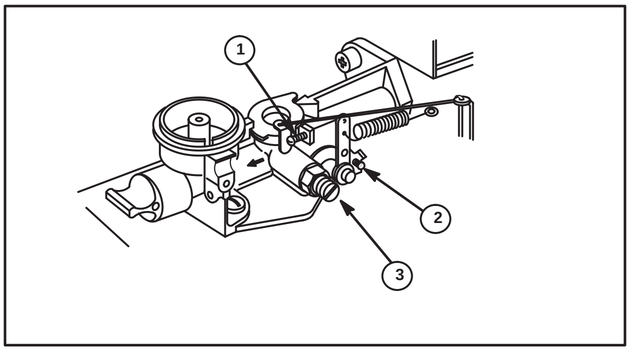


Fig. 25

Inset shows spring attachments, Fig. 26.

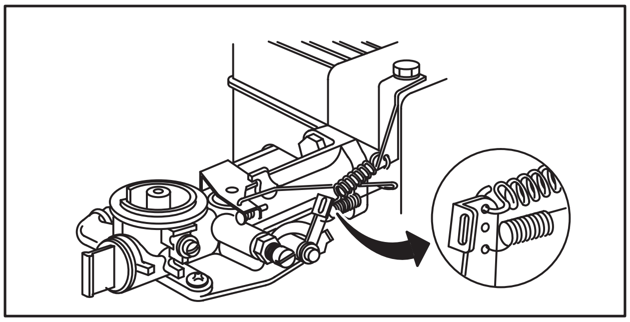


Fig. 26

Choke position closed (1), Inset shows spring attachment to stop switch, Fig. 27.

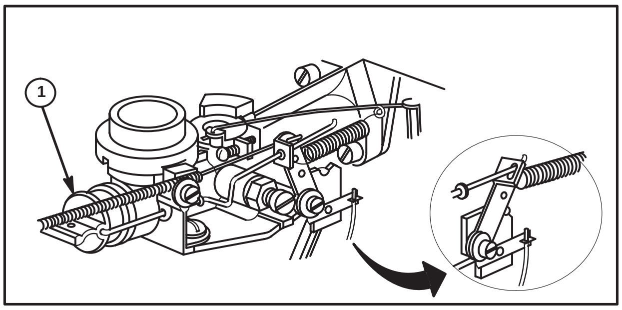


Fig. 27

Model Series 83400 Horizontal Crankshaft

Turn speed adjusting screw (1) clockwise to increase, counterclockwise to decrease, Fig. 28.

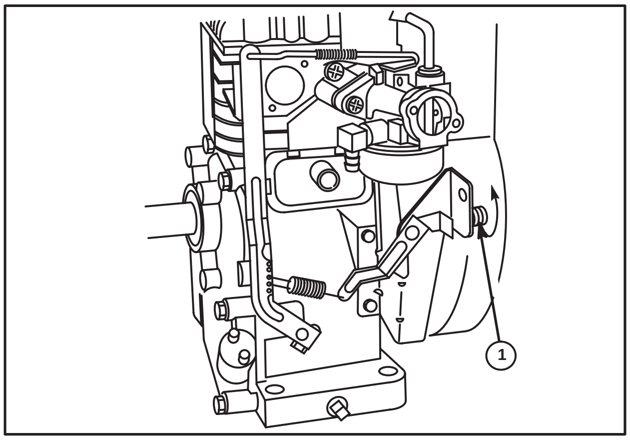


Fig. 28

Model Series 80200, 82200, 90200 Horizontal Crankshaft, Air Vane Governor

Standard controls, Fig. 29.

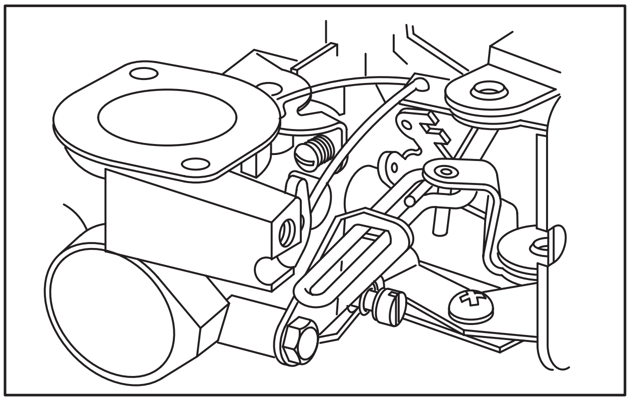


Fig. 29

Manual choke, top mount remote control, Fig. 30.

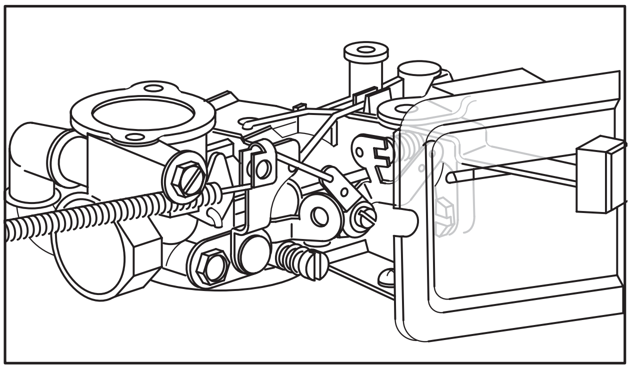


Fig. 30

Manual choke, manual friction throttle, Fig. 31.

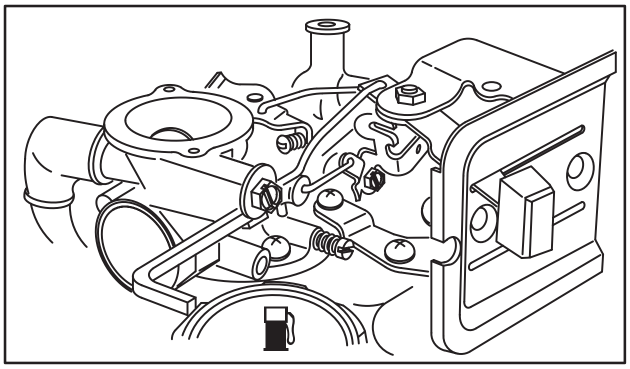


Fig. 31

Manual choke, remote control, governed idle. Fig. 32.

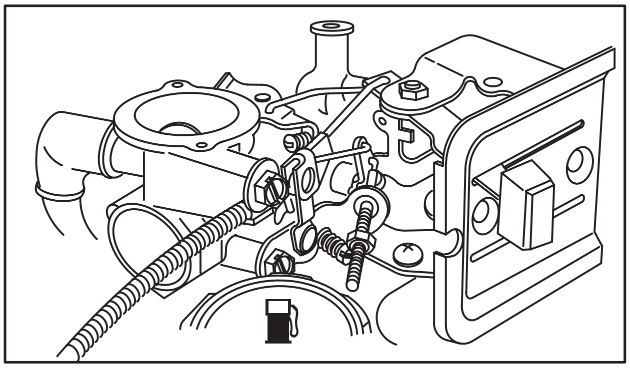


Fig. 32

Choke-A-Matic®, Fig. 33.

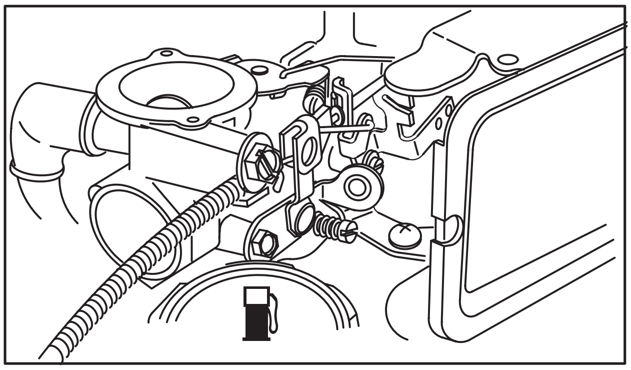


Fig. 33

Manual choke, bottom mount remote control, Fig. 34.

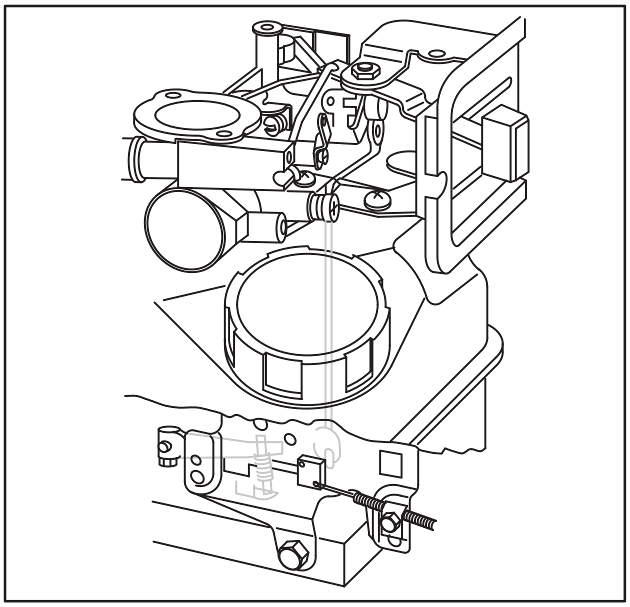


Fig. 34

Model Series 60300, 60400, 61300, 80300, 80400, 81400 Horizontal Crankshaft

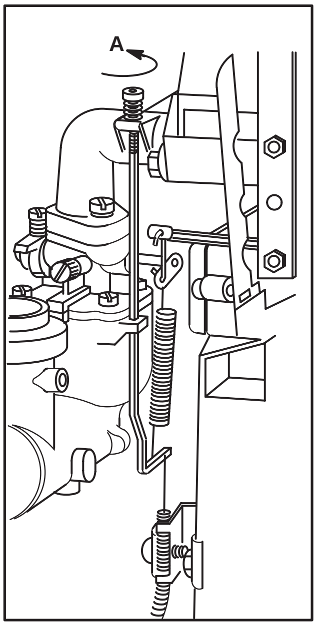


Fig. 35
Turn governor screw as shown to increase speed.

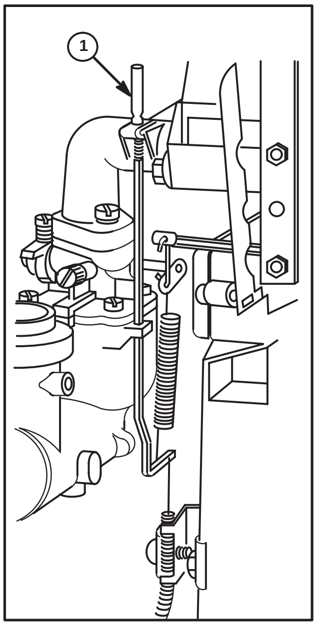


Fig. 36
Top speed limit device (1).

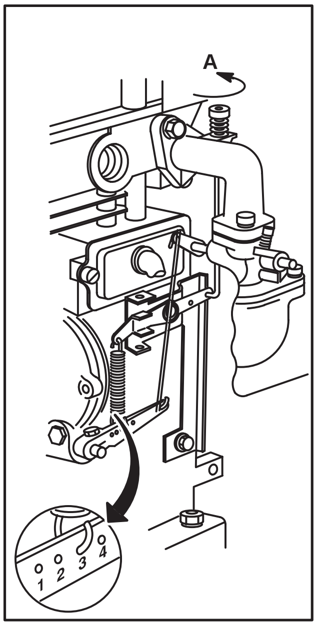


Fig. 37
Turn governor screw as shown to increase speed.

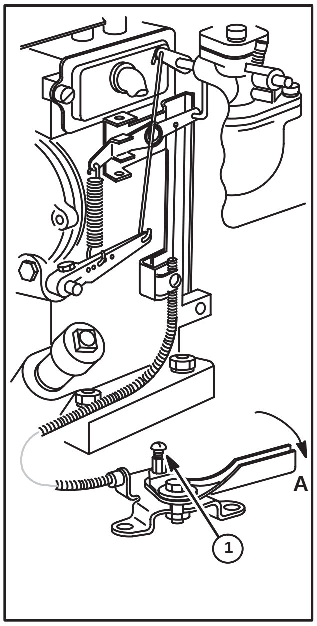


Fig. 38
Move remote control lever as shown to increase speed. Swivel screw, (1).

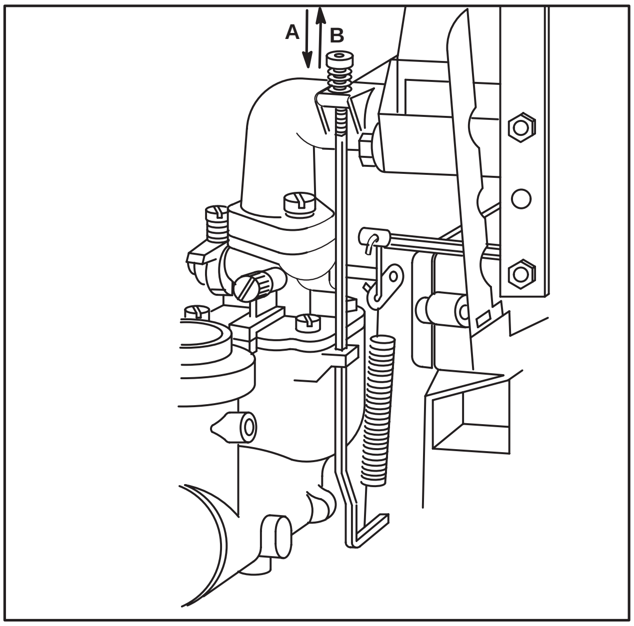


Fig. 39
Turn governor screw as shown to increase (A) or decrease (B) speed.

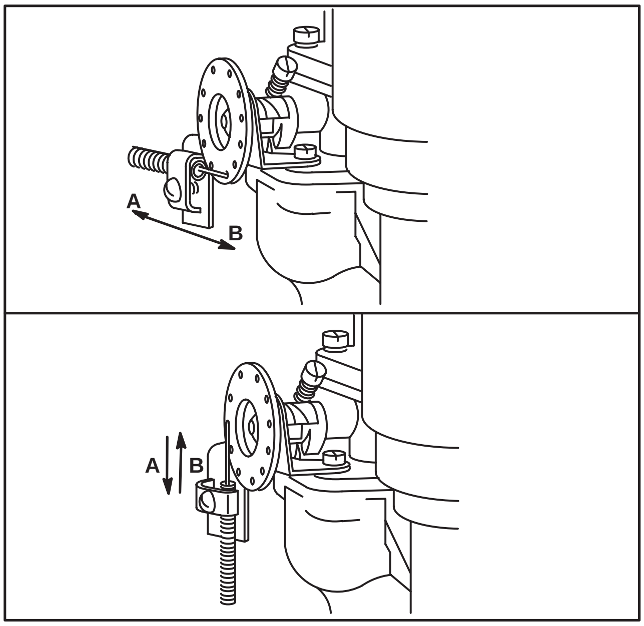


Fig. 40
Move throttle cable as shown to increase (A) or decrease (B) speed.

Model Series 91200, 92200, 94200 Horizontal Crankshaft with date codes ending in A1 through A9 or E1 through E9

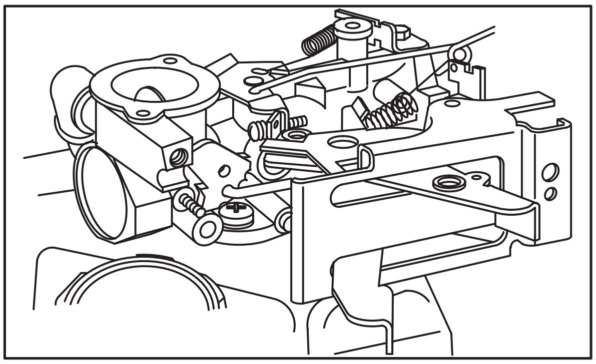


Fig. 41

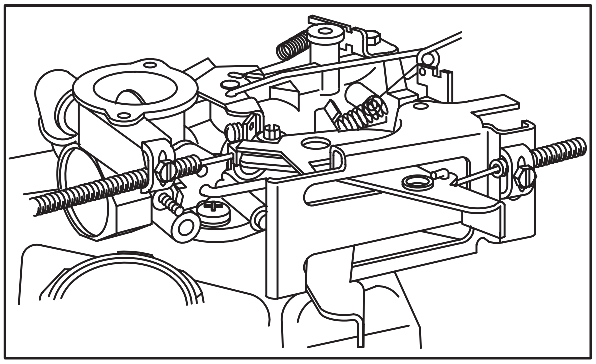


Fig. 42

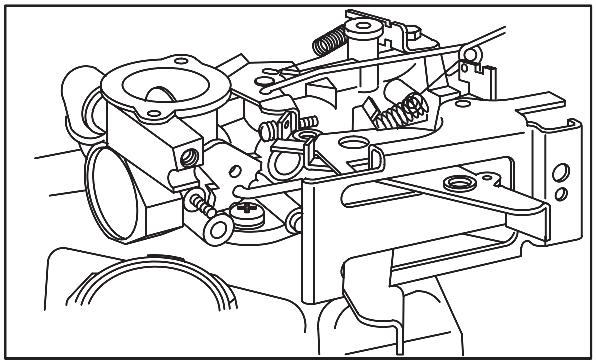


Fig. 43

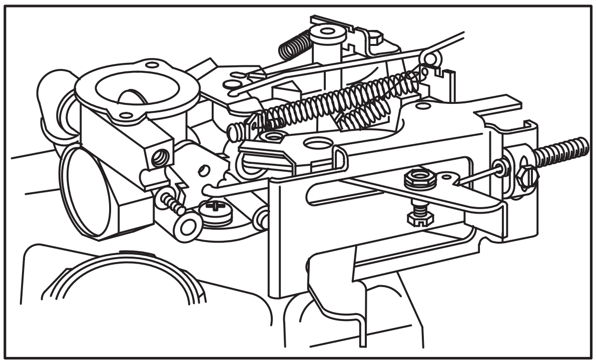


Fig. 44

Fig. 41 – Manual Friction **Fig. 42** – Remote Control **Fig. 43** – Fixed Adjustable **Fig. 44** – Vehicle Control

Model Series 93400 Horizontal Crankshaft

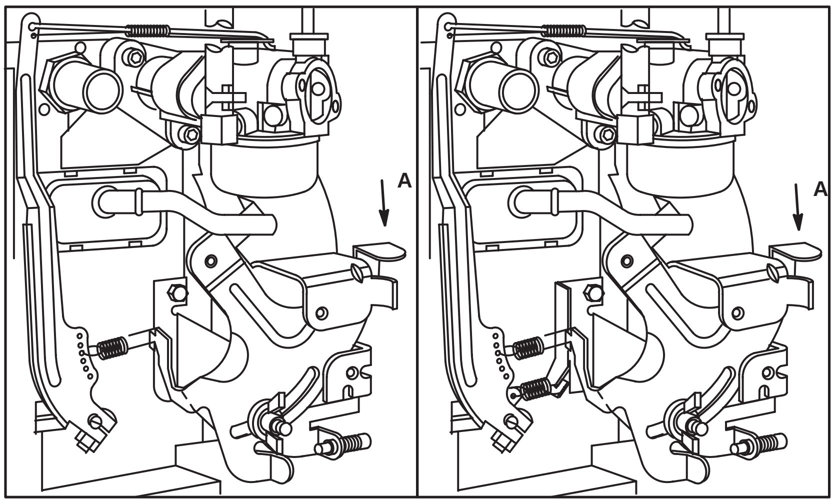


Fig. 45

Fig. 45 – Move lever (A) as indicated to increase speed.

Model Series 133400 Horizontal Crankshaft

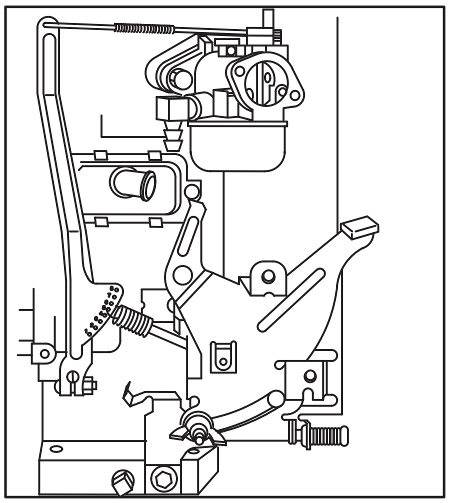


Fig. 46

Model Series 80000, 91200, 110000, 130000 Horizontal Crankshaft, Mechanical Governor

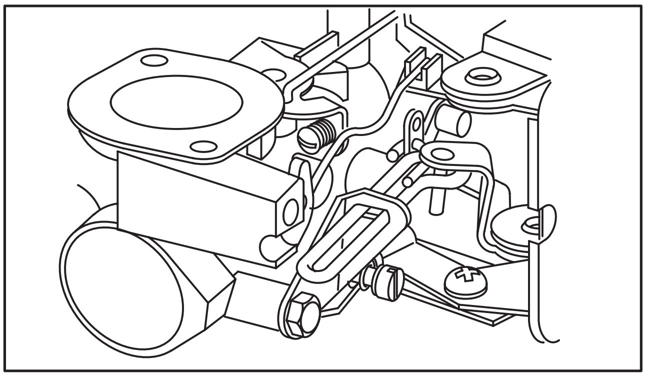


Fig. 47 – Standard Controls

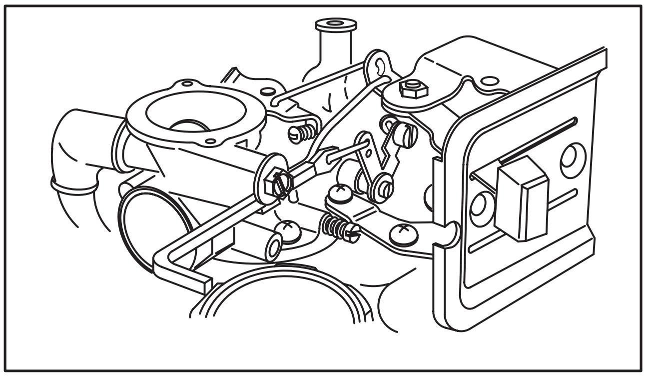


Fig. 48 – Manual Choke, Manual Friction

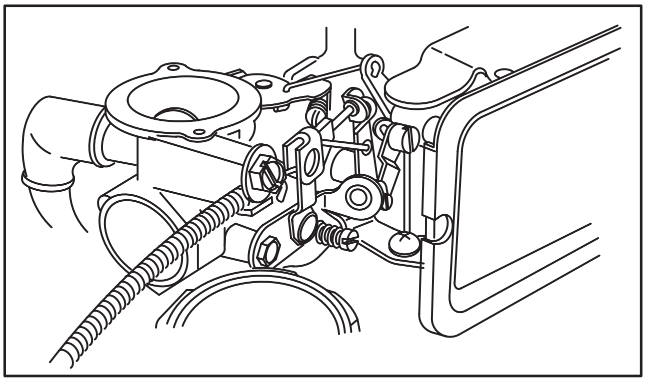


Fig. 49 – Choke-A-Matic®

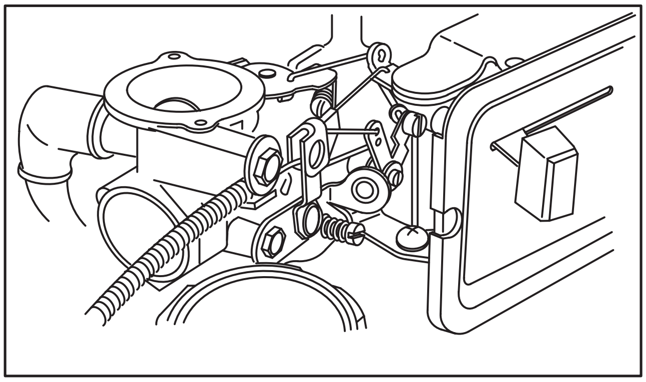


Fig. 50 – Manual Choke, Remote Controls

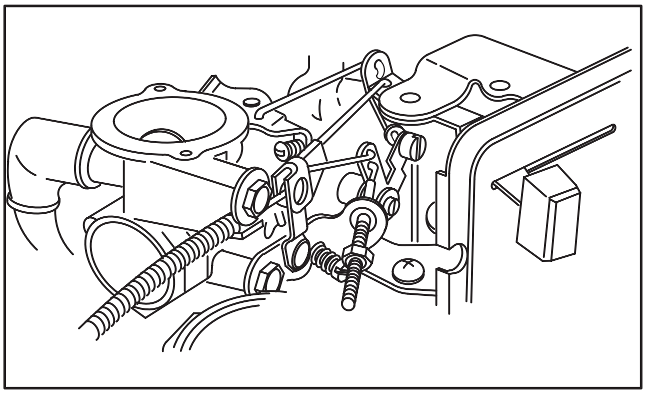


Fig. 51 – Manual Choke, Remote Control, Governed Idle

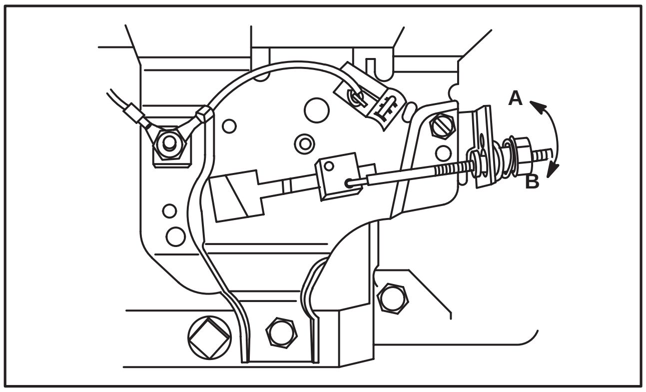


Fig. 52 – Fixed Adjustable

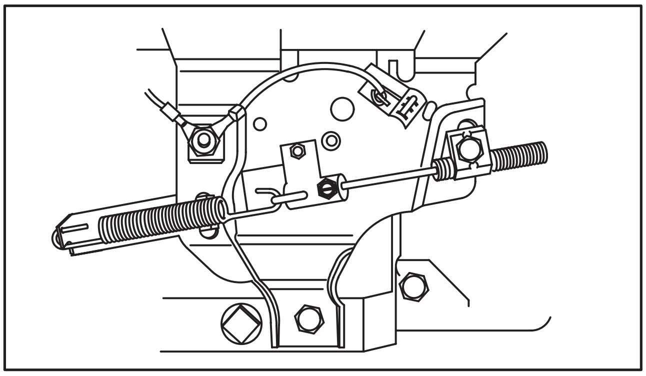


Fig. 53 – Vehicle Controls, Throttle Return

Model Series 100200, 130200 Horizontal Crankshaft

Manual friction governor control. Pull knob up as indicated (A) to increase speed, Fig. 54.

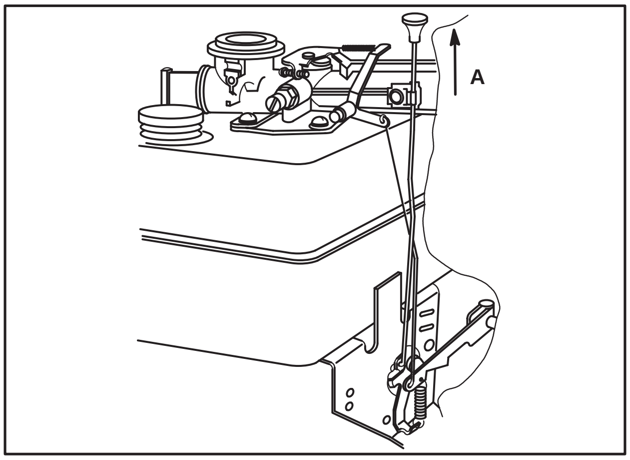


Fig. 54

Remote control with governor, Fig. 55.

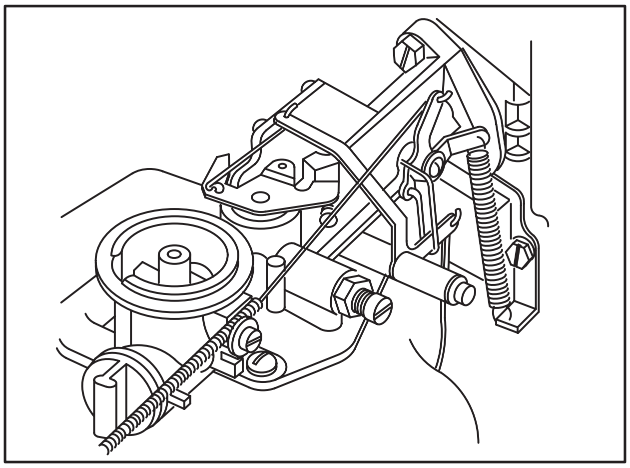


Fig. 55

Standard governor control. Turn thumbscrew clockwise as indicated (A) to increase speed. Inset: remote control cable moves as indicated to increase speed (A) Fig. 56.

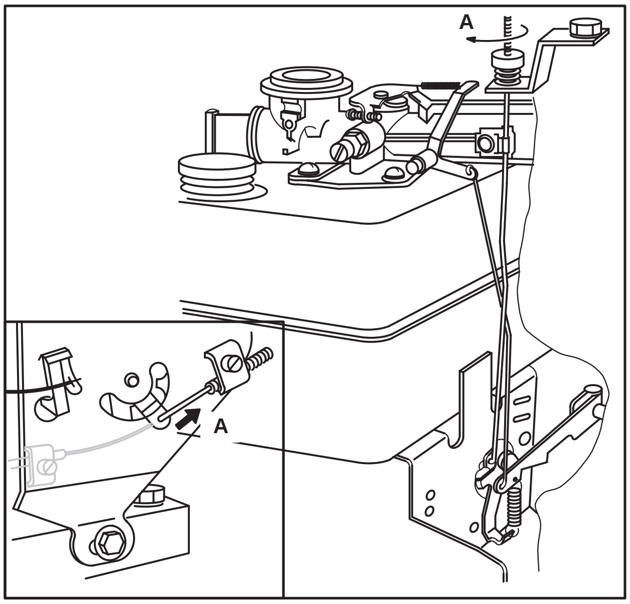


Fig. 56

Choke-A-Matic® remote control mounted on top of engine showing casing clamp (1), (inset A), and direction cable moves to close choke. Choke-A-Matic® remote control (inset B) showing stop switch (2) direction to choke, (3), and movement of linkage to close choke, (4), Fig. 57.

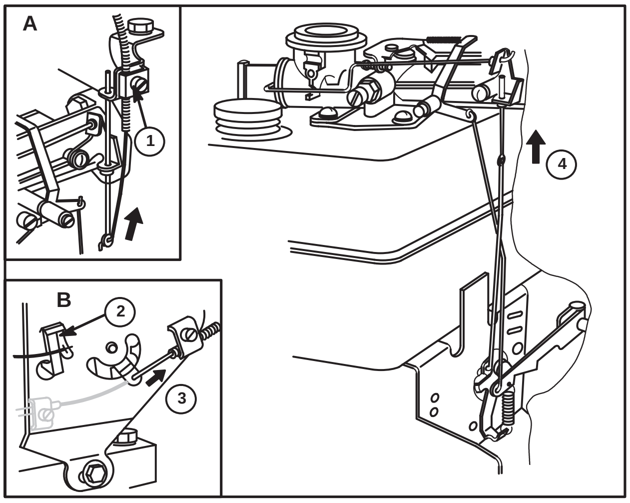


Fig. 57

4

Pull throttle control knob up to run (1), push down to stop (2), Fig. 58.

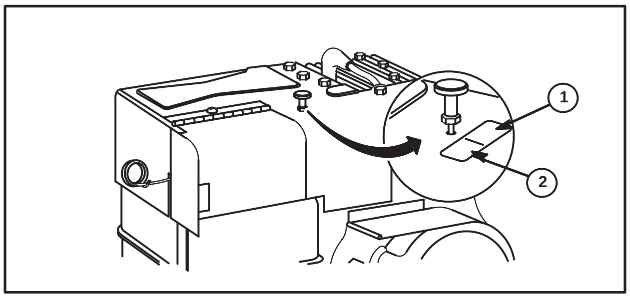


Fig. 58

Place lever (4) in choke detent (5). If choke (1) is not fully closed, adjust nylon nut (2) with socket wrench until choke just closes. Lever stop position (3), Fig. 59.

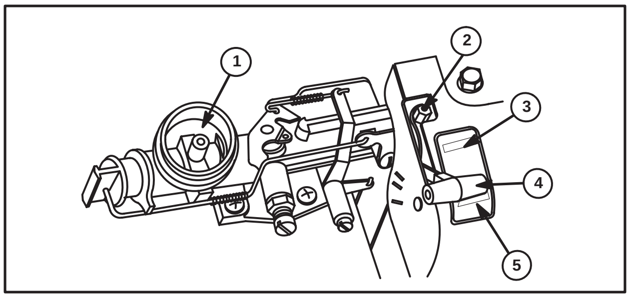


Fig. 59

Pull lever (1) to full choke position (2). The distance between throttle stamping and throttle screw stop (4) must be 9/16” (14.27 mm). To adjust, bend linkage where shown (3), Fig. 60.

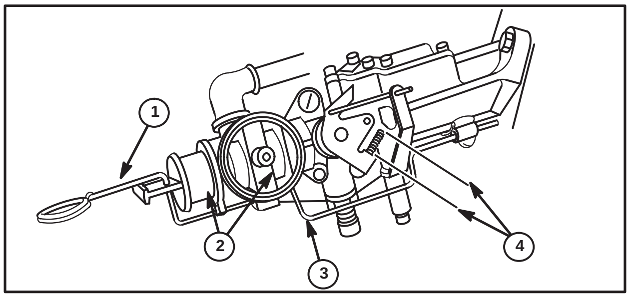


Fig. 60

Model Series 176400, 19B400, 19E400, 19F400, 19G400, 192400, 196400, 197400 with Bell Crank Controls and One Spring, Horizontal Crankshaft

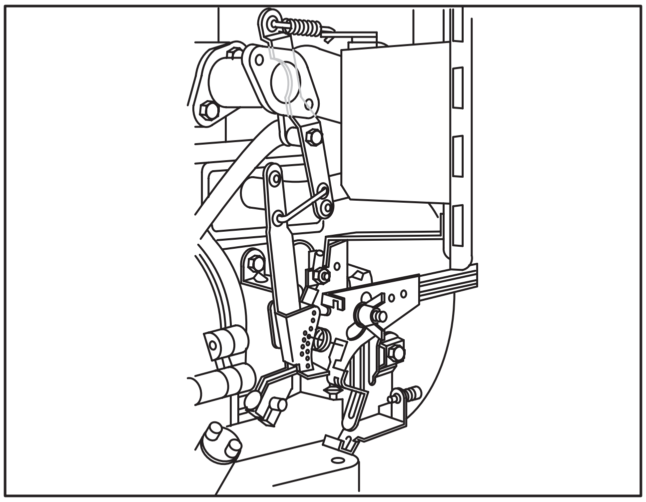


Fig. 61

Model Series 176400, 19B400, 19E400, 19F400, 19G400, 192400, 196400, 197400 with Bell Crank Controls and Two Springs, Horizontal Crankshaft

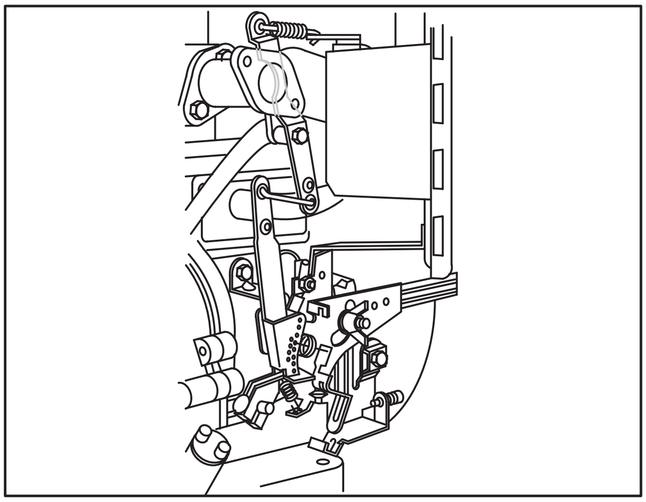


Fig. 62

Model Series 226400, 250400, 256400 Horizontal Crankshaft Control, One Spring

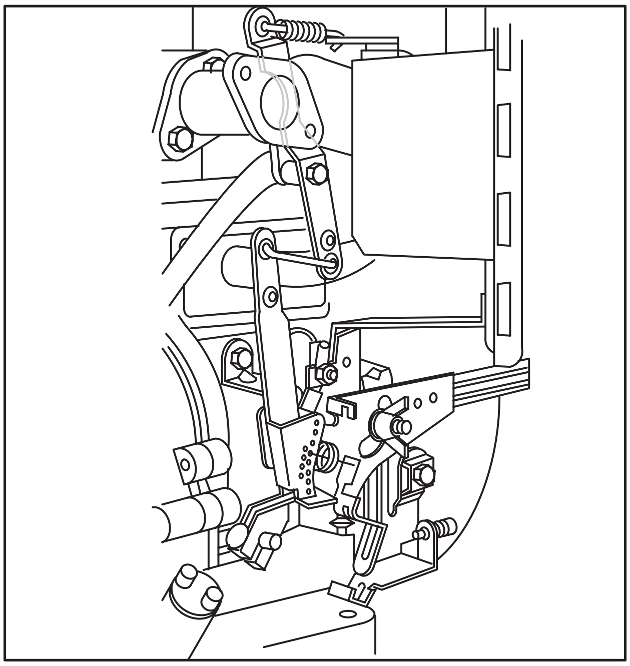


Fig. 63

Model Series 226400, 250400, 256400 Horizontal Crankshaft Control, Two Springs

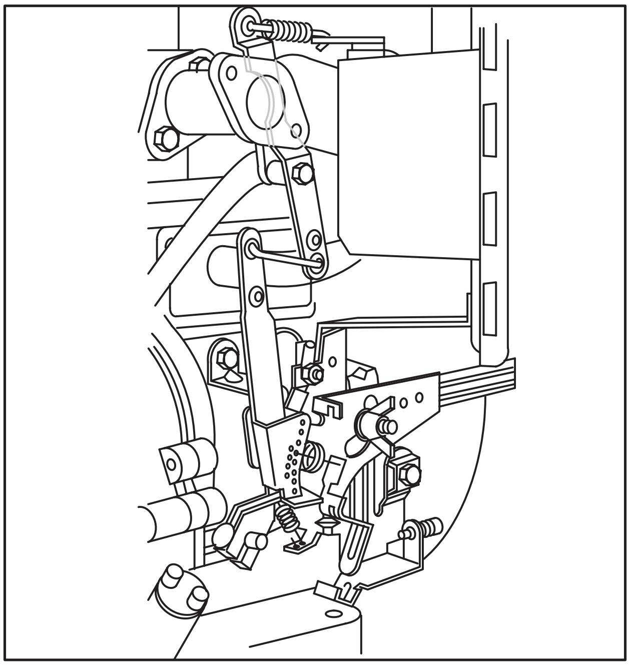


Fig. 64

4

Adjust Choke-A-Matic® as shown (A), to increase speed, Fig. 65.

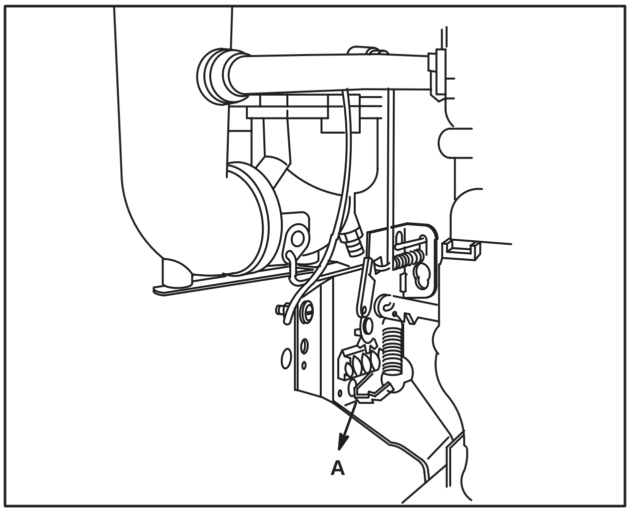


Fig. 65

Adjust remote control cable as shown (A), to increase speed, Fig. 66.

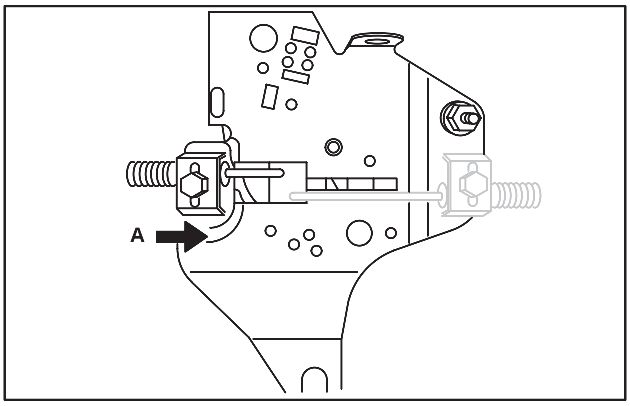


Fig. 66

Adjust Manual Friction as shown (A), to increase speed, Fig. 67.

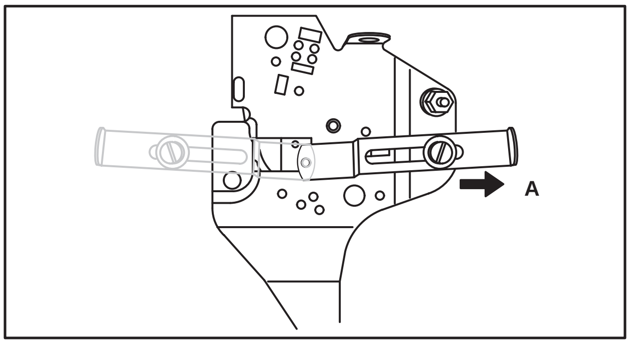


Fig. 67

Turn fixed adjustable as shown – (A) to increase speed, (B) to decrease speed, Fig. 68.

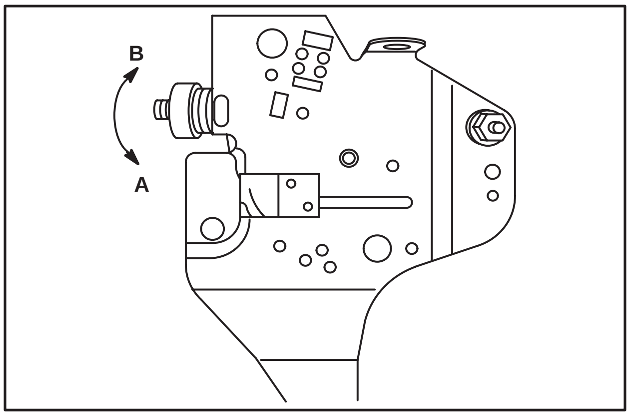


Fig. 68

Model Series 170400, 190400, 195400, 220400, 221400, 251400, 252400 Horizontal Crankshaft with Swivel Lever Control before Date Code 83121600

Adjust Choke-A-Matic® linkage and cable as shown (A), to increase speed, Fig. 69.

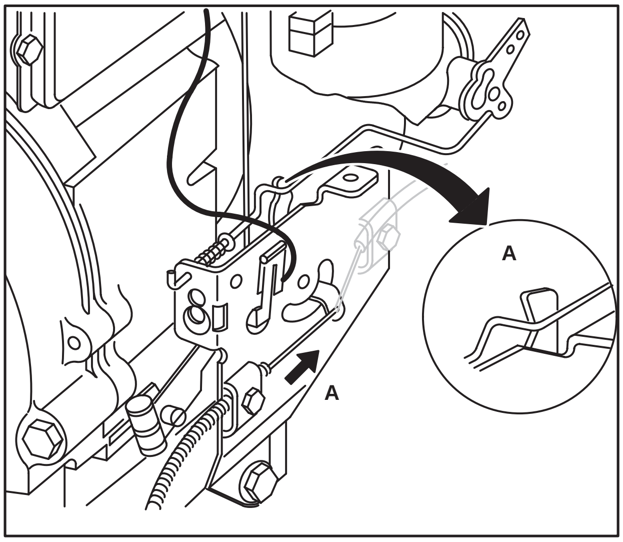


Fig. 69

Adjust cable or turn knob as shown (A) to increase speed. Manual friction (1), fixed adjustable (2), remote control (3), Fig. 70.

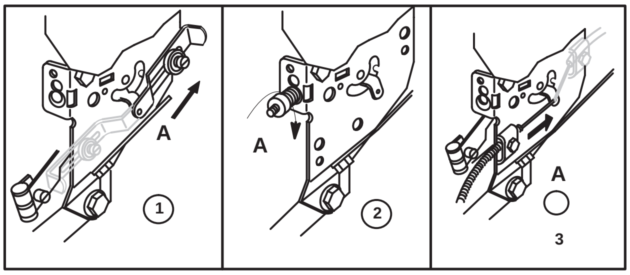


Fig. 70

Adjust as shown (A) to increase speed. Manual friction (1), fixed adjustable (2), remote control (3), Fig. 71.

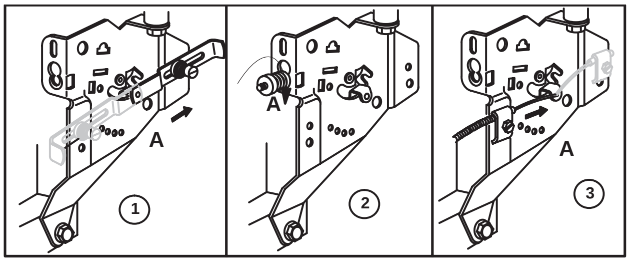


Fig. 71

Model Series 230000, 240000, 300000, 320000 Horizontal Crankshaft

Remote Governor Control

Attach remote control casing and wire as shown in Figs. 72 or 73. Do not change the position of the small elastic stop nuts below the thumb nut (1). They ensure a governed idle speed and protection against over-speeding. Move lever as shown to increase (A) or decrease (B) speed.

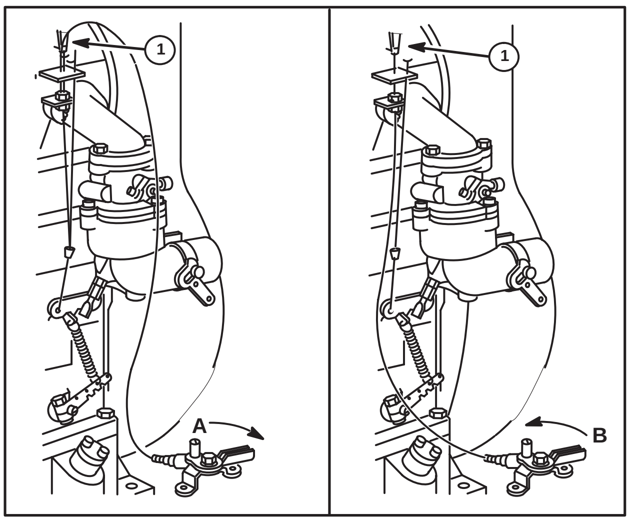


Fig. 72

Fig. 73

Thumb Nut Adjustment

Remove thumb nut and upper elastic stop nut (2), Figs. 76 and 77. Replace thumb nut and adjust to desired operating speed. (See Figs. 74-79). Do not change the position of the lower elastic stop nut. It provides protection against overspeeding.

Governed Idle

All engines in Model Series 243400, 300400, 320400, and some 233400 engines use two governor springs (4), Fig. 78. The shorter spring keeps the engine on governor, even at idle speed. If moderate loads are applied at idle, the engine will not stall.

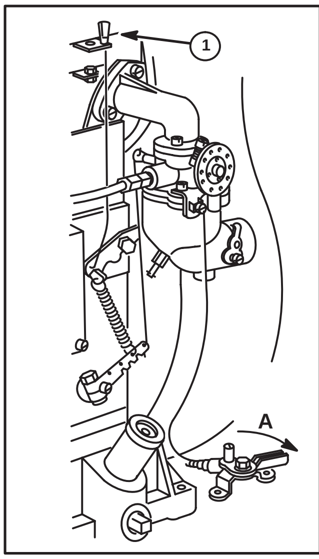


Fig. 74

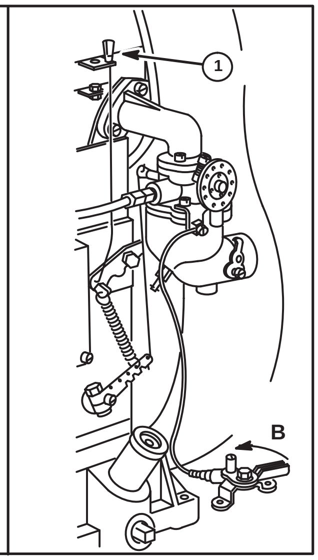


Fig. 75

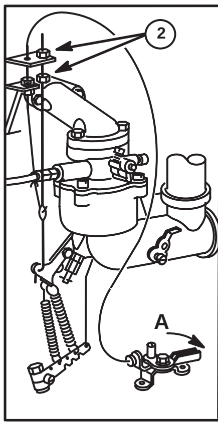


Fig. 76

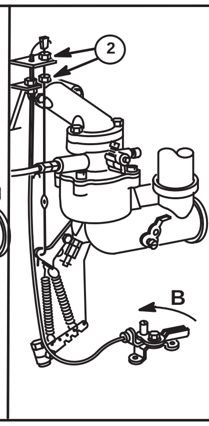


Fig. 77

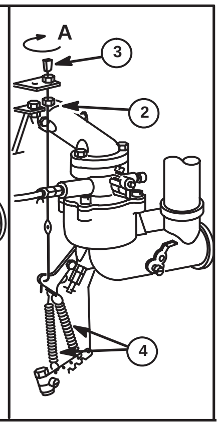


Fig. 78

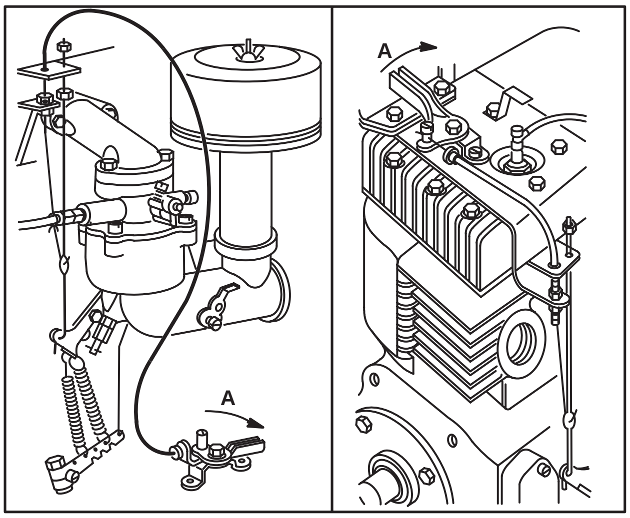


Fig. 79

Model Series 220000, 250000 Horizontal Crankshaft with Rack & Pinion Control after Date code 83121500, Except 253400, 255400

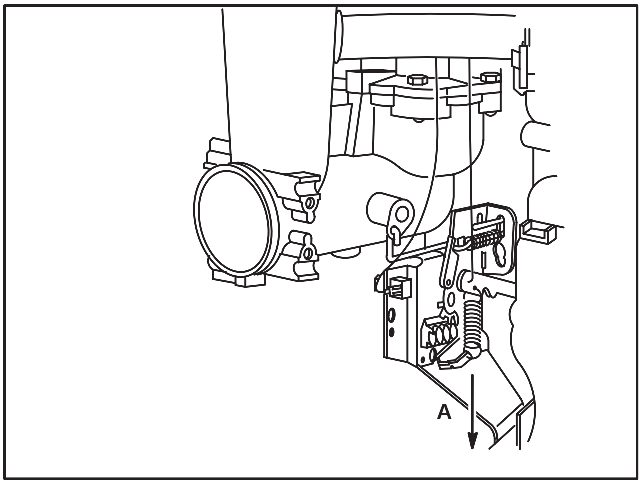


Fig. 80

Fig. 80 – Choke-A-Matic®

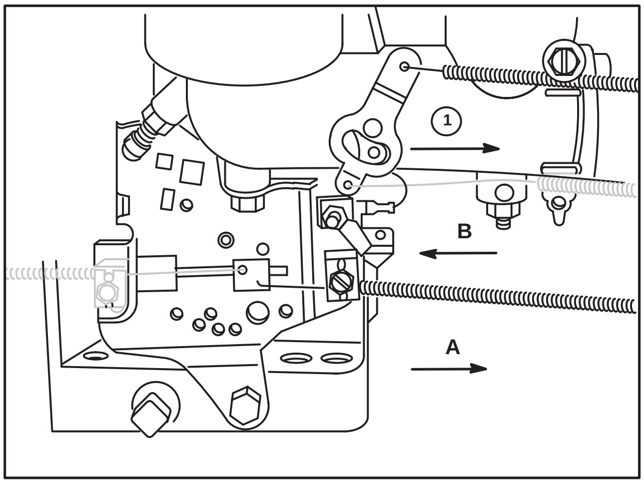


Fig. 81

Fig. 81 – Remote Control Choke (1)

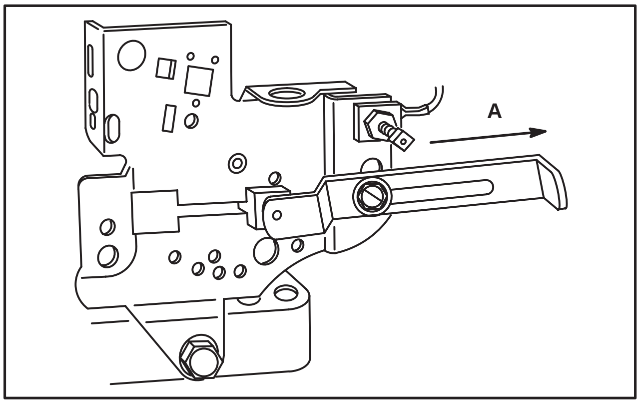


Fig. 82

Fig. 82 – Manual Friction

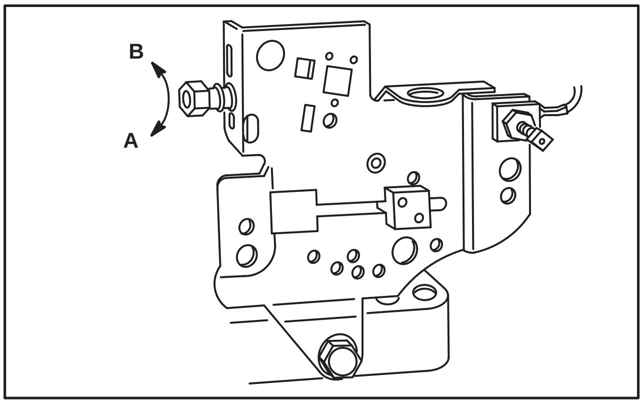


Fig. 83

Fig. 83 – Fixed Adjustable

Figs. 80 – 83: Move as shown (A) to increase speed, (B) to decrease speed.

4

Model Series 253400, 255400 Horizontal Crankshaft

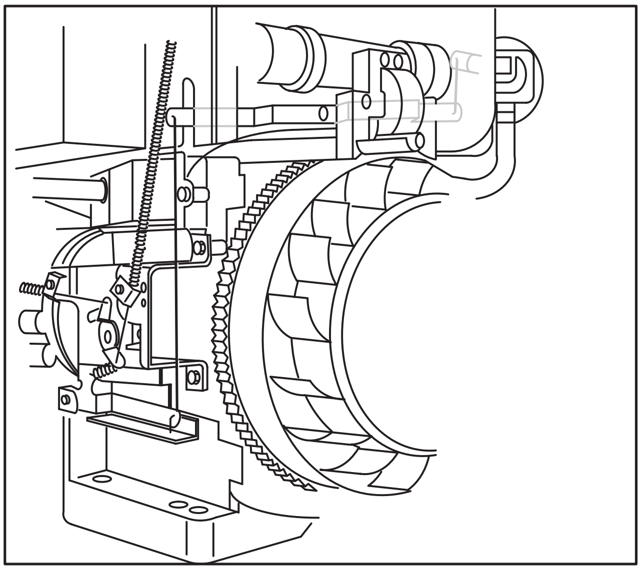


Fig. 84

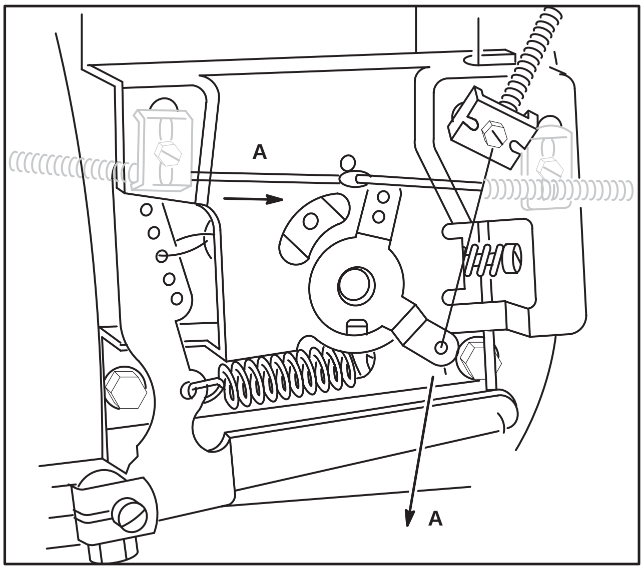


Fig. 85

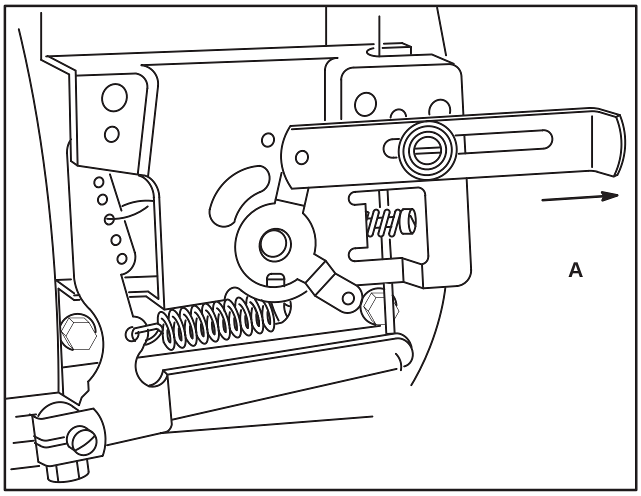


Fig. 86

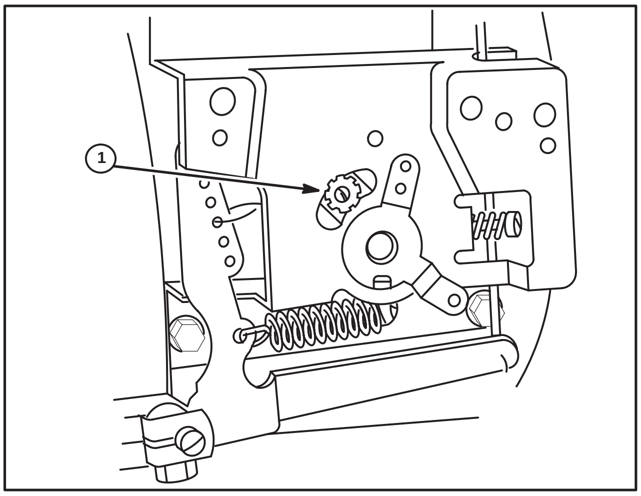


Fig. 87 – Fixed speed screw (1)

Figs. 84 – 87: Move as shown (A) to increase speed, (B) to decrease speed.

Model Series 90000 Vertical Crankshaft – "A" indicates "FAST" position, "B" indicates "STOP" position

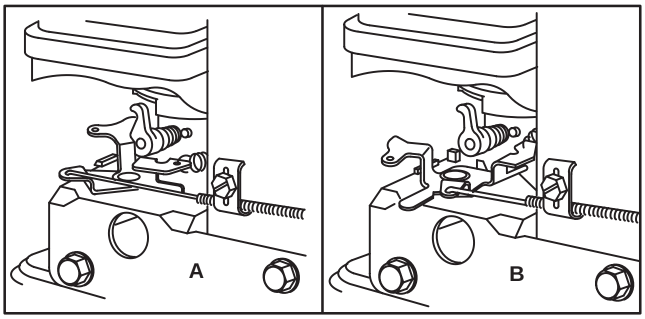


Fig. 88

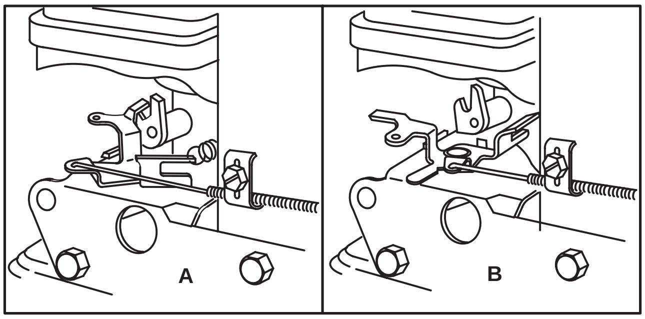


Fig. 89

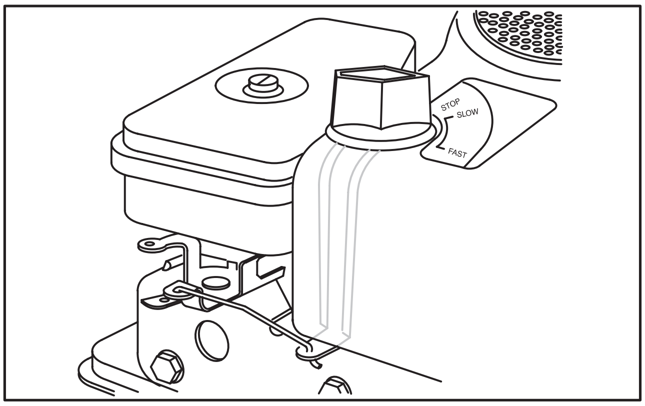


Fig. 90

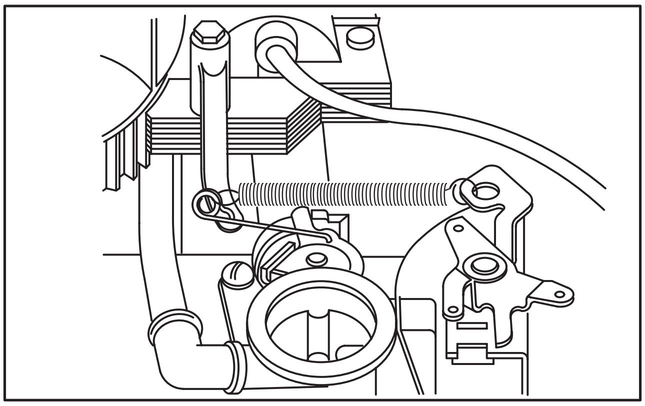


Fig. 91

Model Series 9B900, 9C900, 98900, 10A900, 10B900, 10C900 Vertical Crankshaft, Dual Spring

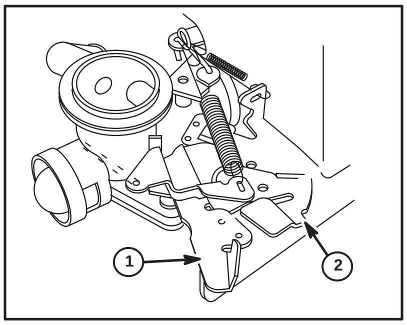


Fig. 92 – Manual Friction

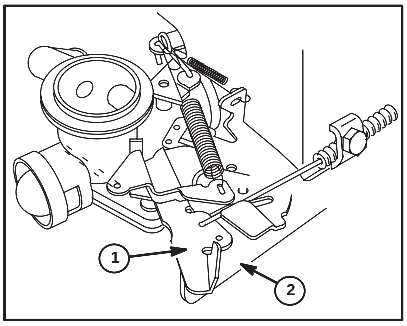


Fig. 93 – Remote Control

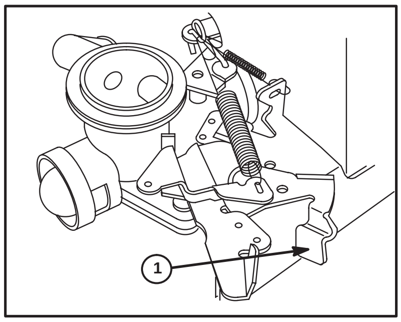


Fig. 94 – Fixed Adjustable

Model Series 9B900, 9C900, 98900, 10A900, 10B900, 10C900 Vertical Crankshaft, Single Spring

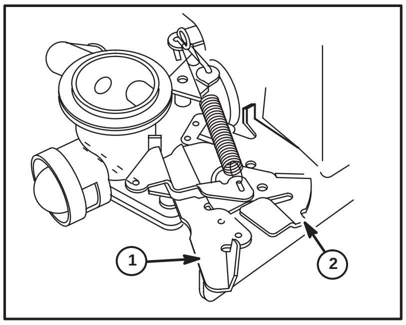


Fig. 95 – Manual Friction

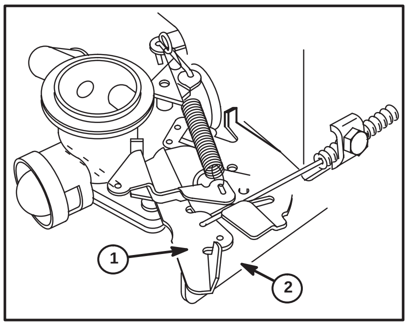


Fig. 96 – Remote Control

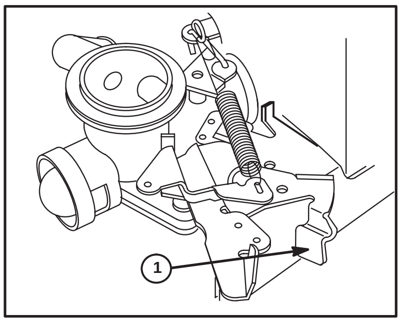


Fig. 97 – Fixed Adjustable

Figs. 92 – 97: Governor control lever (1), governor control bracket (2).

4

Model Series 120000 Vertical Crankshaft

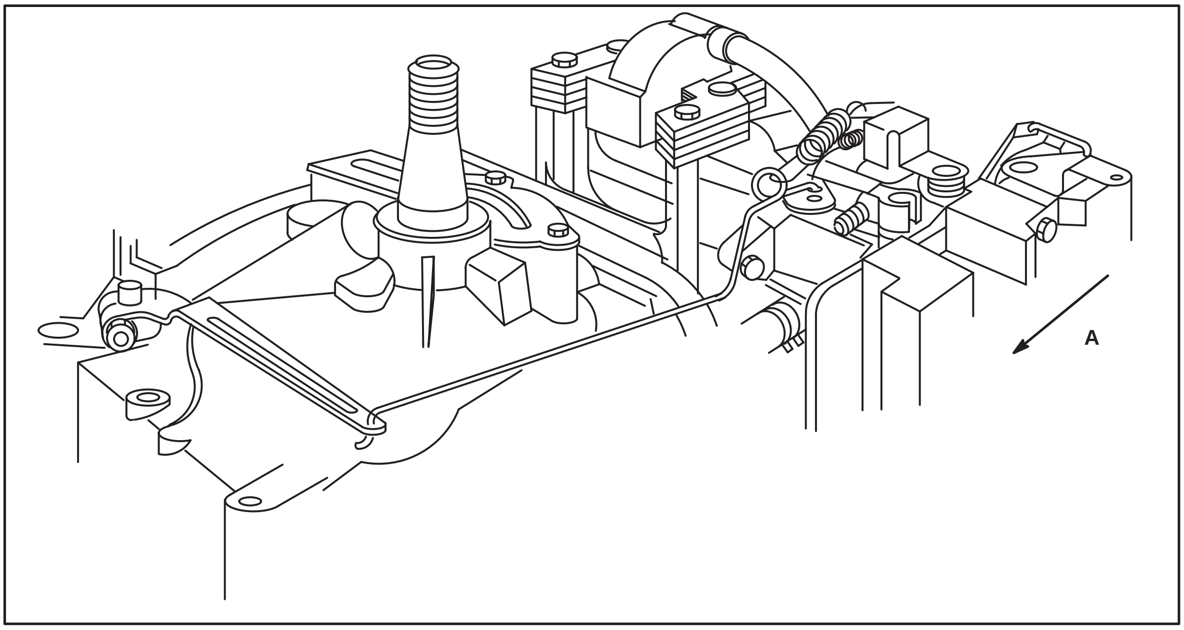


Fig. 98

"A" indicates increase speed, "B" indicates decrease speed.

Model Series 90700, 110700, 112700 Vertical Crankshaft

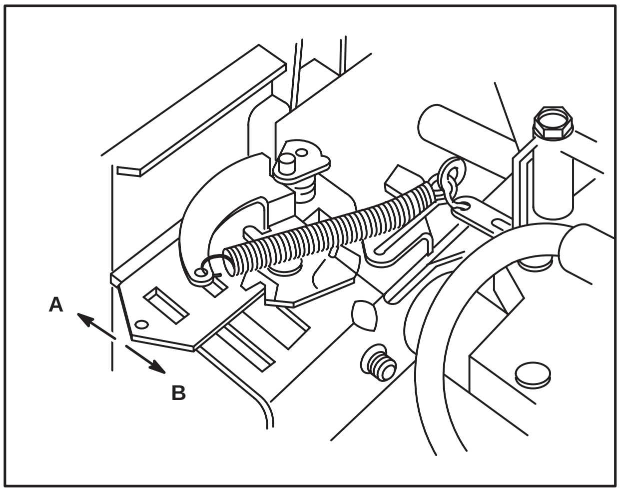


Fig. 99

Model Series 91700, 111700, 114700 Vertical Crankshaft

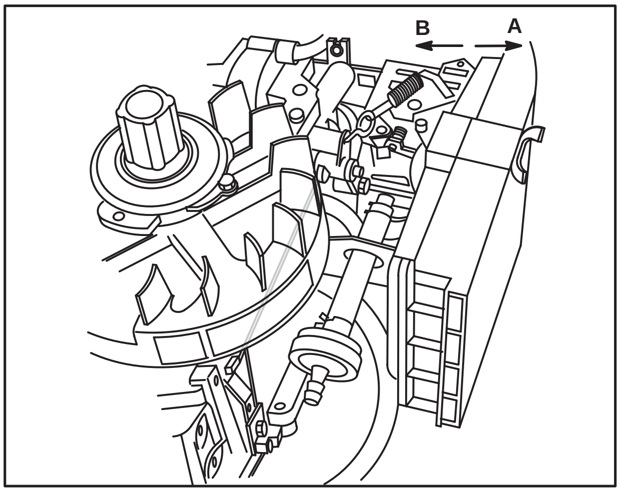


Fig. 100

Model Series 130700, 131700, 132700 Vertical Crankshaft – "A" shows speed increase, "B" shows decrease.

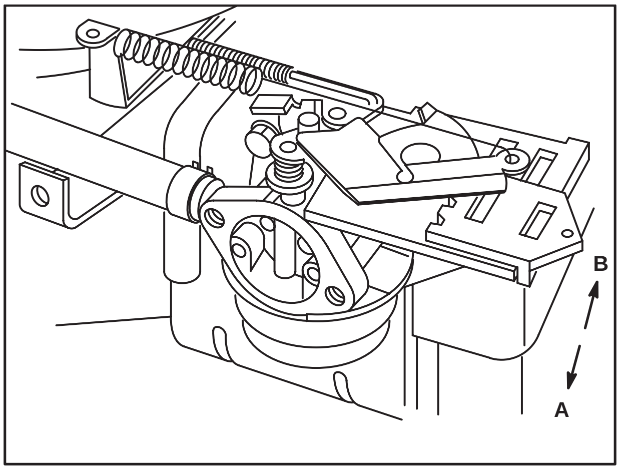


Fig. 101

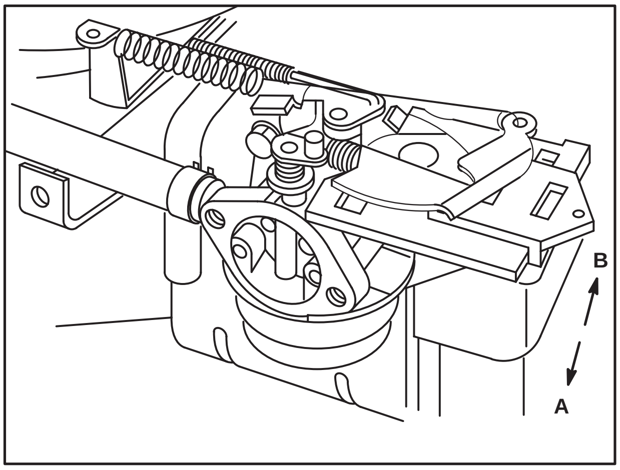


Fig. 102

4

Model Series 100900, 130900 Vertical Crankshaft

Throttle lever (1)
Choke lever (2)
Choke and throttle remote control casings (3)
Casing screws (4)
Fig. 103

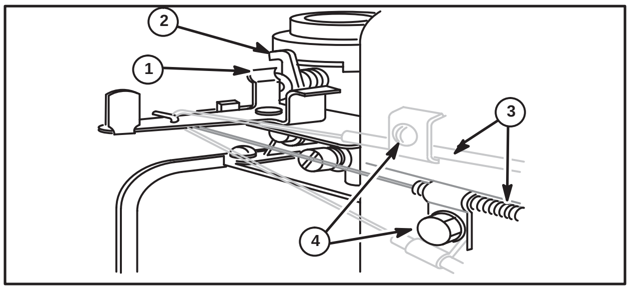


Fig. 103

Choke closed (1)
Lever in choke (2)
Lever in stop(3)
Stop switch (4)
Blade (5)
Fig. 104

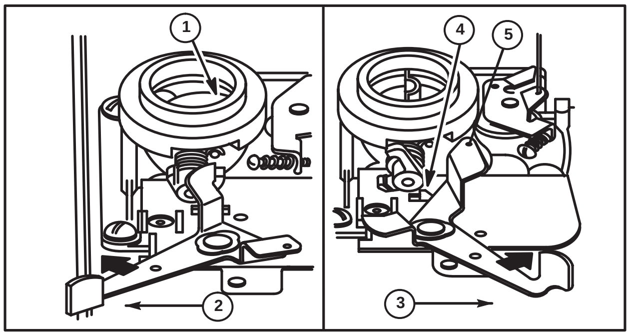


Fig. 104

Place control in choke detent (1). If choke does not fully close, bend linkage as shown until choke is closed (2), Fig. 105.

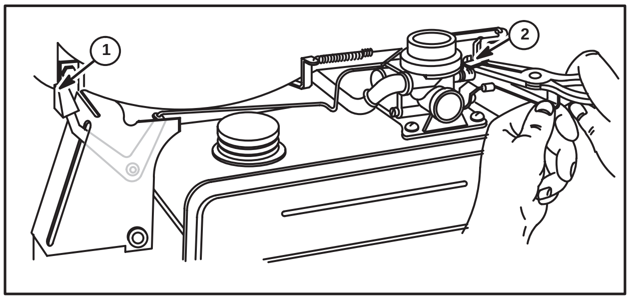


Fig. 105

4

Model Series 170700, 190700, 191700, 192700, 193700, 220700, 252700, 253700, 280000 Vertical Crankshaft with Rack & Pinion Control Except Model 286700

Move as shown (A) to increase speed, Fig. 107.

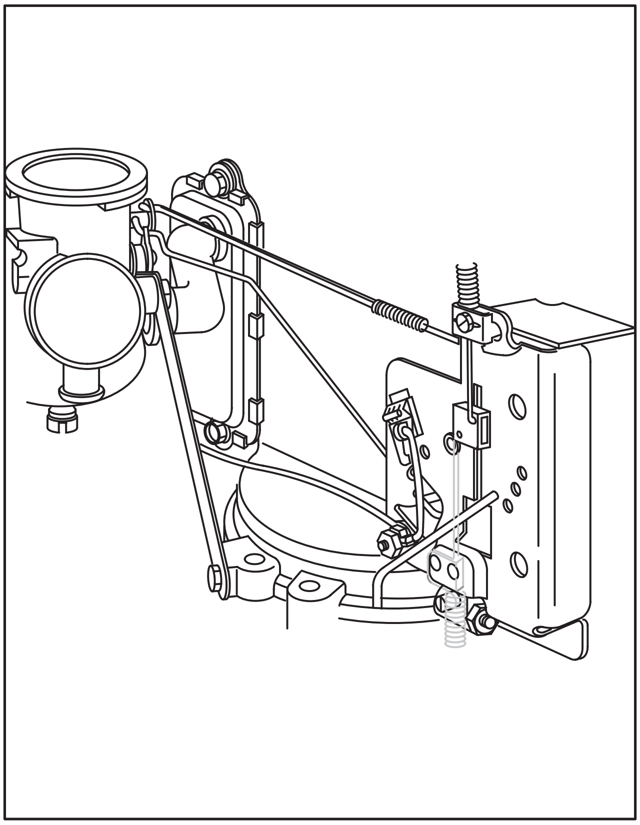


Fig. 106

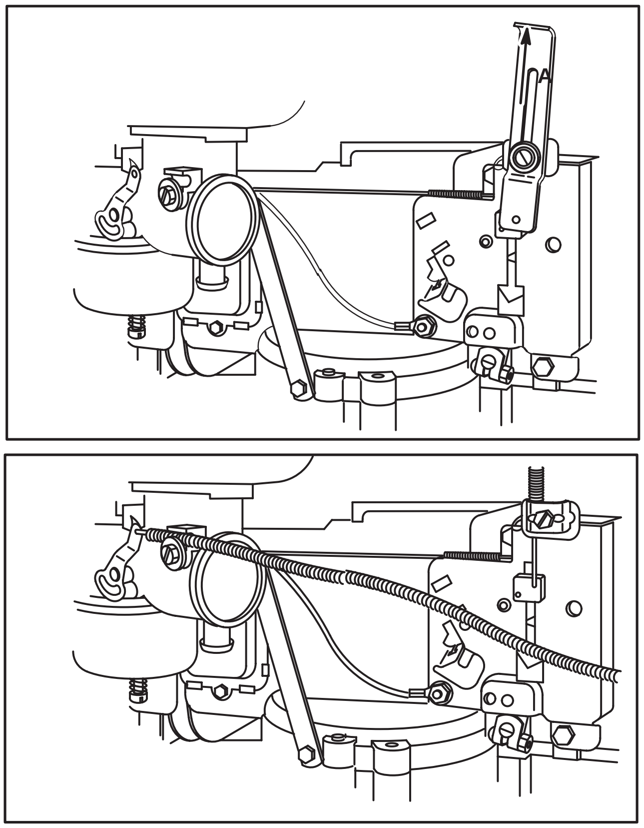


Fig. 107

Model Series 194700, 195700, 254700, 257700, 283700, 286700
Vertical Crankshaft With Horizontal Control Rack & Pinion Control

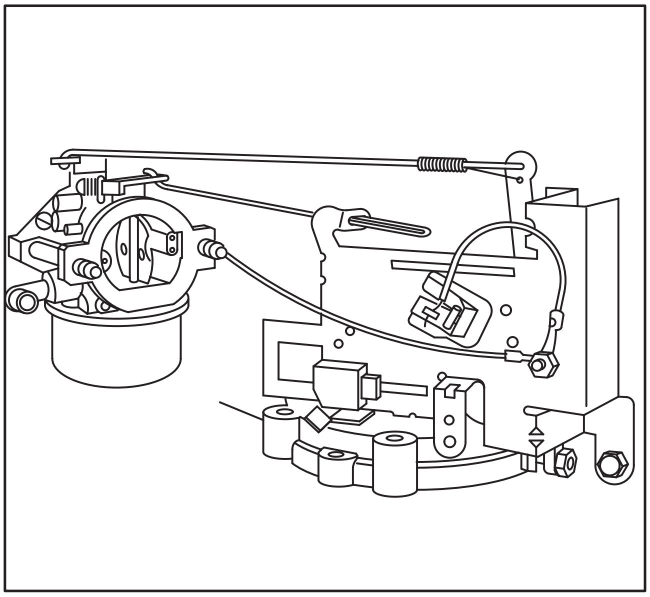


Fig. 108

Move as shown (A) to increase speed.
Slide control (1), Fig. 109.

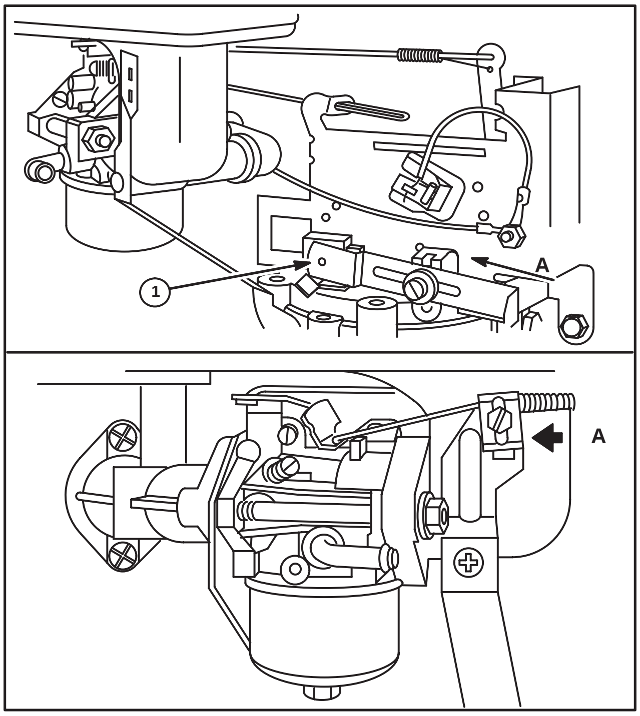
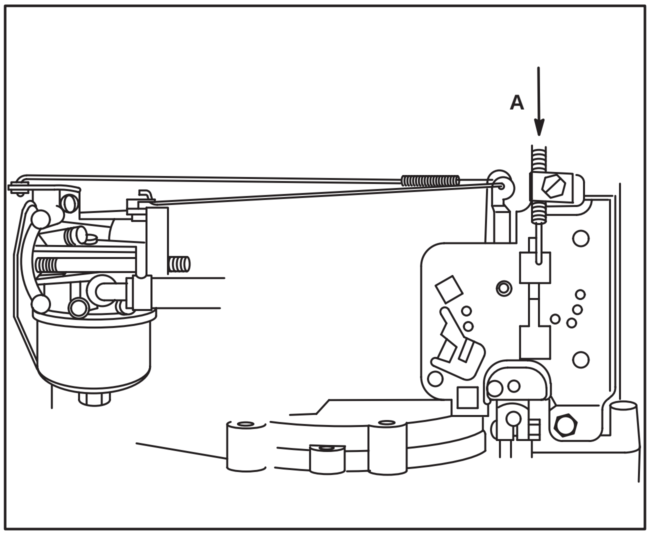


Fig. 109

Model Series 194700, 195700, 196700, 254700, 257700, 283700, 286700
Vertical Crankshaft With Vertical Rack & Pinion Control



Move as shown (A) to increase speed, Figs. 110-111.

Fig. 110

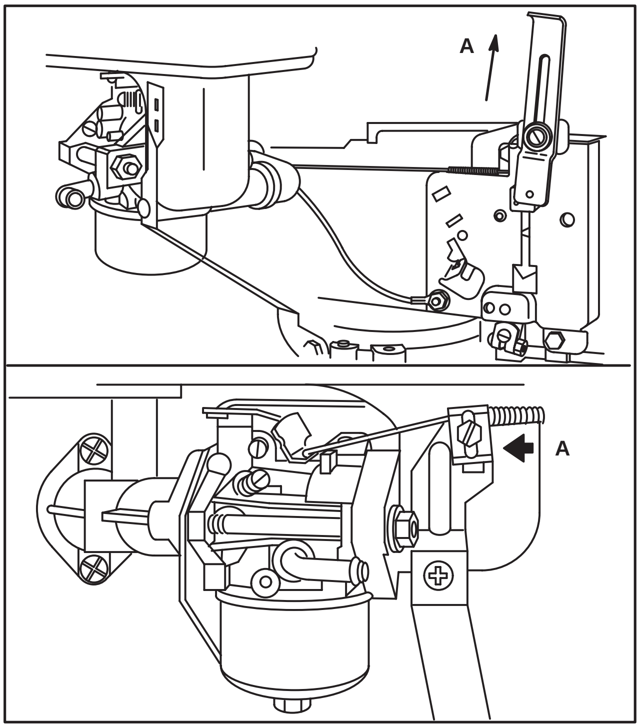


Fig. 111

Model Series 170700, 171700, 190700, 191700 Vertical Crankshaft with Swivel Lever Control

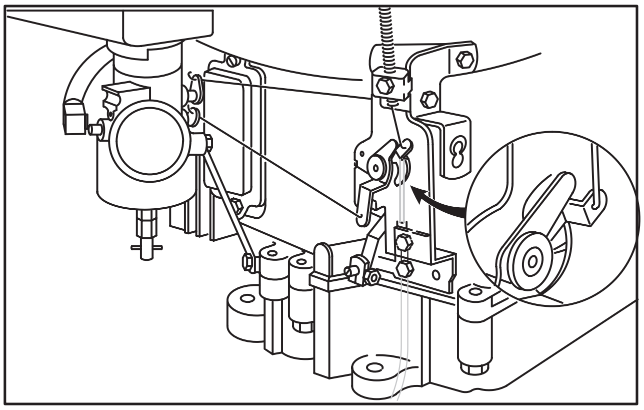


Fig. 112

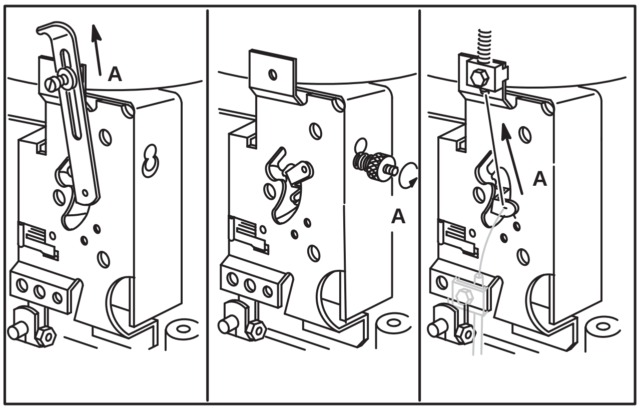


Fig. 113

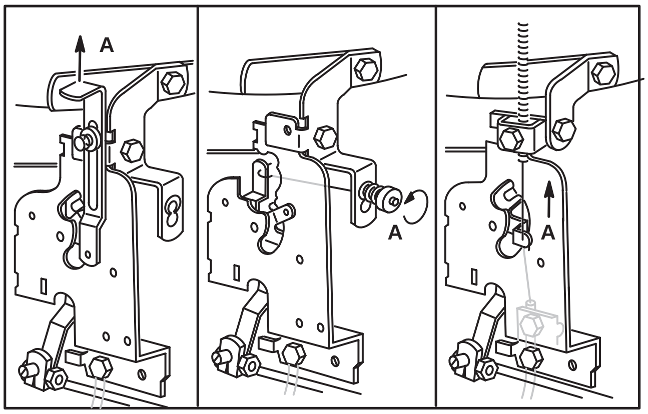


Fig. 114

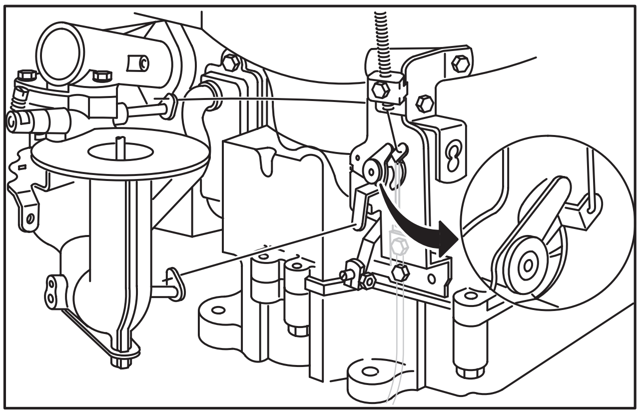


Fig. 115

Move as shown (A) to increase speed, Figs. 112-115.

BAND BRAKE CONTROLS
Model Series 92000, 93000, 94000, 95000, 110000

System 3® and 4® engines are equipped with the band brake feature, Fig. 116. The band brake **MUST STOP** the engine (cutter blade) within **three seconds after operator releases equipment** safety control, Fig. 117.

If stopping time exceeds three seconds with equipment speed control set in "FAST" position, remove blower housing (3), and brake cover (2), and examine following for adjustment, alignment, or damage:

a. Band brake worn or damaged.
b. Anchor post (5) or alternate type – inset (4) misaligned or bent.
c. Brake spring not securely anchored or loose.
d. Control bracket lever (1) rivet worn or loose. (Check ignition system as noted in Section 2.)
e. Control bracket (1) misadjusted.
f. Equipment controls (1) damaged, Fig. 117.

To examine, adjust, or replace band brake, disconnect spark plug wire and place in holding tab. For System 4® engines, disconnect battery wires at connector, loosen battery holder screws and remove battery.

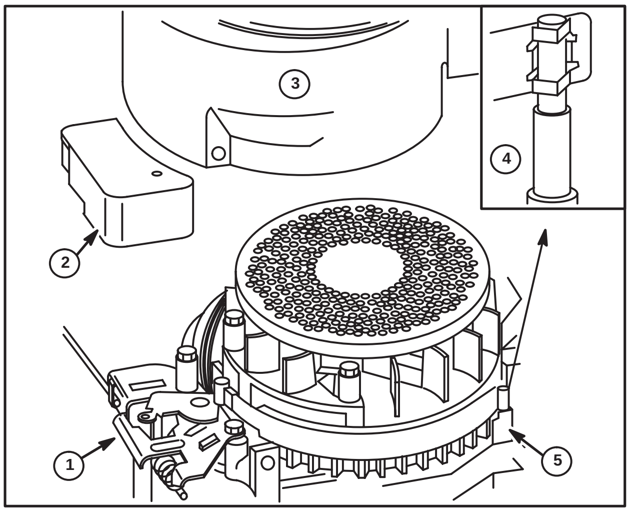


Fig. 116

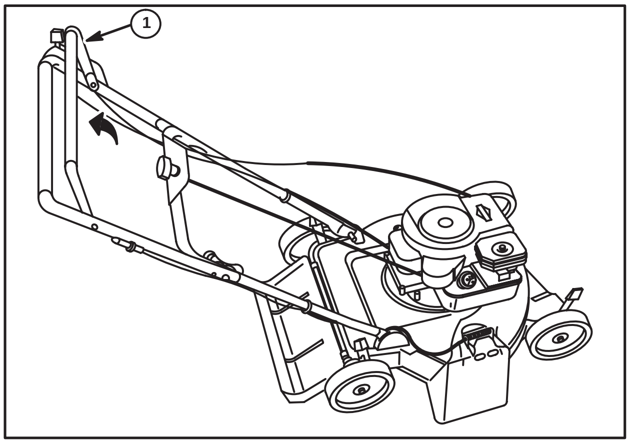


Fig. 117

DISASSEMBLY TO REMOVE BAND BRAKE

1. Remove brake control bracket cover.
2. Loosen cable clamp screw and remove cable from control lever, Fig. 116.

   NOTE: Contact equipment manufacturer for control cable specifications or replacement.

3. Remove two switch cover screws. On System 4® engines, move cover (1) as shown in Fig. 118. Handle with care to prevent damage to lever caused by link when moving switch cover.

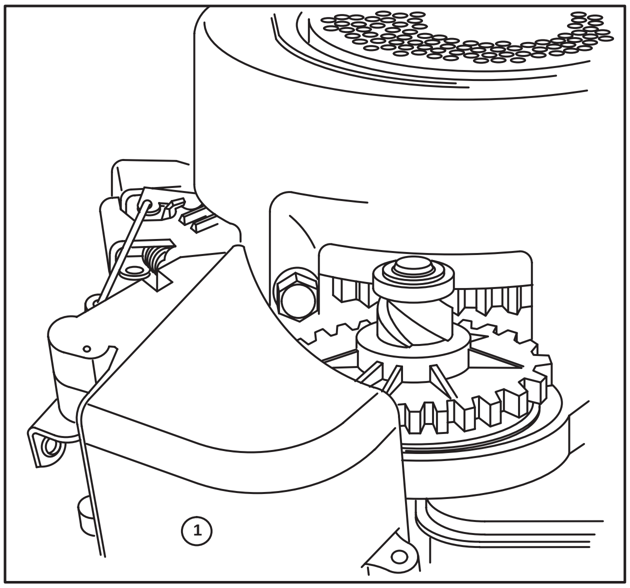


Fig. 118

4

REMOVE BAND BRAKE

1. Remove blower housing and rotating screen, Fig. 116.
2. On current style band brake brackets, release brake spring (1) and lift band brake (2) up off both stationary and moving posts (3), Fig. 119.
3. On early style brake brackets, use tang bender tool #19229 (1) to bend control lever tang (2) to clear band brake loop, then release brake spring tension and remove band brake (4), Fig. 120.
4. Replace band brake if brake material is damaged or worn to less than .030” (.76 mm) thick, (inset, Fig. 119).
5. Remove two screws. Remove control bracket from cylinder.

   NOTE: Disconnect control lever from starter link (System 4® engines only) using care to prevent switch cover lever damage.

6. Remove stop switch wire from stop switch terminal.

ASSEMBLE CONTROL BRACKET AND BAND BRAKE

1. Reinstall stop switch wire on control bracket.
2. Assemble control bracket to cylinder with screws finger tight.
3. On new style brackets, place band brake on stationary post and hook over end of movable post until band bottoms, Fig. 119.
4. On old style brackets, install brake on stationary and movable posts, then use tool #19229 (2) to bend retainer tang over band brake loop, Fig. 121.

   NOTE: Brake material on steel band **MUST** be on flywheel side after assembly.

Adjusting Band Brake

1. Place bayonet end of Band Brake Adjusting Gauge, Tool #19256 (1), in control lever, Fig. 121.
2. Rotate control lever far enough to install other end of gauge in cable clamp screw hole.
3. Install brake spring.

   NOTE: For ease of assembly, brake spring must be temporarily removed from control bracket spring anchor.

4. Re-attach brake spring to control bracket spring anchor **IMMEDIATELY** after installing control bracket screws finger tight.

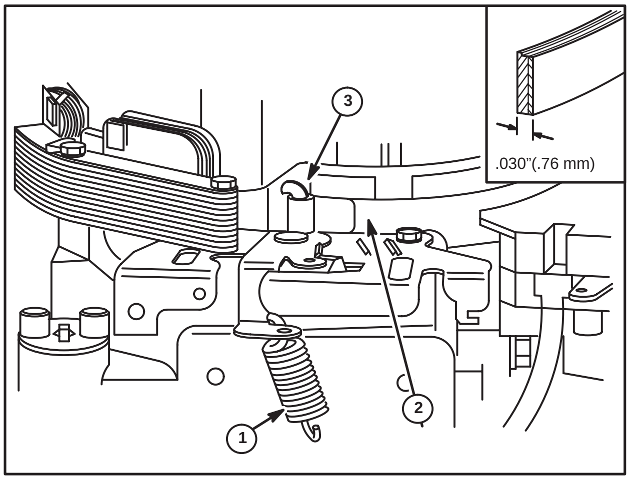


Fig. 119

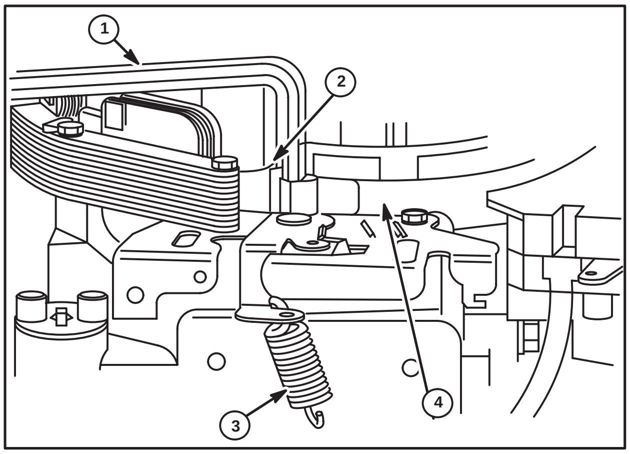


Fig. 120

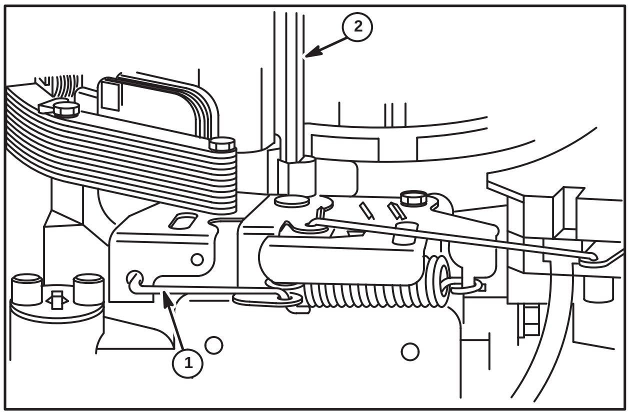


Fig. 121

4

5. With brake spring installed, apply pressure to the control bracket **ONLY**. Move it until gauge link tension is **JUST** eliminated.
6. Hold control bracket in this position while torquing screws to 30 in. lbs. (3 Nm).
7. Remove gauge.

NOTE: Some manufacturers install a cable clamp bracket using a pop rivet in the control bracket cable clamp screw hole. Place bayonet end of gauge in control lever and rotate control lever sufficiently to install other end of gauge into pop rivet hole. Adjust as noted above.

TEST BAND BRAKE

1. To test band brake adjustment, use Torque Wrench, Tool #19197, Starter Clutch Wrench, Tool #19244, and/or a 7/8" socket.
2. With band brake engaged, rotate flywheel clockwise, Fig. 122, <u>and note torque wrench reading.</u>
3. If less than 45 in. lbs. (5 Nm) of torque is required to rotate flywheel, check the following for damage, misalignment, or misadjustment:
   a. Band Brake Lining;
   b. Band Brake Anchors;
   c. Control Bracket;
   d. Brake Spring;
   e. Brake Spring Anchor. Correct, readjust and repeat band brake test.

When band brake is released, engine must turn freely. If band brake drags against flywheel, restricting movement, check for damaged band brake or anchors.

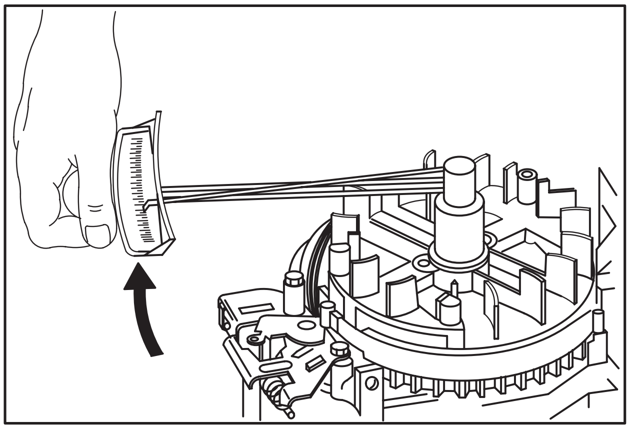


Fig. 122

FINAL ASSEMBLY

Install rotating screen (3) and blower housing (2) on engine. Tighten screws. Note location of blower housing guard (1), Fig. 123.

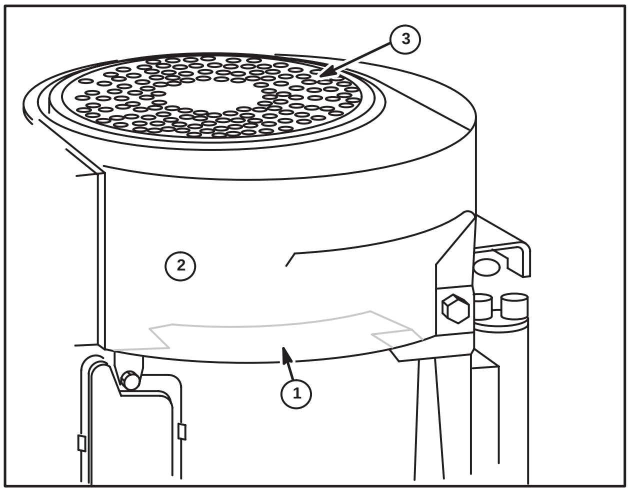


Fig. 123

INSTALL ELECTRIC STARTER CONTROLS (System 4®)

1. Install starter link into control lever.
2. Insert other end of link in switch cover lever.
3. Rotate switch cover into position on starter motor.
4. Fasten screws securely.

NOTE: If equipped with key switch, ignition link may be omitted.

5. Install equipment safety control cable to control lever.

4

6. Tighten cable clamp screw securely.
7. Conduct Stop Switch and Stop Switch Wire Tests described in Section 2, Ignition.
8. Install brake control bracket cover and tighten screws.
9. Place battery in holder and tighten screws.
10. After engine is installed on equipment, connect battery wires to connector and place wire on spark plug.
11. Re-test stopping time.

FLYWHEEL BRAKE
MODEL SERIES 90000, 10A900, 10B900, 10C900, 120000

4

Description

The flywheel brake is part of the safety control required for some applications of this engine models. **The flywheel brake MUST stop the engine within three seconds**, while running at **FAST** speed position, when the operator releases the equipment safety control.

Remove Flywheel Brake
All except Model Series 120000

1. Remove screw from brake cover (1) and lift brake cover straight up, Fig. 124.
2. Remove three (3) blower housing screws and remove blower housing.
3. Straighten stop switch wire (2) and remove from stop switch (1). Remove brake spring (3), Fig. 125.
4. Remove two screws from brake bracket and remove bracket.

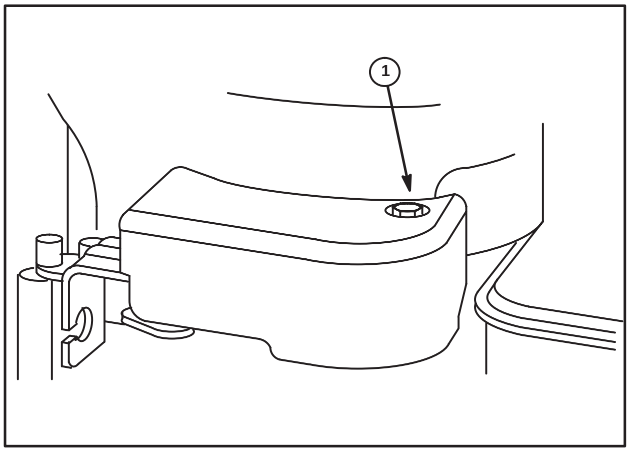


Fig. 124

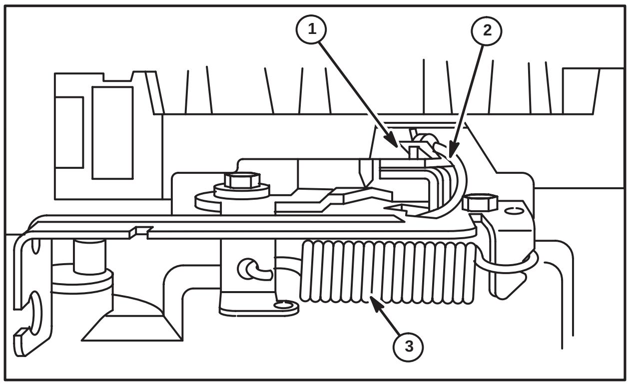


Fig. 125

MODEL SERIES 120000

1. Remove finger guard (1) and fuel tank (2), Fig. 126.
2. Remove dipstick and oil fill tube (1), Fig. 127.

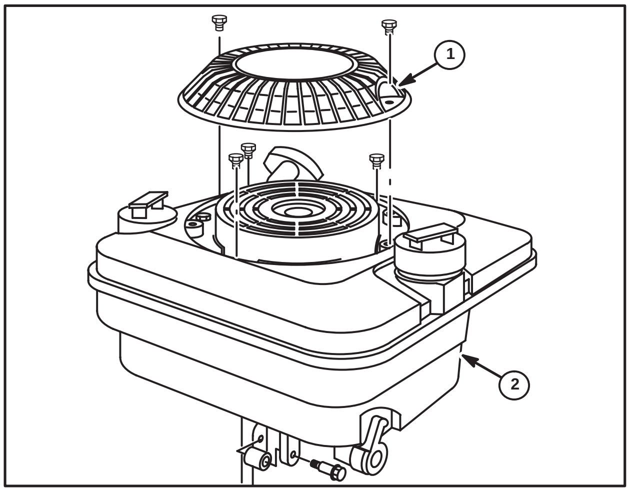


Fig. 126

3. Remove blower housing and rewind starter (3, 2), Fig. 127.

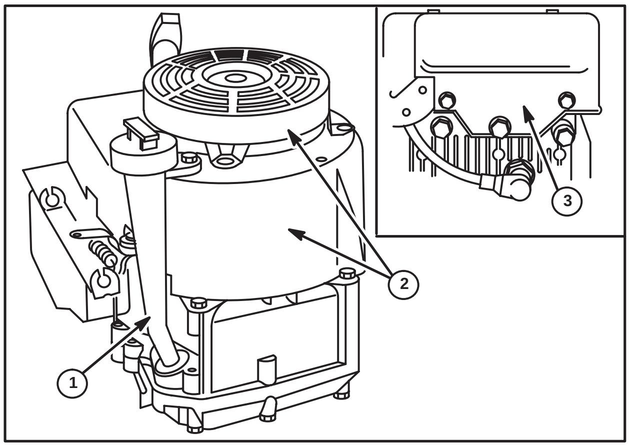


Fig. 127

4. Disconnect spring (2) from brake anchor (3), Fig. 128.
5. Disconnect stop switch wire (1) from stop switch.

NOTE: If engine is equipped with electric starter, disconnect both wires (4) from starter interlock switch (5). Remove two screws from brake bracket (6) and remove bracket.

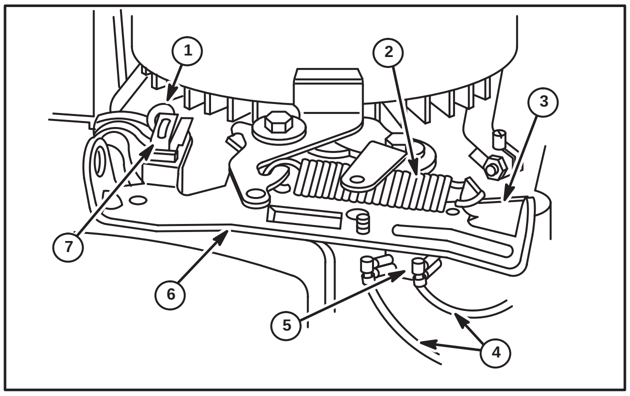


Fig. 128

Inspect Flywheel Brake and Switches

1. Inspect brake lining on brake lever. Replace brake assemble if lining is less than .090" (2.29 mm).
2. Test stop switch as described in Section 2, STOP SWITCH – REMOTE CONTROL.
3. Model Series 120000, test electric starter interlock switch as described in Section 7B, INTERLOCK SWITCH – ELECTRIC STARTER.

Assemble Flywheel Brake

1. Install brake assembly on cylinder and torque mounting screws to 40 in. lbs. (5 Nm).
2. Install stop switch wire and bend end of wire 90°. Install interlock switch wires on interlock switch, if used.
3. Install brake spring.
4. Install blower housing as described in Section 7A, SERVICE STARTER.
5. Model Series 120000, install dipstick tube and dipstick.
6. Model Series 120000, install fuel tank and finger guard.
7. ANSI requires blade to stop at 3 seconds or less.

SECTION 5
Governors

Section Contents

SAFETY **Page**

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

Section Contents, Cont'd.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

TOP NO LOAD GOVERNED SPEED LIMITS

To comply with specified top governed speed limits, Briggs & Stratton supplies manufacturers with engines using either calibrated governor springs or an adjustable top no load speed. Both methods will regulate top governed speed when the engine is operated on a rigid test stand. However, the design of the cutter blade, deck, etc., can affect engine speeds. Therefore, the top no load speed should be checked with a tachometer when the engine is operated on a completely assembled machine. Lawn mowers should be operated on a hard surface to eliminate cutting load on the blade.

If a governor spring must be replaced, search the appropriate Illustrated Parts List by engine type number.

NOTE: Worn linkage or damaged governor springs should be replaced to ensure proper governor operation.

CAUTION:

After a new governor spring is installed, check engine top no load speed.

Run engine at half throttle to allow the engine to reach normal operating temperature before measuring speed with a tachometer.

Table No. 1, Page 28, lists various lengths of rotary lawn mower cutter blades, and the maximum blade rotational speeds, which will produce blade tip speeds of 19,000 feet per minute.

If a service replacement engine is used, check the top no load speed with the engine operating on a completely assembled mower. If necessary, change the governor spring or adjust the top no load speed limit device, so the engine will not exceed the recommended speed. See page 6 for adjustment procedure for mechanical governor. See TABLE NO. 1, page 28 for RPM and blade length.

NOTE: For correct no load RPM by model and type, see Engine Sales Manual, MS-4052 or MS-6225, Service Engine Sales Manual microfiche under note column, or MAXIMUM RPM TABLE at end of each manual for the model engine.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

PNEUMATIC GOVERNOR SYSTEMS (FIGS. 1, 2)

Adjust Top No Load Speed, Model Series 80000, 90000 Pneumatic Governor with Control Panel

1. Run engine until it reaches operating temperature or for about 5 minutes.
2. Set control lever or remote controls to fast position with engine running.
3. Adjust governed idle by turning stop nut (3) and idle speed screw (2), Fig. 2. Turn stop nut clockwise (A) to increase speed, counterclockwise (B) to decrease.
4. Use tool #19229 (4), to bend spring anchor tang (1, Fig. 1), to obtain the proper top no load RPM, Figs. 3 and 4. Fixed speed tang (5), Figs. 3 and 4.

Adjust Governed Idle

Some engines are equipped with governed idle. Governed idle permits the governor to operate at idle speeds while the engine is operating under light loads.

1. Place control lever in minimum speed position with engine running at operating condition.
2. **80000 Series:** Hold throttle lever against stop and adjust idle speed screw (2), to obtain 1600 RPM. Release throttle lever. Then, turn governed idle stop nut (3) to obtain 1750 RPM, Fig. 2.
3. **90000 Series, Low Emissions Carburetors, Type Numbers ending in A1-A9 or E1-E9**

   NOTE: Fixed adjustable control: before control lever can be moved to slow position, fixed speed tang (5), Figs. 3, 4, must be bent down to move lever.

   NOTE: Fixed adjustable control: After setting governed idle, move control lever back to fast speed position and bend fast speed tang up to hold speed control lever.

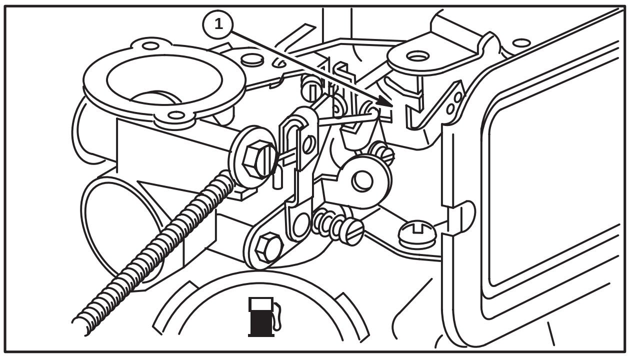


Fig. 1

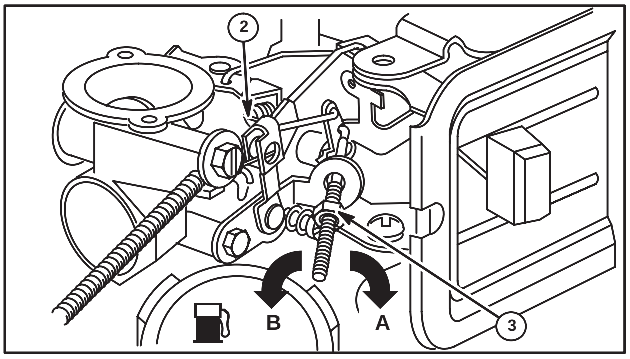


Fig. 2

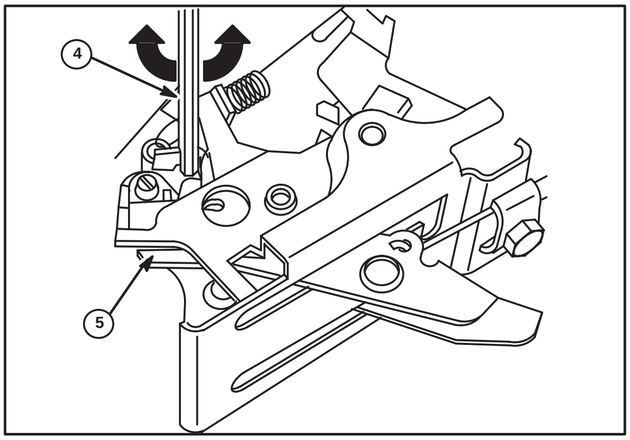


Fig. 3

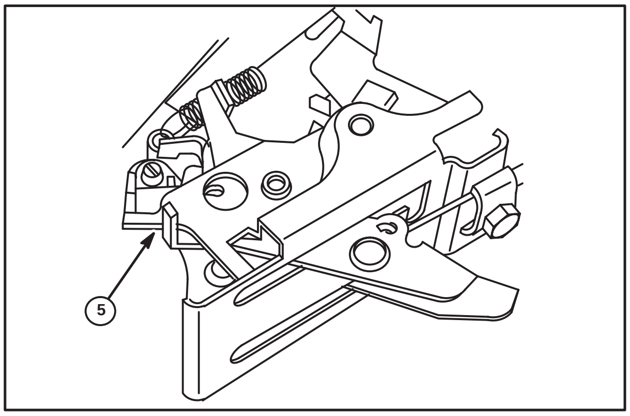


Fig. 4

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

Adjust Top No Load Speed
Pneumatic Governor, Dual Spring Control
Model Series 9B900, 9C900, 98900, 10A900, 10B900, 10C900.

Single Spring Control
Model Series 9B900, 9C900, 93900, 95900, 96900, 98900, 10A900, 10B900, 10C900

1. Run engine until it reaches operating temperature or for about 5 minutes.
2. Move governor lever (1) to “Fast Position.” Hole in lever (2) will line up with hole in governor control bracket (4). Insert 1/8” rod (3) through both holes to lock lever position, Figs. 5, 6.

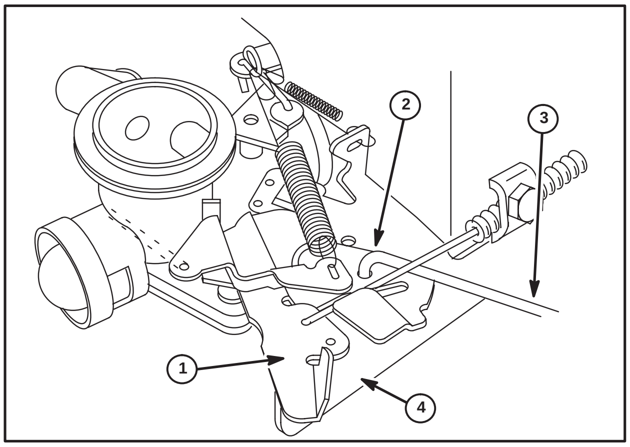

Fig. 5

3. **Dual Spring:** Using Tool #19229 or 19352, Tang Bender (5), bend secondary governor spring tang, (“A” to increase, “B” to decrease), until there is no tension on secondary spring, Fig. 6.

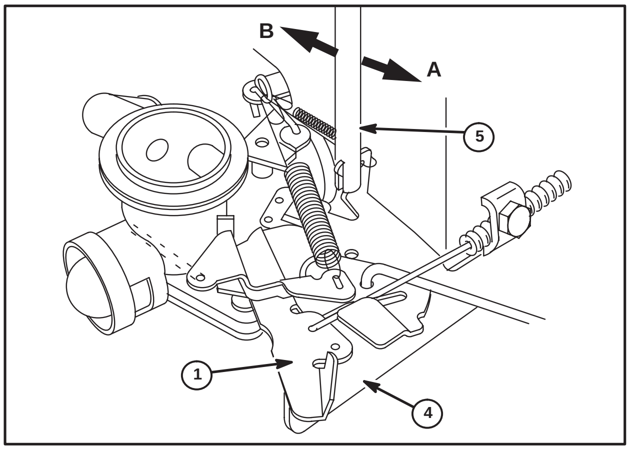

Fig. 6

4. Bend primary governor spring tang, (“A” to increase, “B” to decrease), until engine speed is 200 RPM less than “TOP NO LOAD” RPM, **Dual Spring**, or at “TOP NO LOAD” RPM, **Single Spring**, Fig. 7.
5. **Dual Spring:** Bend secondary governor spring tang until “TOP NO LOAD” RPM is obtained, Fig. 6, as specified in Engine Sales Manual, MS-4052 or MS-6225, Service Engine Sales Manual microfiche.

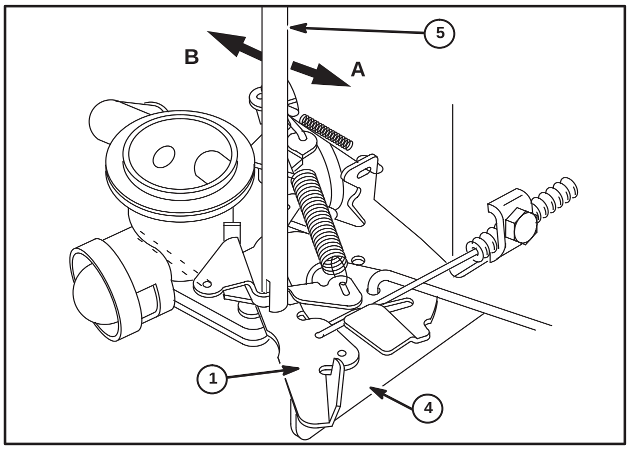

Fig. 7

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

5

Replace Governor Spring
Model Series 90000, 110000

The governor springs used on engine Model Series 90000, 110000 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.

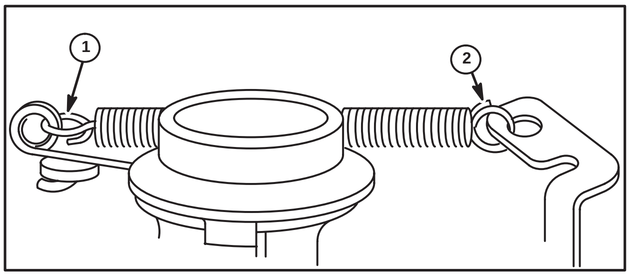

Fig. 8

CAUTION:

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 will be positioned as shown in Fig. 8, with loop (1) horizontal, end of spring pointing down, and loop (2) vertical, end of spring pointing toward engine.

Removing Spring (Fig. 9, typical)

1. Twist spring toward engine until end of loop can be pushed under lever (A).
2. Push spring forward (B).
3. Twist spring toward engine until end of loop snaps out of hole in lever (C).

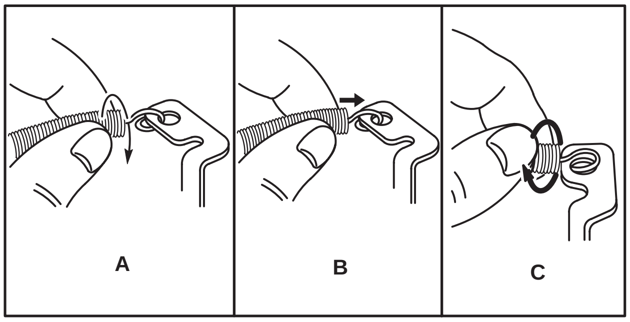

Fig. 9

Installing Spring (Fig. 10, typical)

1. Steady link (1) with finger and grasp spring as shown, (A)
2. Assemble end of loop into link eyelet, (B).
3. Twist spring toward you to fully link as shown in inset, (C).

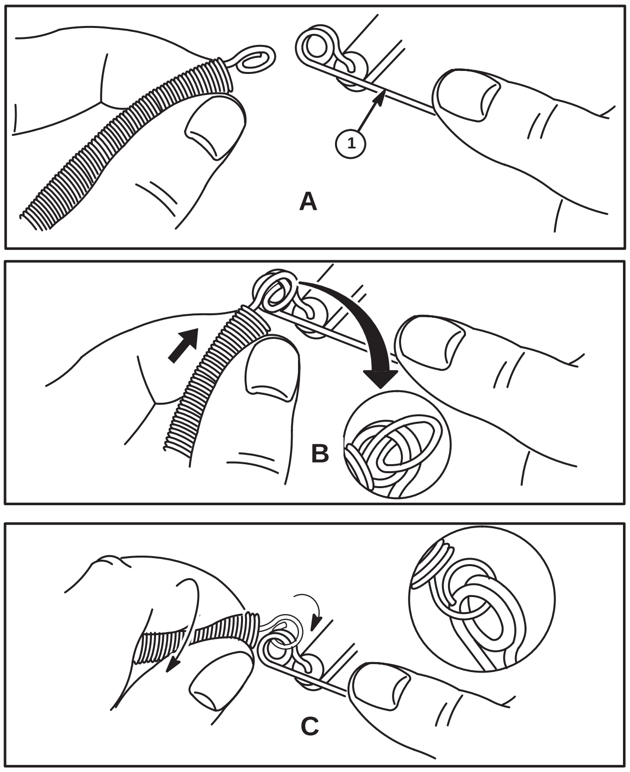

Fig. 10

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

MECHANICAL GOVERNOR SYSTEM HORIZONTAL CRANKSHAFT (Fig. 11, typical)

1. Fig. "A" shows engine not running, throttle open (1), spring compressed (2), and counterweights closed (3). Turning thumbscrew as shown (A) increases speed.
2. Fig. "B" shows engine running, throttle closing (1), spring stretching (2), and counterweights opening (3).

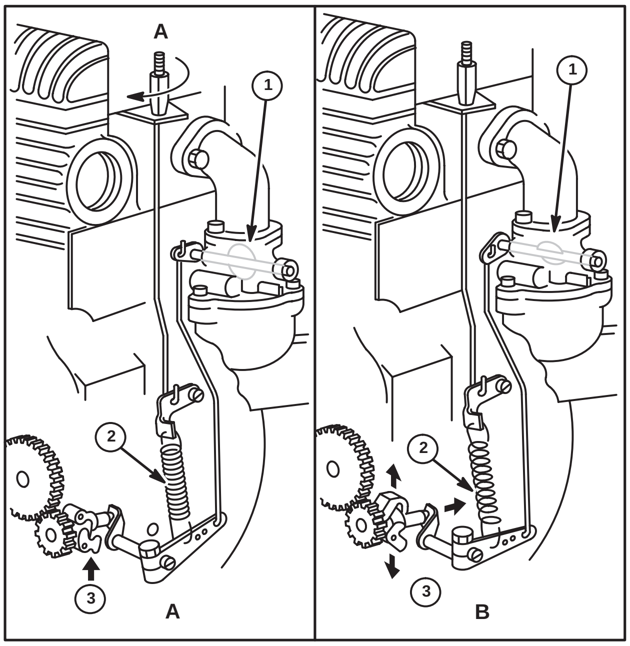

Fig. 11

Mechanical Governors Horizontal Crankshaft Model Series 80000, 83400, 100200, 130000, 170000, 190000, 220000, 251400, 252400, 254400 With Governor Crank in Cylinder

Typical governor components on horizontal shaft models are illustrated in Fig. 12.
Carburetor (1)
Throttle link (2)
Manual governor control (3)
Governor link (4)
Cam gear (5)
Governor gear (6)
Governor lever (7)
Governor spring (8)

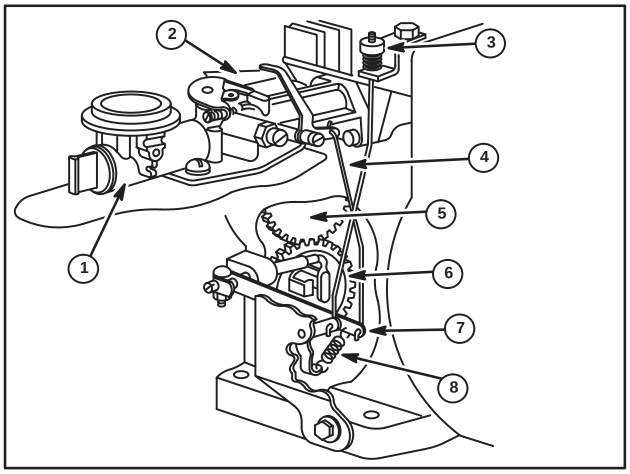

Fig. 12

The only disassembly necessary is removing the governor assembly as one unit from the governor gear shaft on the crankcase cover on horizontal models, Fig. 13. Governor crank should point down (1), as shown.

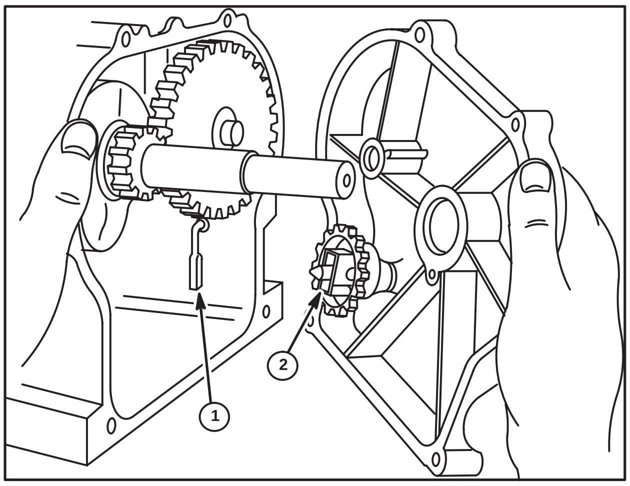

Fig. 13

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

Assemble Horizontal Crankshaft

On horizontal crankshaft models, the governor rides on a short stationary shaft and is retained by the governor shaft, with which it comes in contact after the crankcase cover is secured in place.

1. Press governor cup (2), Fig. 13, against crankcase cover to seat retaining ring on shaft, prior to installing crankcase cover.

   NOTE: It is suggested that the assembly of the crankcase cover be made with the crankshaft in a horizontal position.

2. The governor crank should hang straight down parallel to the cylinder axis (1), Fig. 13.

   NOTE: If the governor crank is clamped in an angular position, pointing toward the crankcase cover, it is possible for it to be jammed inside of the governor assembly, resulting in damage when the engine is started.

3. After the crankcase cover and gasket are in place, install cover screws. Be sure that screw in hole (1) Fig. 14, has nonhardening sealant, such as Permatex® II, on threads of screw.
4. Complete installation of remaining governor linkages and carburetor and then adjust governor shaft and lever. See “Adjust Governor, Static”, page 11.

   NOTE: See page 21, 3/16” (4.7 mm) inside diameter, or page 18, 1/4” (6 mm) inside diameter, for procedure if necessary to replace governor crank bushing.

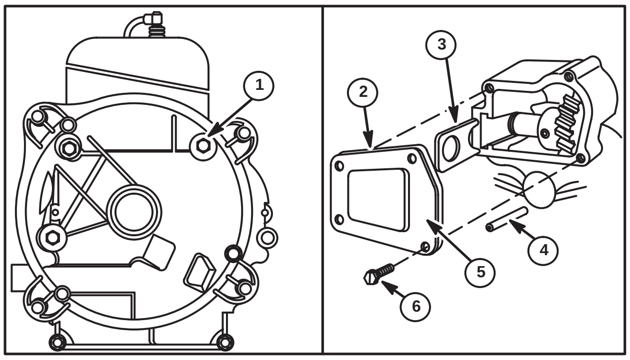

Fig. 14

MECHANICAL GOVERNORS
Model Series 60000, 80000
With Governor Lever and Shaft Mounted on Crankcase Cover

Disassemble

1. To service governor, remove crankcase cover.
2. Loosen the screw on the governor lever (1) and pull lever from governor shaft (2).
3. Loosen the two mounting screws to remove gear housing (8). As the housing is removed, the governor gear (6) will slip off the housing shaft. Note the steel thrust washer (7) between the gear and the governor housing.
4. Remove roll pin (3) and washer from governor shaft.
5. Unscrew shaft from follower (4) by turning clockwise to remove.

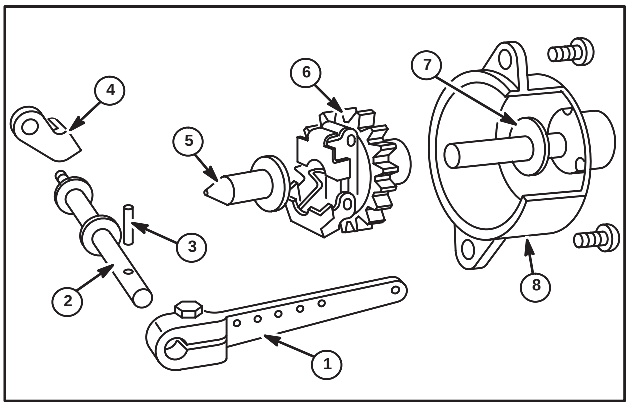

Fig. 15

Assemble

1. Push governor shaft (2) into crankcase cover, with threaded end in.
2. Assemble small washer on the inner end of the shaft, then screw shaft into governor follower (4) by turning shaft counterclockwise.
3. Tighten securely. Turn shaft until follower (4) points down as illustrated, Fig. 16.
4. Place washer on outside end of shaft.
5. Install roll pin (3). The leading end of the pin should just go through the shaft so pin protrudes from only one side of shaft.
6. Place thrust washer and then governor gear on shaft in gear housing.
7. Hold governor housing in a vertical (normal) position (8) and assemble housing with gear in position so point of steel cup on gear (9) rests against crank follower.
8. Tighten housing with two mounting screws.
9. Assemble governor lever to lever shaft with lever pointing downward at about a 30° angle. Final adjustment will be made later when carburetor linkage is assembled.

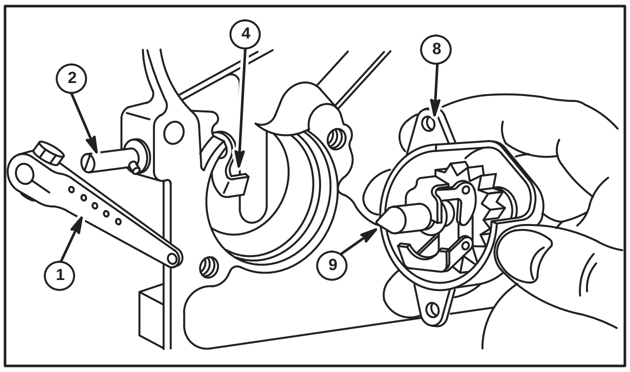

Fig. 16

Adjust Top No Load Speed

1. Start and run engine at half throttle for five minutes to bring engine to operating temperature.
2. Move speed control lever to maximum RPM position.
3. Turn knob (1) to increase (A) or decrease RPM to desired speed, Fig. 17.

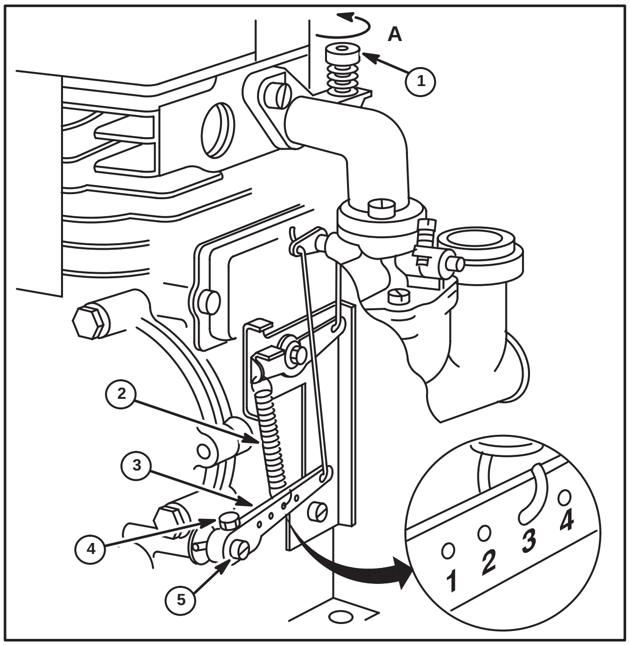

Fig. 17

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

Governor Spring Location

Note: Consult Engine Sales Manual, MS-4052 or Service Engine Sales Manual Microfiche at the end of each manual to determine specified RPM for engine, EXCEPT FOR GENERATOR ENGINES. See text for Top No Load Speed and Governed Idle adjustments according to engine model and application.

Model Series 93400

See Table 4, Specifications, Page 28, and place governor spring in holes 1 through 6, Fig. 18, to attain required RPM.

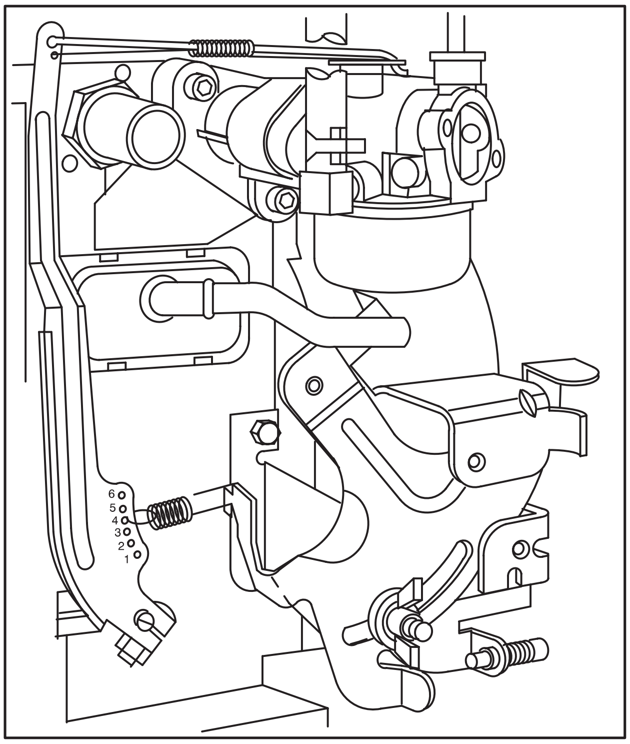

Fig. 18

Governor Spring Location

Model Series 133400

See Table 5, Specifications, Page 28, and place governor spring in holes 1 through 8, Fig. 19, to attain required RPM.

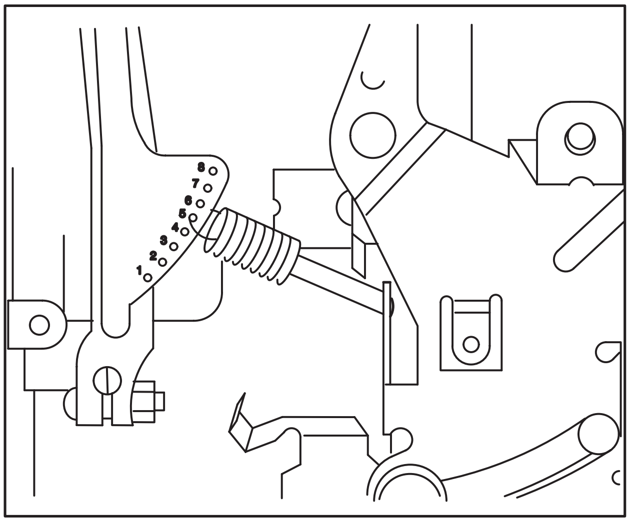

Fig. 19

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

Single & Dual Spring
Model Series 176400, 19B400, 19C400, 19E400, 19F400, 19G400, 192400, 196400, 226400, 250400, 256400

See Table No. 6, Specifications, Page 28, and place governor spring in holes 1 through 12, Fig. 20, to attain required RPM.

Generator Engines
Model Series 93400

Place governor spring in governor lever hole number 2 for 50 Cycle (3000 RPM) or hole number 3 for 60 Cycle (3600 RPM) generators.

DO NOT USE HOLE LOCATIONS SHOWN IN TABLE NO 4, SPECIFICATIONS, Page 28.

Generator Engines
Model Series 133400

Place governor spring in governor lever hole number 2 for 50 Cycle (3000 RPM) or hole number 4 for 60 Cycle (3600 RPM) generators.

DO NOT USE HOLE LOCATIONS SHOWN IN TABLE NO. 5, SPECIFICATIONS, page 28.

Generator Engines
Model Series 176400, 19B400, 19C400, 19E400, 19F400, 19G400, 196400, 226400, 250400, 256400

Place governor spring in governor lever hole number 4 for 50 Cycle (3000 RPM) or hole number 8 for 60 Cycle (3600 RPM) generators.

DO NOT USE HOLE LOCATIONS SHOWN IN TABLE NO. 6, SPECIFICATIONS, page 28.

Static Governor Adjustment
Horizontal Crankshaft

1. Loosen screw holding governor lever to governor crank.
2. Rotate throttle plate linkage from idle position to wide open position. Note direction of rotation of the governor arm attached to the throttle linkage.
3. Place and hold the linkage in high speed position.
4. While holding the linkage in this position, use an appropriate tool to rotate the governor shaft until it stops in the direction noted in step 2.
5. Tighten screw holding governor lever to governor crank. Torque to 35 – 45 in. lbs. (3 – 5 Nm).
6. Before starting engine, manually actuate governor linkage to check for binding.

Final Governor Adjustment
Adjust Top No Load Speed
Model Series 83400 (Generator)

Turn screw to 3750 RPM, Fig. 21, unless a load bank is available to load engine to full generator rated output. Then load generator to full rated output with load bank and turn screw to obtain 3600 RPM.

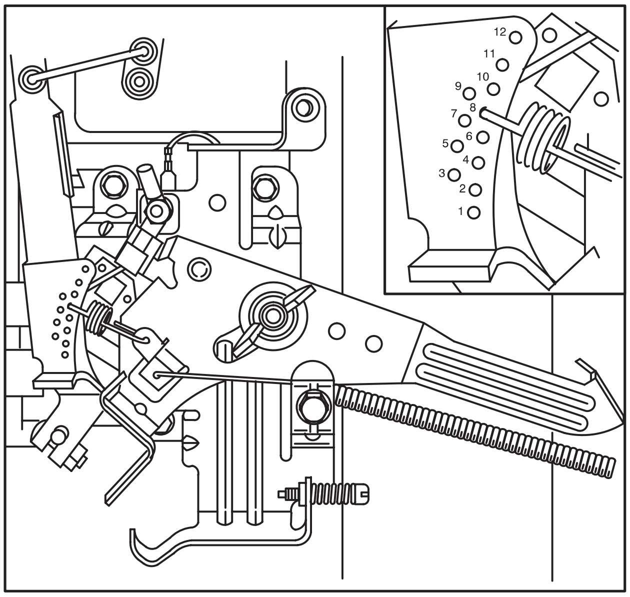

Fig. 20

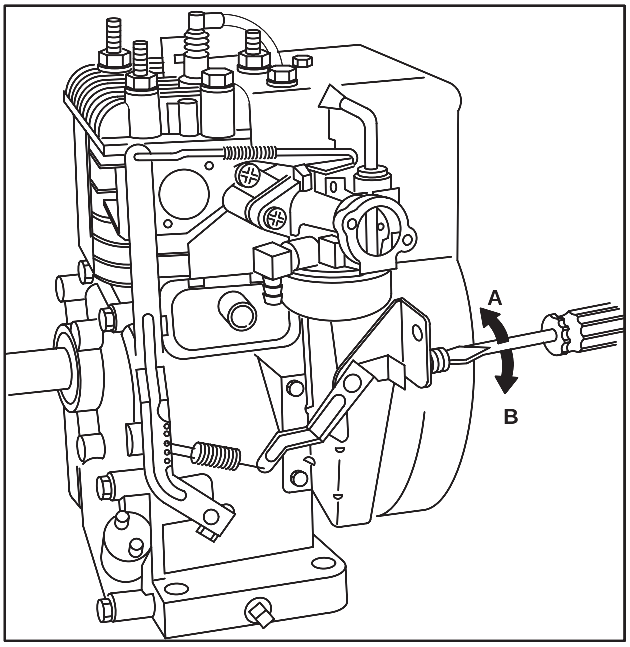

Fig. 21

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

Adjust Top No Load Speed
Single Spring
Model Series 93400, 133400, 176400, 192400, 196400, 250400, 256400

1. Run engine at half throttle for five minutes to bring engine to operating temperature.
2. Move speed control lever to maximum RPM position.
3. If tab on lever (1) is touching head of TOP NO LOAD RPM adjusting screw (2), back out screw until tab no longer touches screw when control lever is in maximum RPM position, Fig. 22.

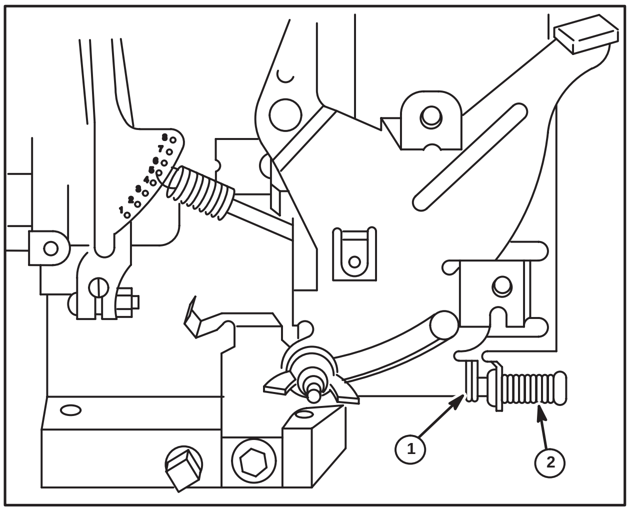

Fig. 22

4. First adjustment: bend spring anchor tang (1), Fig. 23, using Tang Bender Tool #19229 (4), to 100 to 200 RPM above specified speed, See Table No. 4, Page 28, Table No. 5, Page 28 and Table No. 6, Page 28, Specifications.
5. Second adjustment: use Torx® driver (3) to turn TOP NO LOAD RPM screw (2) clockwise until specified speed is obtained, Fig. 23.

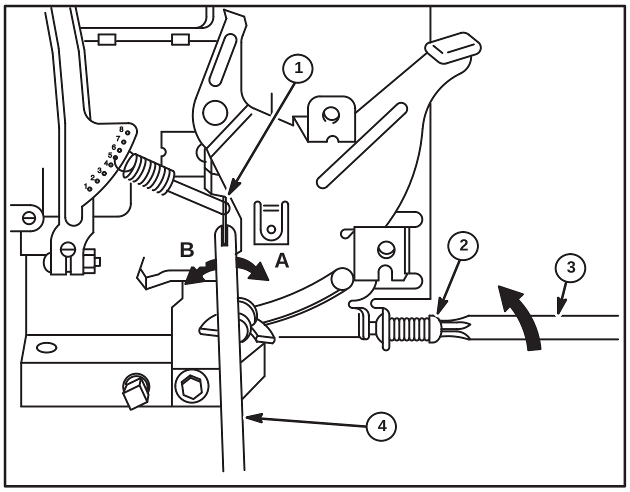

Fig. 23

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

Adjust Governed Idle
Model Series 93400 (Fig. 24)
Single Spring

Model Series 133400, (Fig. 25A)
Model Series 176400, 192400, 196400, 226400, 256400 (Fig. 25B)

1. If governed idle is specified, move speed control down until engine is at minimum RPM and adjust carburetor idle speed screw to 1600 RPM.

   NOTE: See Section 3 for proper idle speed adjusting procedure for small or large Briggs & Stratton/Walbro carburetors.

2. Move speed control lever to obtain 1800 RPM. Use Tool 19229 (4) to bend governed idle speed tang up against speed control lever, ("A" to increase, "B" to decrease), Figs. 24, 25.

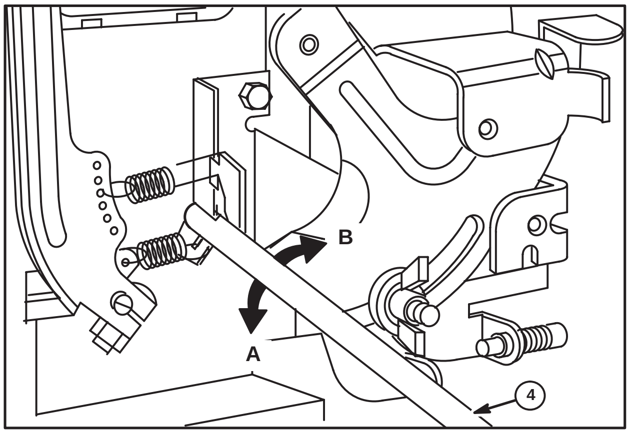

Fig. 24

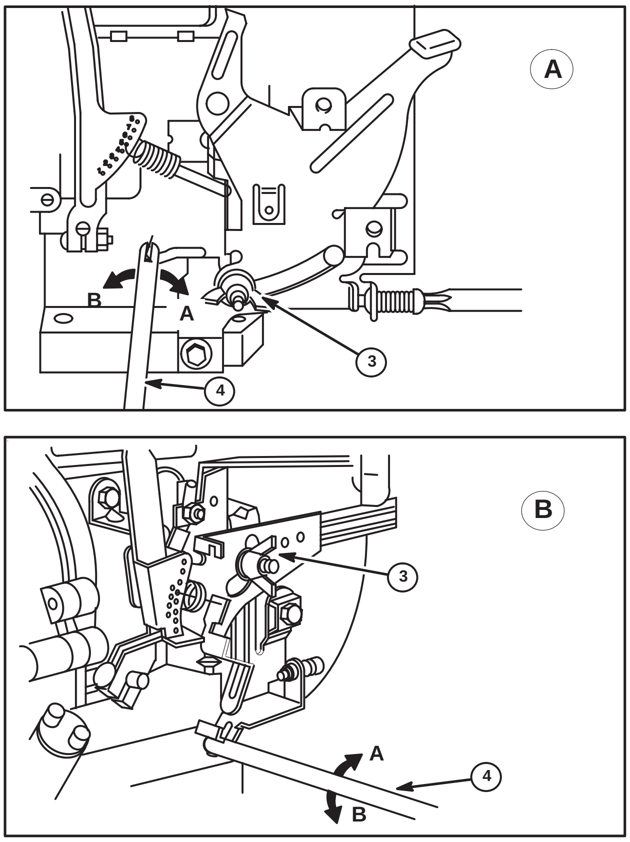

Fig. 25

5

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

Adjust Dual Spring Governor (Figs. 26, 27) Model Series 176400, 19B400, 19C400, 19E400, 19F400, 19G400, 192400, 196400, 197400, 226400, 250400, 256400

NOTE: On dual spring system, governed idle must be set before setting TOP NO LOAD RPM.

Adjust Governed Idle (Figs. 26, 27)

1. Run engine at half throttle for five minutes to bring to operating temperature.
2. Move speed control lever (1) down to idle speed position until there is slack on main governor spring (2).
3. Hold throttle lever (3) against idle speed screw (4) and turn idle speed screw until engine idles at 1750 RPM.
4. While holding throttle lever, adjust idle mixture needle (5) to midpoint between too lean and too rich.
5. Repeat Step 3. and reduce engine idle speed to 1200 RPM.
6. Bend governed idle speed tang (6) to obtain 1750 RPM.

Adjust Top No Load Speed – Dual Spring (Figs. 26, 27)

1. Move speed control (1) to fast position. If control lever stop is against high speed adjustment screw (7), back out high speed adjustment screw until TOP NO LOAD stop no longer touches screw.
2. Adjust main governor spring tang (8) until you have 100 to 150 RPM over the final TOP NO LOAD RPM required.
3. Adjust high speed adjustment screw (7) to obtain correct TOP NO LOAD RPM.

Adjust Top No-Load Speed Rack and Pinion or Swivel Control Plates Model Series 100200, 130000, 170000, 190000, 220000, 250000 (Except 253400, 255400) (Non-Generator Applications)

1. Set control lever to maximum speed position with engine running.
2. Insert a 1/8” (3.18 mm) rod (2) through hole in control plate and governor tang (3), Fig. 28, on rack and pinion control plates. See note below for engines using Top Speed Limit Screws.

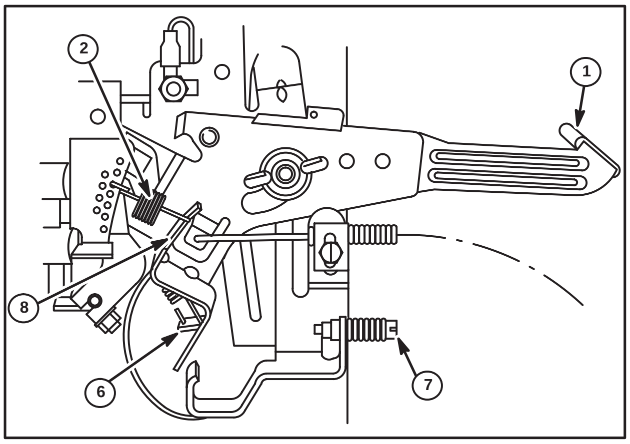

Fig. 26

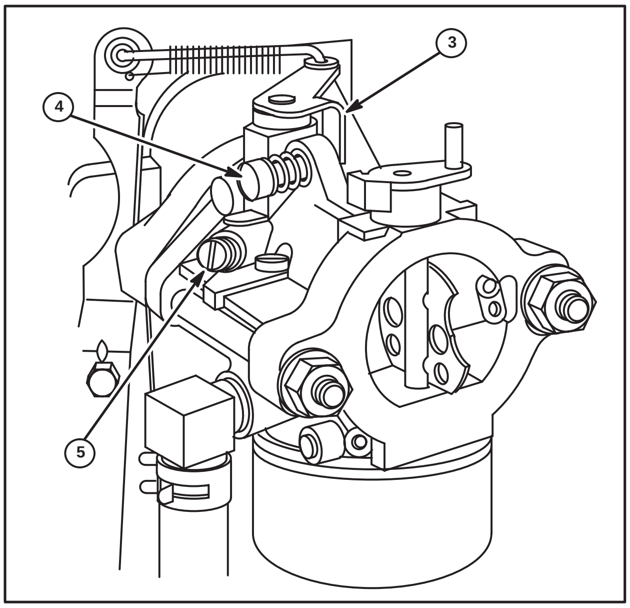

Fig. 27

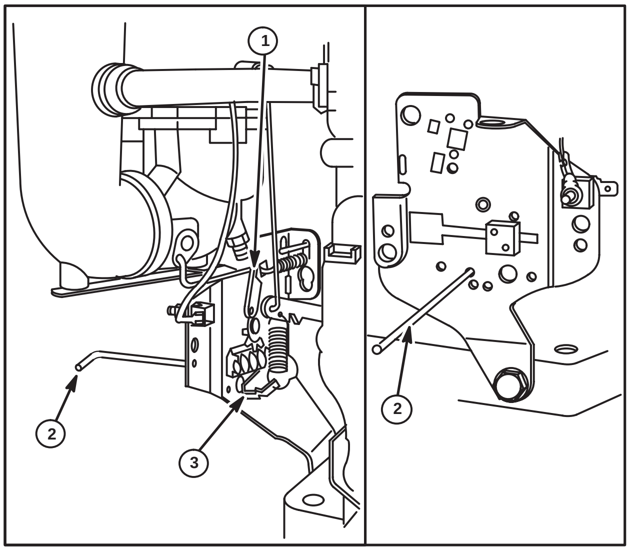

Fig. 28

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

3. Use Tool #19229, Tang Bending Tool, to bend spring anchor tang to obtain the proper TOP NO LOAD RPM, Fig. 29. For engines using Top Speed Limit Screws, adjust tang to 4000 RPM. Top Speed Limit screw must be removed while adjusting tang.

Choke-A-Matic® top speed range is 3700 to 4000 RPM with standard spring. (Top speed limit screw cannot be used.)

NOTE: Refer to Figs. 29 and 30 to identify the type of control. Then refer to Table No. 2, Page 28 (Fig. 29) or Table No. 3, Page 28 (Fig. 30) to find correct hole to use after adjusting governor tang, Step 3, and installing Top Speed Limit Screw (4).

NOTE: If specified TOP NO LOAD RPM cannot be obtained, recheck spring anchor hole location for that speed. If location is correct, repeat procedure beginning at Step 2.

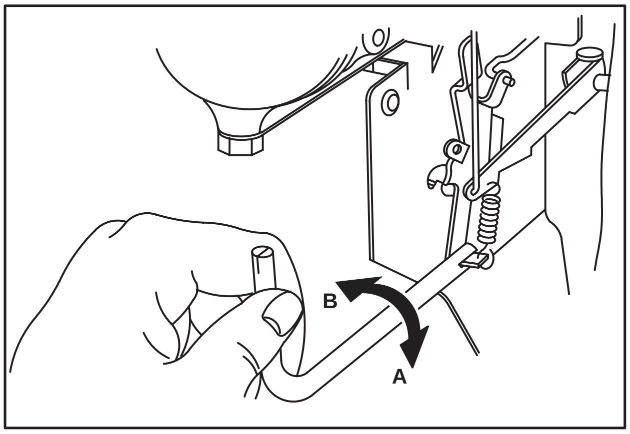

Fig. 29

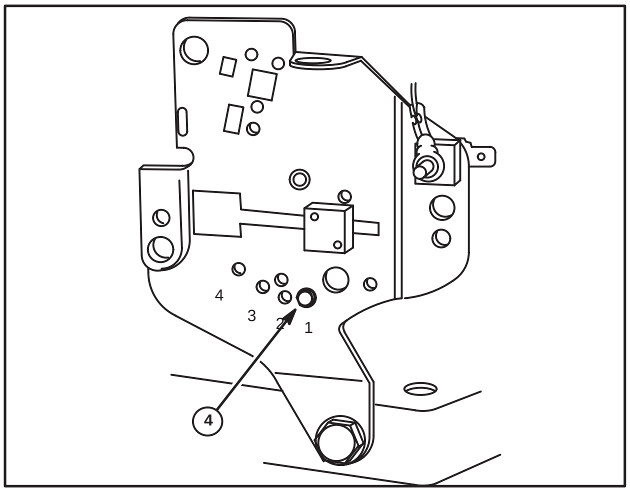

Fig. 30

Adjust Governed Idle
Rack and Pinion Control
Horizontal Crankshaft Models, Fig. 31

1. Make final carburetor mixture adjustment.
2. Place remote control in idle position.
3. Hold throttle in closed position with finger, adjust idle speed screw (1) to 1550 RPM, (“A” to increase, “B” to decrease).
4. Release throttle.
5. Set remote control to 1750 RPM. Turn screw in until it contacts remote control lever, Fig. 31.

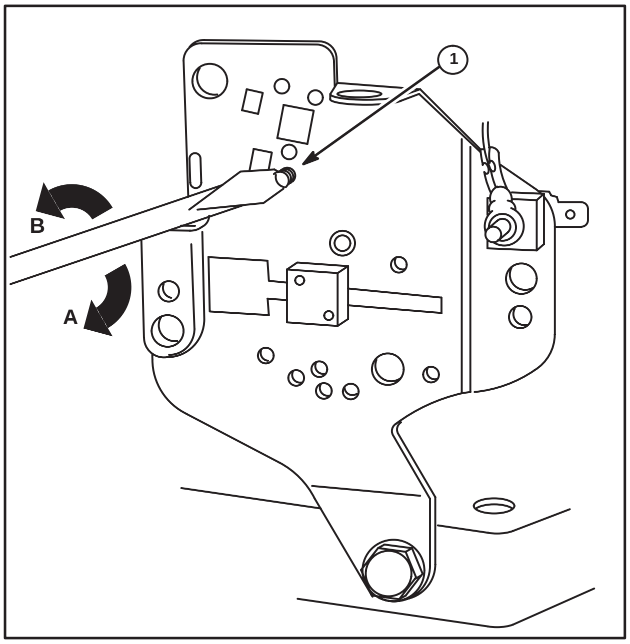

Fig. 31

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

Adjusting Top No Load Speed Generator Applications

1. Run engine at half throttle for five minutes to bring to operating temperature.
2. Move speed control lever to maximum RPM position.
3. If tab on lever is touching head of TOP NO LOAD RPM adjusting screw (2), back out screw until tab no longer touches screw when control lever is in maximum RPM position, Fig. 23.
4. Bend spring anchor tang (1) using Tang Bender-Tool #19229 (4), to 3300 for 50 cycle or 3800 for 60 cycle.
5. Turn TOP NO LOAD RPM screw clockwise until 3150 RPM, 50 Cycle or 3750 RPM, 60 Cycles is obtained, no load.

NOTE: If available, use a load bank to load engine to full generator rated output. With generator at full rate output, turn screw to obtain 3000 RPM, 50 Cycle or 3600 RPM, 60 Cycle.

Adjust for Manual Friction Control

For fixed speed place speed control lever in maximum RPM position and tighten wing nut (3) until lever cannot be moved, Fig. 25.

For manual friction, tighten wing nut (3) until lever will stay in any position without moving while engine is running.

Adjust for Remote Control Adjust

For remote control, loosen wing nut (3) until speed control lever drops of its own weight down to idle, Fig. 25.

Adjusting Top No Load Speed Model Series 253400, 255400

1. On Model Series 253400, 255400 with speed control at fast position, turn screw (1) to set TOP NO LOAD RPM, Fig. 32.
2. Turn “A” to increase or “B” to decrease speed.

NOTE: For correct top no load RPM by model and type, see Engine Sales Manual, MS-4052 or MS-6225, Service Engine Sales Manual microfiche under NOTE column, or MAXIMUM RPM TABLE at end of each manual for the engine model.

3. Set Speed control to desired RPM and tighten fixed speed screw (1), Fig. 33.

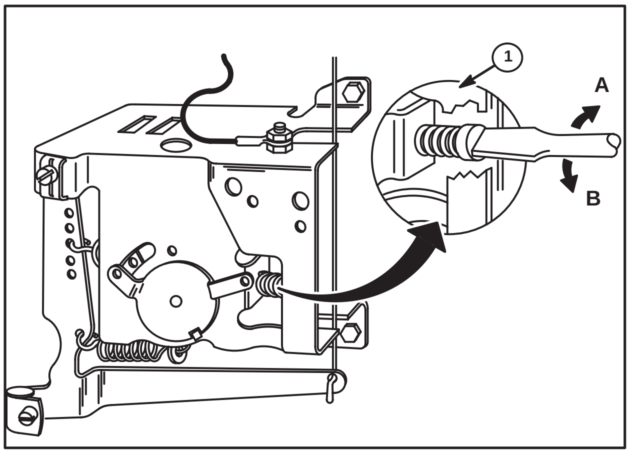

Fig. 32

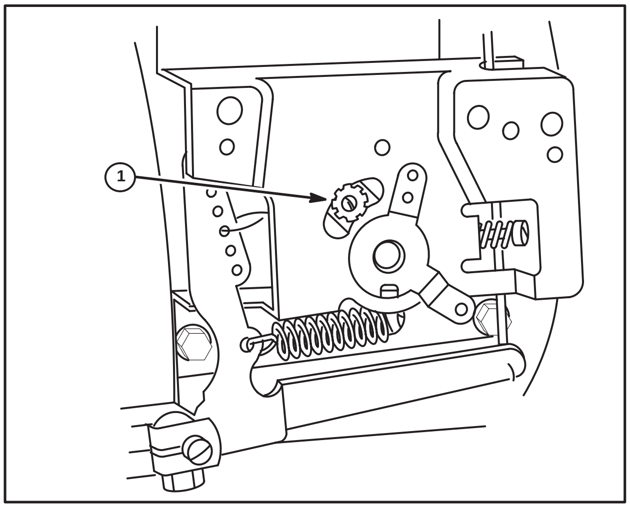

Fig. 33

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

Governed Idle (Non-Generator)

1. Turn carburetor idle speed adjusting screw to obtain 1600 RPM while holding throttle lever against screw.
2. Release throttle lever.
3. Align holes in control bracket and inside lever with 1/8” (3.18 mm) diameter rod. Governor speed control lever of equipment should be in “IDLE” position, Fig. 34.
4. Adjust if necessary. Bend spring tang to obtain 1750 RPM.
5. Remove 1/8” (3.18 mm) diameter rod.

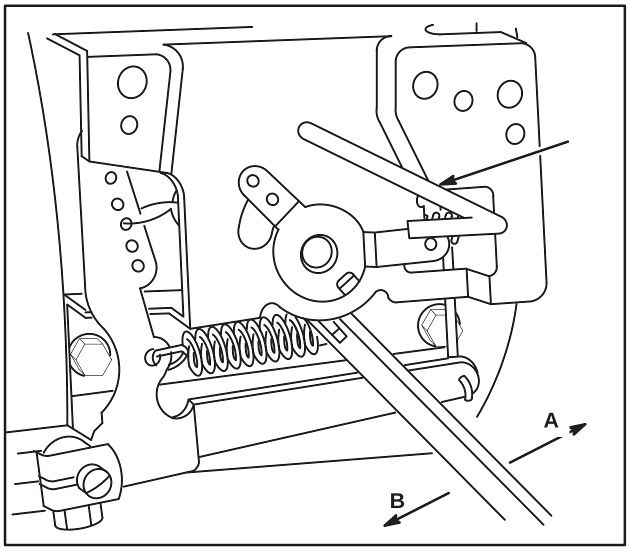

Fig. 34

Generator Applications Only

Governor regulation to within two cycles of either 60 or 50 cycles can be obtained if the procedures indicated below are followed:

1. Push speed adjusting nut in and up to release spring tension on nut.
2. Start engine and pull out on speed adjusting nut to maximum length of travel, Fig. 35.

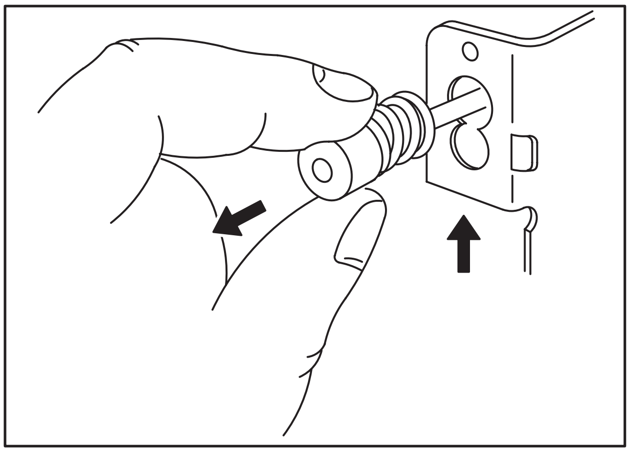

Fig. 35

3. Set engine speed per Table No. 10, Specifications, Page 30 by bending governor tang, Fig. 36.
4. With engine still running, return speed adjusting nut to slot, push in to compress spring and push nut down into slot.
5. Then turn speed adjusting nut to obtain:

1600 RPM Top No Load for 1500 RPM 50 cycle generator

1875 RPM Top No Load for 1800 RPM 60 cycle generator

3150 RPM Top No Load for 3000 RPM 50 cycle generator

3750 RPM Top No Load for 3600 RPM 60 cycle generator

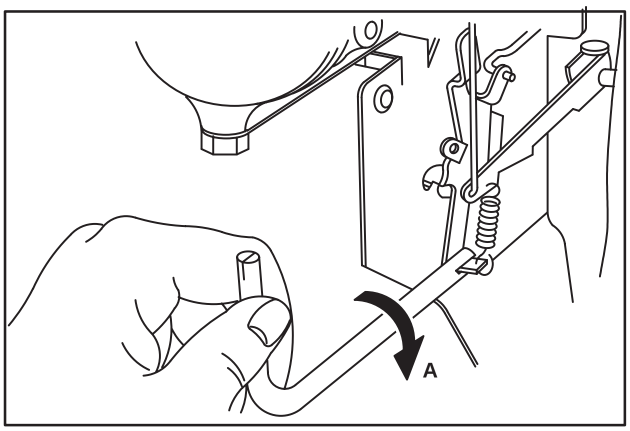

Fig. 36

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

Cast Iron Model Series 230000, 240000, 300000, 320000 (Fig. 37)

Disassemble

1. Remove engine base.
2. Loosen governor lever bolt and nut.
3. Remove governor lever from governor crank assembly.
4. Remove cotter pin and washer from governor crank (3).
5. Remove any paint or burrs from governor crank.
6. Remove governor crank.

NOTE: Current production engines have a spacer (2) on the governor crank (3). Earlier production engines have a long bushing without spacer.

7. Slide governor gear assembly off governor shaft.

Replace Governor Shaft Bushing

1. Press old bushing (1) out of cylinder.
2. Press new bushing into cylinder until bushing is flush with outside surface of cylinder.
3. Ream new bushing with Tool #19333, Finish Reamer, using suitable lubricant.

Assemble Governor

1. Assemble governor gear (4) and cup assembly on governor shaft in cylinder.
2. Slide governor crank (and spacer, when used) through bushing from inside cylinder, Fig. 37.
3. Install lever, governor spring, and links.

Adjust Top No Load Speed

NOTE: Consult Engine Sales Manual, MS-4052 or MS-6225, Service Engine Sales Manual Microfiche under note column, or MAXIMUM RPM TABLE at the end of each engine manual for TOP NO LOAD RPM.

Fixed Speed Operation

1. Loosen lower stop nut (2).
2. Adjust top stop nut (1) to obtain specified TOP NO LOAD RPM.
3. After speed is set, tighten lower stop nut, Fig. 38. Idle speed screw (3).

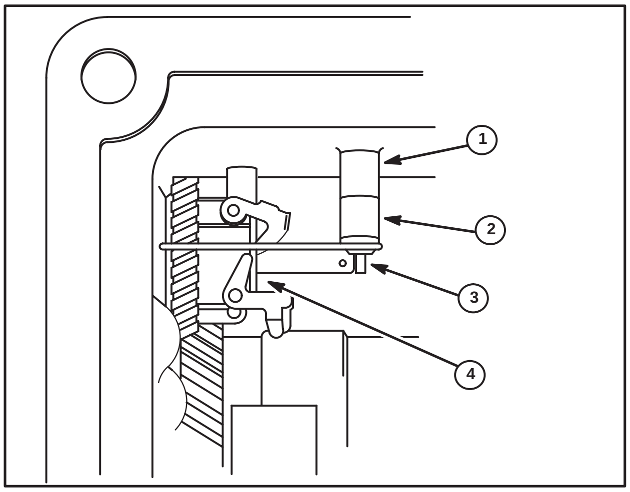

Fig. 37

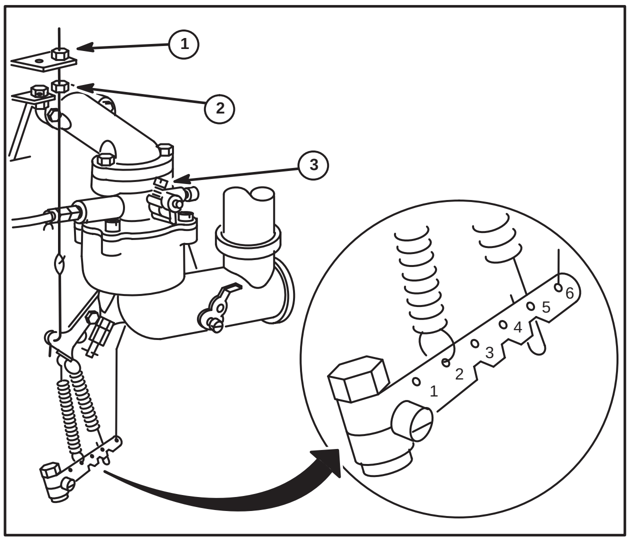

Fig. 38

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

Remote Control Operation

Adjust lower stop nut to obtain specified TOP NO LOAD RPM.

Adjust Governed Idle

First make final carburetor mixture adjustments. Then place remote control in idle position. Hold throttle shaft in closed position and adjust idle screw (2) to 1000 RPM. Release the throttle. With remote control in idle position, adjust upper elastic stop nut (1) to 1200 RPM, Fig. 39.

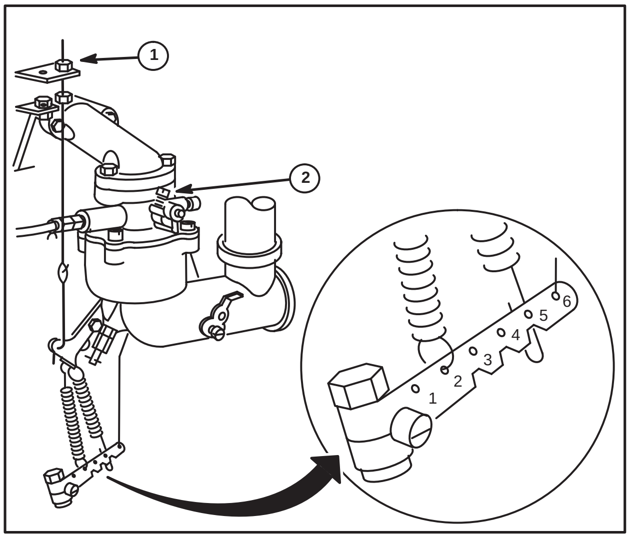

Fig. 39

MECHANICAL GOVERNOR SYSTEM VERTICAL CRANKSHAFT Model Series 100900, 130000, 170000

Disassemble 190000, 220000, 250000, 280000

The governor used on the vertical shaft models is incorporated with the oil slinger, Figs. 40 and 41. It is removed as part of the oil slinger, Fig. 42. Further disassembly is unnecessary.

Fig. 40 – Model Series 100900, 130000
Governor adjusting lever (1)
Throttle (2)
Governor spring (3)
Link (4)
Governor lever (5)
Governor shaft (6)
Governor gear (7)
Cup (8)
Cam gear (9)

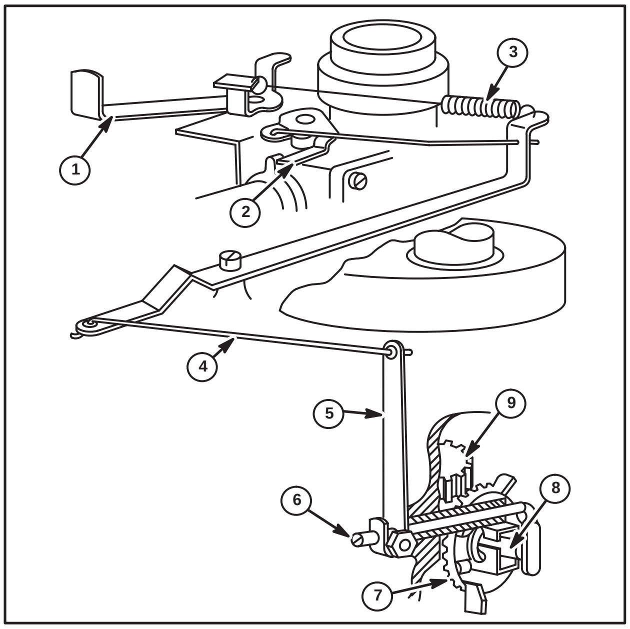

Fig. 40

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

Fig. 41 – Model Series 170000, 190000, 220000, 250000, 280000, Typical
Throttle (1)
Link (2)
Governor bracket (3)
Governor spring (4)
Cam gear (5)
Cup (6)
Governor gear (7)
Governor shaft (8)
Governor lever (9)
Carburetor (10)

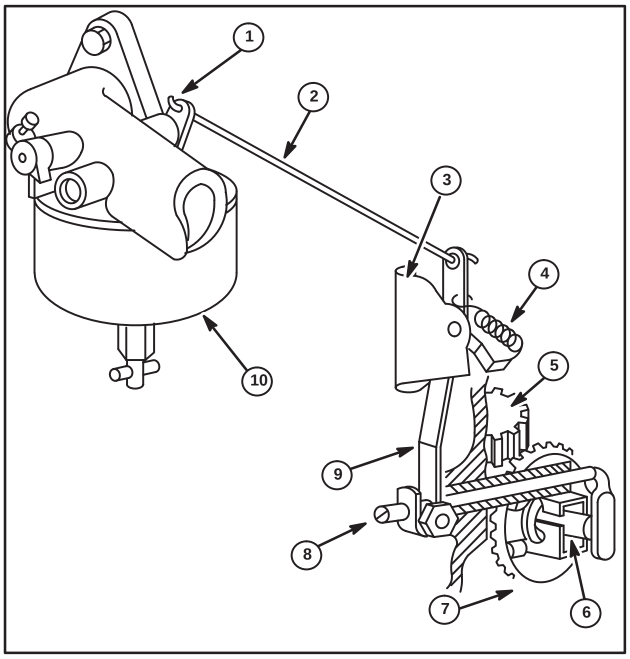

Fig. 41

Fig. 42 – Vertical Shaft Governor and Oil Slinger Assembly, Typical
Governor crank (1)
Governor cup (2)
Crankshaft (3)
Spring washer (4)
Cam gear (5)
Governor slinger (6)

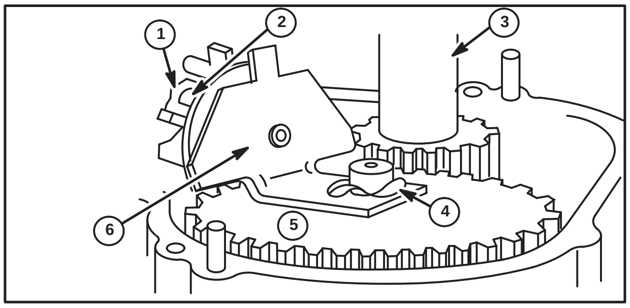

Fig. 42

Assemble
Model Series 100900, 130700, 130900, 131900, 132900, 170000, 190000, 220000, 250000, 280000

1. Before installing sump be sure that governor cup is in line with governor shaft paddle.
2. Install sump and gasket being sure the screw that enters the breather chamber has nonhardening sealant on threads such as Permatex® II, (See Fig. 47).

Fig. 43 shows spring on camshaft after governor is installed, Model Series 100900, 130700, 130900, 131900, and 132900 only.
Governor crank (1)
Cup (2)
Crankshaft (3)
Spring washer (4)
Governor slinger (5)

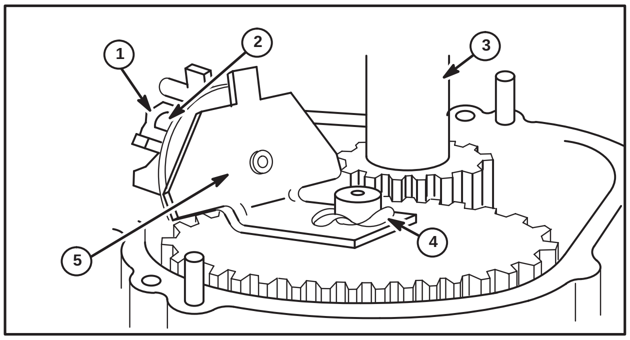

Fig. 43

NOTE: On right angle auxiliary drive power take-off models, screw (1) does not need sealant, but the four screws holding the gear sump cover require sealant, Fig. 47.

NOTE: Model Series 100900, 130700, 130900, 131900 and 132900 use spring washer as shown in Fig. 42. On Model Series 130700, 130900, 131700 and 132900 equipped with right angle auxiliary drive power take-off, the spring washer is not to be used.

3. Complete installation of remaining governor linkages and carburetor.

NOTE: If governor shaft bushing is replaced, it must be finish reamed with Tool #19333, Finish Reamer, for 1/4" (6.35 mm) governor crank or with Tool #19058, Finish Reamer, for 3/16" (4.74 mm) governor crank.

Model Series 91700, 94500, 94900, 111700, 113900, 114700, 114900
Current Style, Fig. 44: Oil slinger and governor (1), governor crank (2).

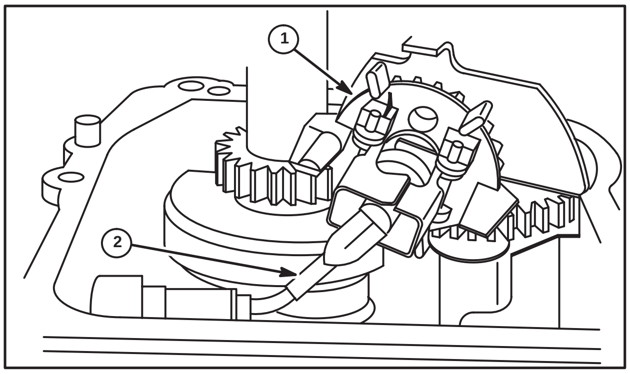

Fig. 44

Model Series 91700, 94500, 94900, 95500, 111700, 113900, 114700, 114900
Early Style, Fig. 45

Disassemble

1. Remove engine sump.
2. (Current Style): Loosen governor lever bolt and nut (5). Slide lever (3) off governor crank (1) and snap out governor link (4), then remove cotter pin (6) and washer (2) from governor crank.
   (Early Style) Fig. 45: Remove lever adjusting screw (2) and loosen lever clamp screw (6). Slide off clamp, then lift up on governor lever (1) to release lever from slot in governor crank (3).
3. Remove any paint and burrs from governor crank.
4. Remove governor crank, Fig. 46 (current), Fig. 45 (early).

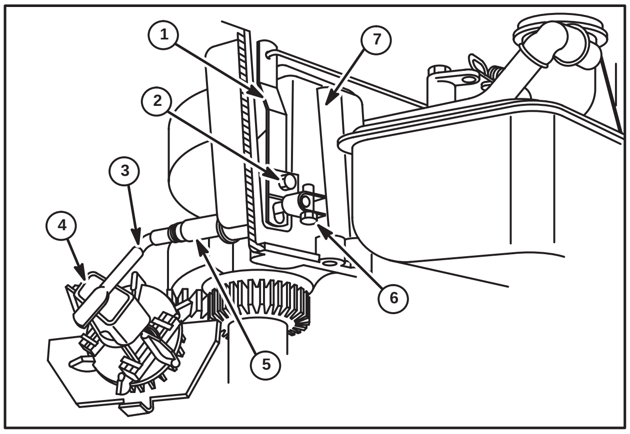

Fig. 45

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

Replace Governor Shaft Bushing

1. Press old governor shaft bushing (5), Fig. 45, out of cylinder.
2. Press new bushing into cylinder until bushing is 1/16” (1.57 mm) above outside surface of cylinder.
3. Ream bushing using Tool #19058, Finish Reamer, using suitable lubricant.
4. Place new gasket(s) same thickness as original gasket(s) on cylinder.

Assemble

1. Install governor crank from inside cylinder.
2. (Current Style): Slide washer (2) onto governor crank and install cotter pin (6). Slide governor lever (3) onto governor crank and tighten bolt and nut (5) on lever until crank turns with resistance. Turn crank counterclockwise until paddle contacts governor cup on oil slinger, Fig. 46, and snap governor link (4) into retainer on governor lever.

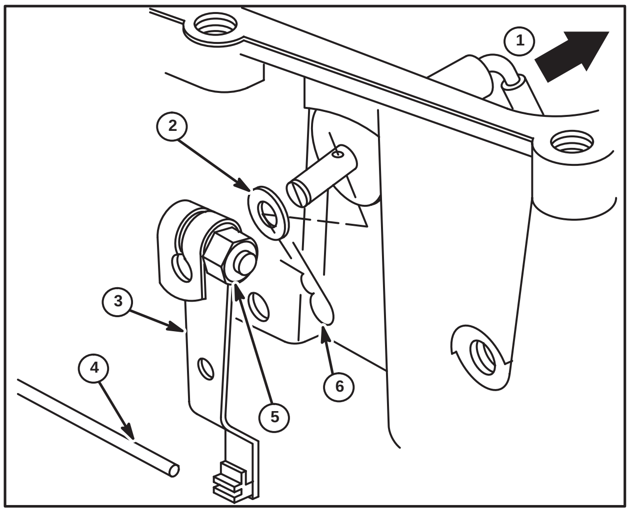

Fig. 46

5

3. (Early Style): Slide governor (1) lever on governor crank (3) and slide lever down onto shaft slot. Install lever clamp and torque lever clamp screw (6) to 15 in. lbs. (2 Nm). Install governor gear and oil slinger assembly making sure governor crank (3) is against governor cup (4), Fig. 45.
4. Insert Tool #19334, Seal Protector, into seal of oil sump and install oil sump on cylinder.
5. Place non-hardening sealant on screw (1) that enters the breather chamber, Fig. 47, such as Permatex® II, and install sump screws.
6. Torque screws to 90 in. lbs. (10 Nm).
7. Remove seal protector.

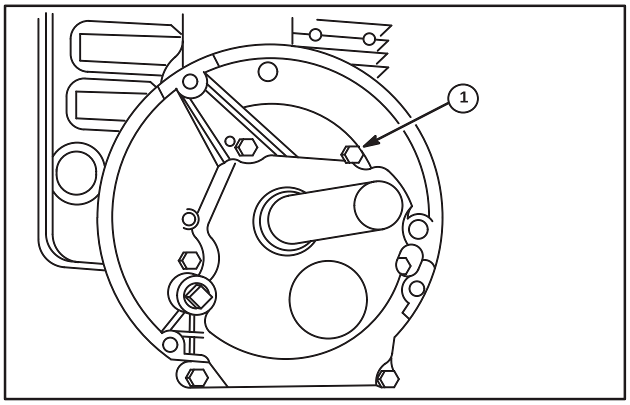

Fig. 47

MODEL SERIES 120000 (Fig. 48)

Disassemble Governor

1. Remove engine sump.
2. Loosen governor lever bolt and nut (1).
3. Slide lever off governor crank (2) and disconnect from governor link (5).
4. Remove push nut and washer (3) from governor crank, remove burrs from governor crank, and remove crank.

Assemble Governor

1. Install governor crank from inside cylinder.
2. Slide washer onto governor crank and install new push nut on governor crank.
3. Slide governor lever onto governor crank and tighten bolt and nut on lever until governor crank turns with resistance.

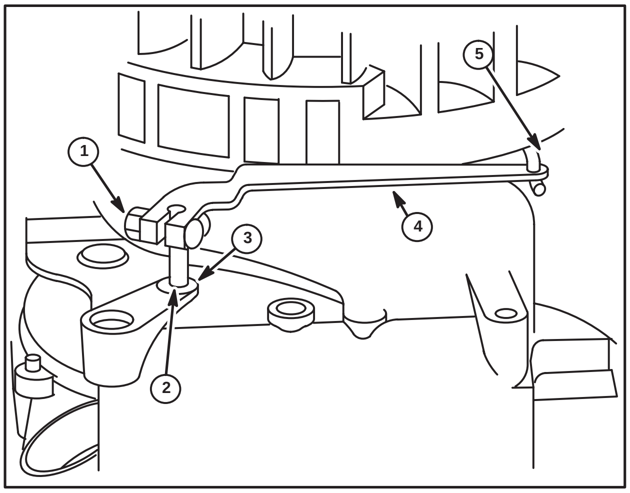

Fig. 48

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

4. Turn crank until paddle (1) contacts governor cup on oil slinger (2), Fig. 49.
5. Place new gasket(s) same thickness as original gasket(s) on cylinder.
6. Insert Tool #19356, Orange Seal Protector, into seal of oil sump and install oil sump on cylinder.
7. Place non-hardening sealant such as Permatex® II, on screw (1) that enters the breather chamber, Fig. 50, and install sump screws.
8. Torque screws to 85 in. lbs. (10 Nm). Remove seal protector.

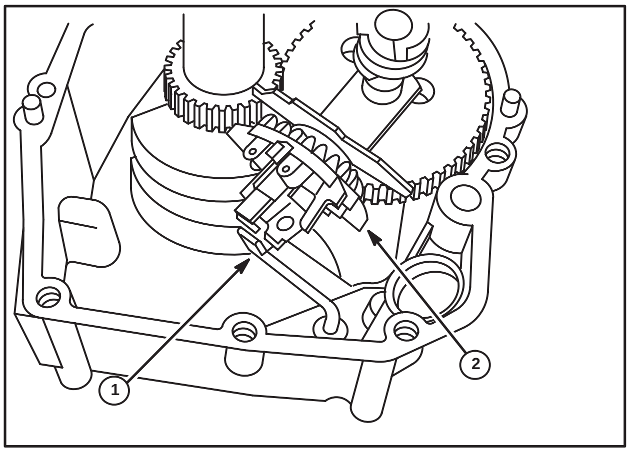

Fig. 49

Model Series 91700, 94500, 94900, 95500, 111700, 113900, 114700, 114900 (Early Style)

Static Governor Adjustment,Vertical Crankshaft

(See Static Governor Adjustment, Horizontal Crankshaft, page 11, except engines listed below.)

1. Move throttle control to wide open throttle position, Fig. 45.
2. Loosen lever adjusting screw.
3. Turn governor crank counterclockwise and hold.
4. Torque lever adjusting screw to 15 in. lbs. (2 Nm.).

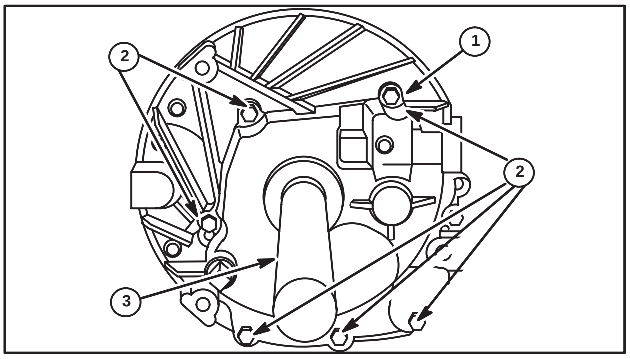

Fig. 50

Final Governor Adjustment
Install Governor Spring
Model Series 91700, 111700, 114700 (Current Style)

Governor spring should be installed as shown in Fig. 51, with large loop (1) horizontal, small loop (2) vertical.

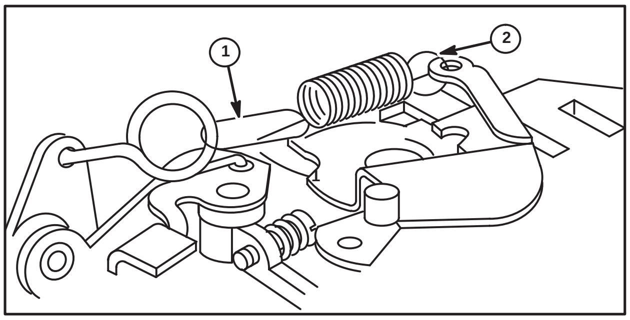

Fig. 51

Model Series 94500, 94900, 95500, 113900, 114900 (Current Style)

Governor spring should be installed as shown in Fig. 52. Note position of spring loops (1) and (2).

Install Governor Spring (Early Style)
Model Series 91700, 111700, 114700

Install governor spring as shown in Fig. 51.

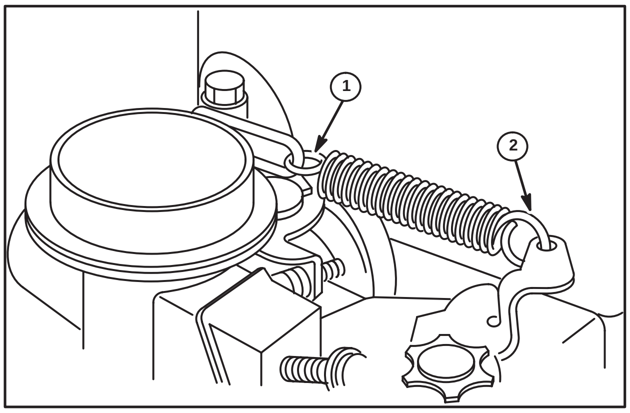

Fig. 52

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

5

Install Governor Spring
Model Series 94500, 94900, 95500, 113900, 114900 (Early Style)

1. Hold governor spring with open end of small loop down (1).
2. Hook large loop in throttle link loop as shown in (2), Fig. 53, and pull loop toward throttle lever until end of spring loop snaps on.
3. Hook small loop (3) in throttle control lever (4) as shown in Fig. 54.

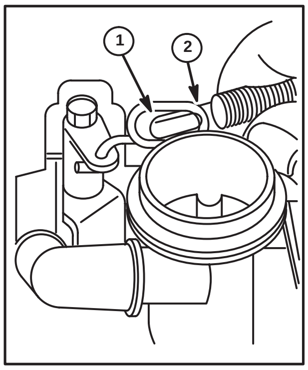

Fig. 53

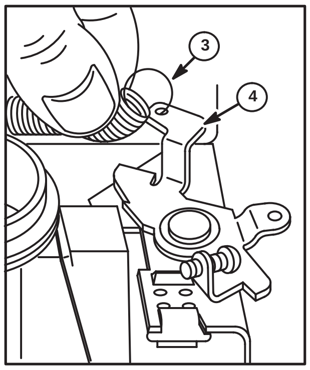

Fig. 54

Adjust Top No Load Speed
Model Series 91700, 94500, 94900, 95500, 111700, 113900, 114700, 114900 (Early Style)

Top No Load RPM is changed on these engines by changing to governor spring. Start and run engine at fast position. If RPM is not within specifications, as listed in Service Engine Sales Manual, MS-4052 or MS-6225, Service Engine Sales Manual microfiche under NOTE column.

Adjust Top No Load Speed
(Current Style) (120000)

1. Place throttle in fast position and insert a 1/8” (3.18 mm) rod through holes in carburetor control bracket and lever.
2. Start engine and adjust Top No Load RPM by turning bending tang to decrease (B) or increase (A), Fig. 55.

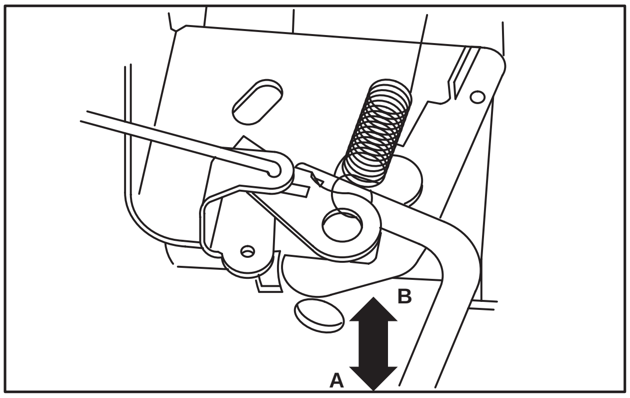

Fig. 55

Adjust Top No Load Speed
(Early Style) (120000)

1. Place throttle in fast position and insert a 1/8” (3.18 mm) rod (1) through holes in carburetor control bracket (2) and lever.
2. Start engine and use #20 Torx® driver (3) to adjust Top No Load RPM by turning screw clockwise to decrease (B) or counterclockwise to increase (A), Fig. 56.

NOTE: For correct TOP NO LOAD RPM by model and type, see Engine Sales Manual, MS-4052 or MS-6225, Service Engine Sales Manual microfiche.

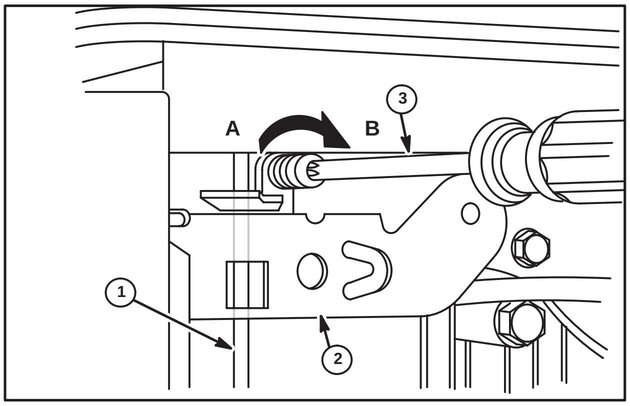

Fig. 56

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

Adjust Top No Load Speed
Swivel Vertical Rack and Pinion Control Bracket
Horizontal Rack and Pinion Control Bracket
Model Series 100900, 130700, 130900, 131900, 132900, 170000, 190000, 220000, 250000, 280000

1. Set control lever to maximum speed position, with engine running.
2. Use Tool #19229, Tang Bending Tool, to bend spring anchor tang to obtain the proper TOP NO LOAD RPM, Fig. 57, swivel and vertical rack and pinion control brackets or Fig. 58, horizontal rack and pinion control bracket. For engines using Top Speed Limit Screw, adjust tang to 4000 RPM, unless otherwise noted in Table No. 7, page 29 for Model Series 197400, 195700, 196700, 254700, 257700, 259700, 28A700, 28B700, 28C700, 28D700, 28F700, 28M700, 28R700, 28T700, 28V700 or Table No. 8, page 29, for Model Series 170000, 190000, 220000, 250000, 280000 before installing top speed limit screw.

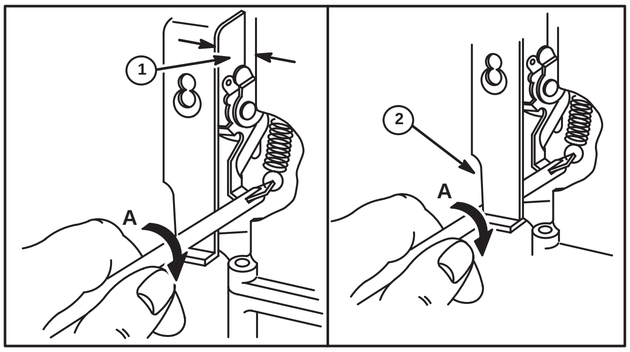

Fig. 57

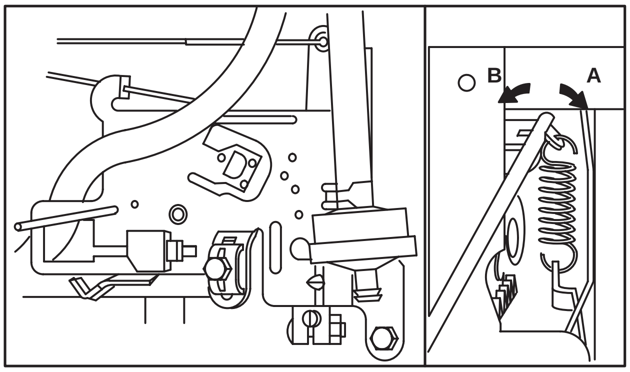

Fig. 58

3. Install Top No Load limit screw in correct hole after adjusting governor tang.

NOTE: Refer to Fig.'s 59, 60 and 61 to identify the type of control and refer to Table No. 7, Page 29 for Fig. 59, Table No. 8, Page 29 for Fig. 60 and Table No. 9, Page 29 for Fig. 61 for correct hole location.

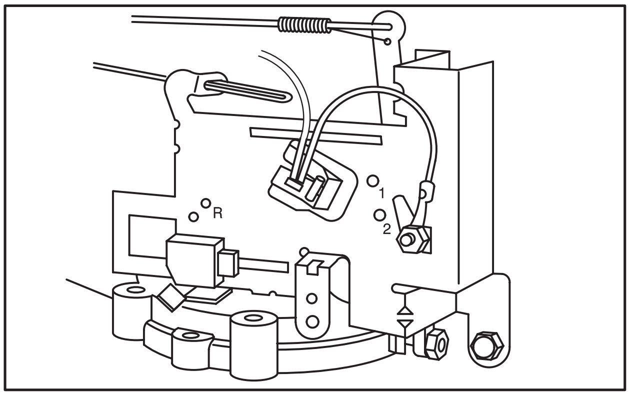

Fig. 59

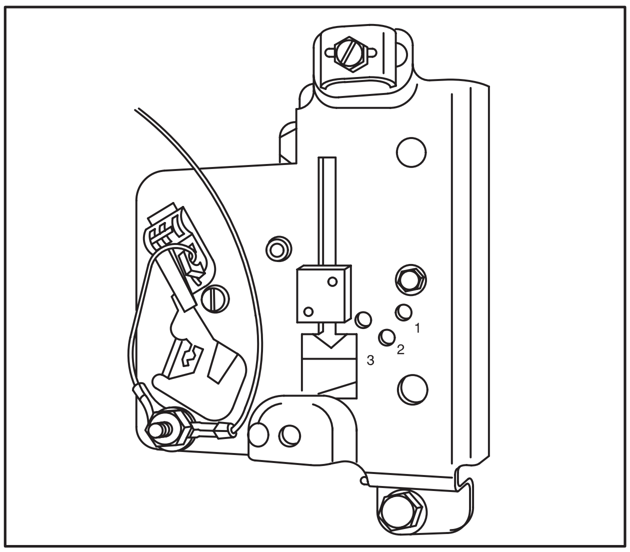

Fig. 60

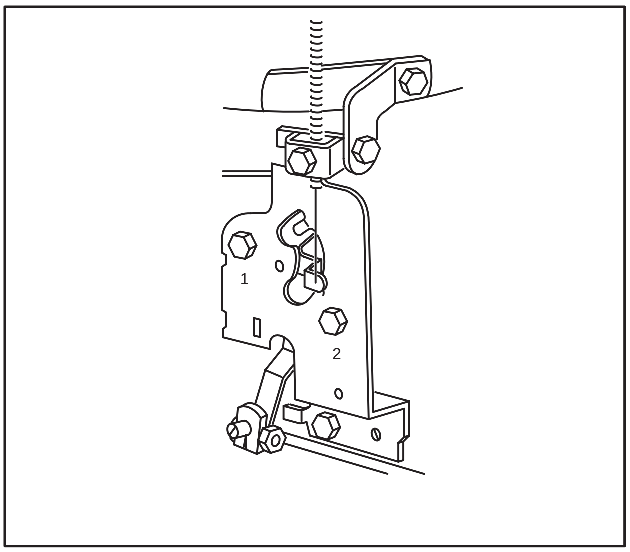

Fig. 61

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

Adjust Governed Idle
Rack and Pinion Control Horizontal Slide, Vertical Slide

1. To adjust, first make final carburetor mixture adjustments.
2. Then place remote control in idle position.
3. Hold throttle shaft in closed position with finger, adjusting idle speed screw to 1200 RPM (Horizontal Slide), 1550 RPM (Vertical Slide).
4. Release throttle.
5. Set remote control to 1750 RPM and bend tang (1) until it contacts remote control slide, Fig. 62 (Horizontal Slide), or turn screw until it contacts remote control lever, Fig. 63 (Vertical Slide).

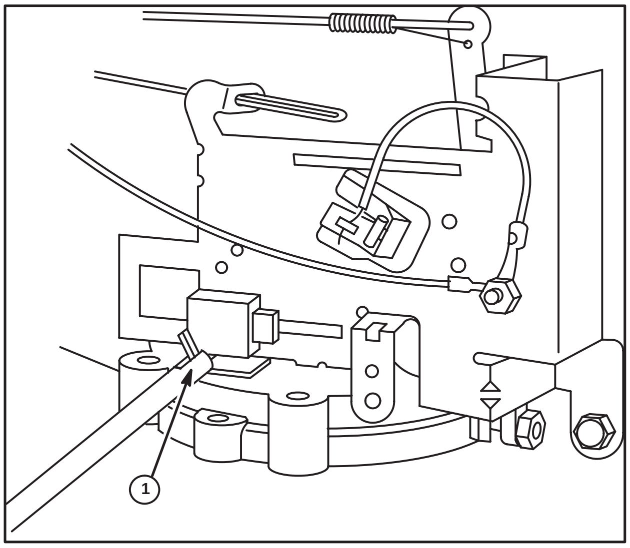

Fig. 62

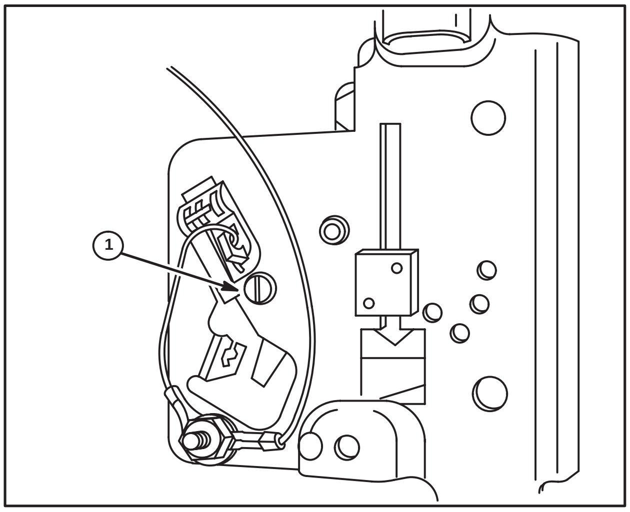

Fig. 63

5

Adjust Governed Idle
Swivel Control

1. To adjust, first make final carburetor mixture adjustment.
2. Place remote control in idle position.
3. Hold throttle in closed position with finger, adjust idle speed screw (1) to 1550 RPM.
4. Release throttle.
5. Set remote control to 1750 RPM. Turn screw (1) in until it contacts remote control lever, Fig. 64.

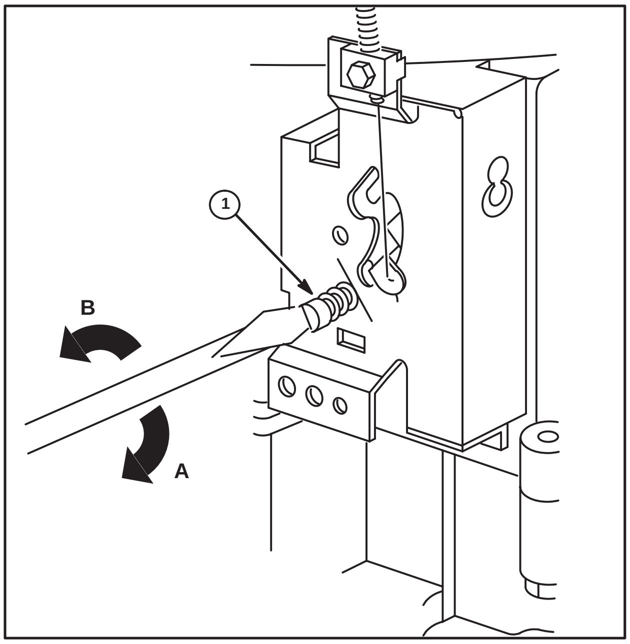

Fig. 64

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

Adjust Spring Loaded Screw Type

Following steps 1 through 4 above, turn screw (1) until it contacts remote control lever. See Fig. 65.

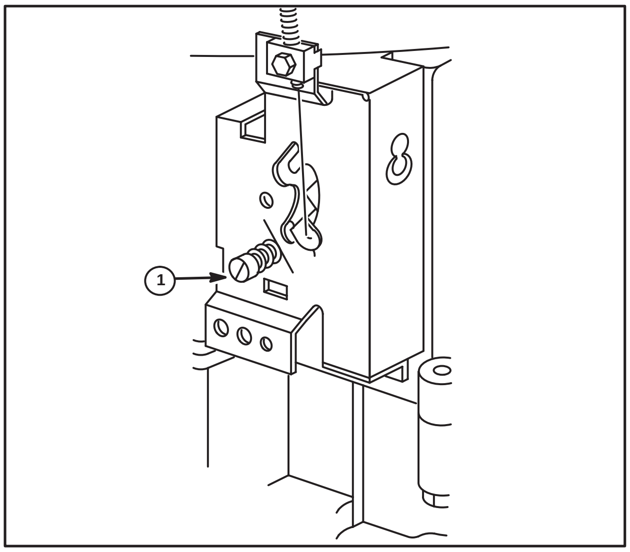

Fig. 65

Adjust Governed Idle Stop

1. Set remote control to 1750 RPM.
2. Loosen governed idle stop and place against remote control lever, Fig. 66.
3. Tighten governed idle stop.

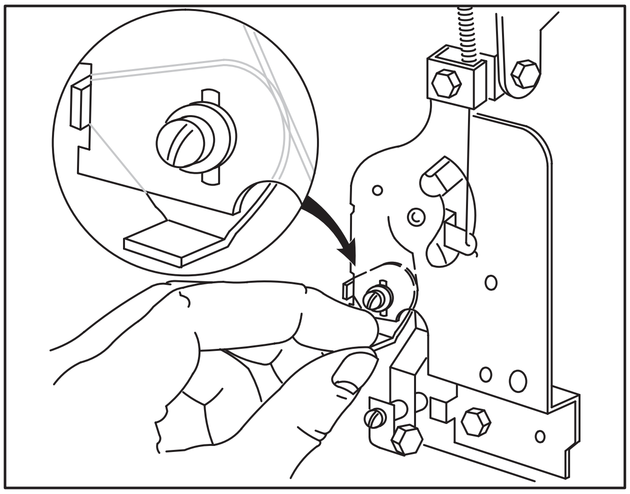

Fig. 66

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

SPECIFICATION TABLES

TABLE NO. 1

Blade Length	Maximum Rotational RPM
18" (457 mm)	3800
19" (483 mm)	3600
20" (508 mm)	3400
21" (533 mm)	3250
22" (559 mm)	3100
23" (584 mm)	2950
24" (610 mm)	2800
25" (635 mm)	2700

TABLE NO. 2
Setting Top No Load Speed

Top Speed Limit Screw Position	No Load Top Speed Range
None	3800 to 4000 RPM
No. 1 Position	3400 to 3700 RPM
No. 2 Position	3000 to 3300 RPM
No. 3 Position	2500 to 2900 RPM
No. 4 Position	1800 to 2400 RPM

TABLE NO. 3
Setting Top No Load Speed

Top Speed Limit Screw Position	No Load Top Speed Range
None	4000 to 3800 RPM
No. 1 Position	3700 to 3400 RPM
No. 2 Position	3300 to 3000 RPM
No. 3 Position	2900 to 2500 RPM
No. 4 Position	2400 to 1800 RPM

TABLE NO. 4
Hole Location, Model Series 93400

RPM Range	Hole No.	Date Codes
2800 – 3000	2	–
3100 – 3500	3	–
3600 – 3900	4	–
4000 – 4200	5	After 94111300
	6	Before 94111400

TABLE NO. 5
Hole Location, Model Series 133400

RPM Range	Hole No.
2800 – 3100	3
3200 – 3400	4
3500 – 3700	5
3800 – 4000	6
4100 – 4200	7

TABLE NO. 6
Hole Location, Model Series 176400, 196400, 226400, 250400, 256400

RPM Range	Hole No.
2600 – 2800	2
2900 – 3100	4
3200 – 3400	6
3500 – 3700	8
3800 – 4000	11

5

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

TABLE NO. 7
Setting Top No Load Speed

Top Speed Limit Screw Position	Model Series	No Load Top Speed Range
No. 1 Position with governor tang set to 4000 RPM	194700, 195700, 196700, 254700, 257700, 283700, 286700	3300
No. 1 Position with governor tang set to 3500 RPM	194700, 195700, 196700, 254700, 257700, 283700, 286700	2800
No. 2 Position with governor tang set to 4000 RPM	194700, 195700, 196700, 254700, 257700, 283700, 286700	2850

TABLE NO. 8
Setting Top No Load Speed

Top Speed Limit Screw Position	Model Series	No Load Top Speed Range
None	170000, 190000, 220000, 250000, 280000	4000
No. 1 Position	170000, 190000, 220000, 250000, 280000	3300
No. 2 Position	170000, 190000	2800
No. 3 Position	220000, 250000, 280000	2800

TABLE NO. 9
Setting Top No Load Speed

Top Speed Limit Screw Position	No Load Top Speed Range
None	4000 to 3800 RPM
No. 1 Position	3400 to 2900 RPM
No. 2 Position	2800 to 2400 RPM

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

TABLE NO. 10
ALUMINUM MODEL SERIES 80000, 112200, 130000 (EXCEPT 133400), 170000, 190000, 220000, 250000

Model Series	Governor Type	Governor Pre-Set RPM	Notes
80000	Mechanical	4600	Without Flat Cartridge Air Cleaner
80000	Mechanical	4400	With Flat Cartridge Air Cleaner
112200	Mechanical	4300	Type Numbers below 0799
112200	Mechanical	4400	Type Numbers above 0800
130200, 131200, 132200	Mechanical	4600	Without Flat Cartridge Air Cleaner
130200 & 132200	Mechanical	4000	60 Cycle, 3600 RPM with Flat Cartridge Air Cleaner
130200 & 132200	Mechanical	3600	50 Cycle, 3000 RPM With Flat Cartridge Air Cleaner
131400	Mechanical	4200	60 Cycle, 3600 RPM
132400	Mechanical	4600	50 & 60 Cycle, 3000 & 3600 RPM
170000 & 190000	Mechanical	4250	50 & 60 Cycle, 3000 & 3600 RPM, with Standard Air Cleaner
170000 & 190000	Mechanical	4150	50 & 60 Cycle, 3000 & 3600 RPM, with Front Mount Air Cleaner
170000 & 190000	Mechanical	2400	60 Cycle, 1800 RPM
220000 & 250000	Mechanical	4200	50 & 60 Cycle, 3000 & 3600 RPM
220000 & 250000	Mechanical	2400	60 Cycle, 1800 RPM

5

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 28 OF THIS SECTION.

SECTION 6
Compression

Section Contents

Page

6

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 11 OF THIS SECTION.

Compression Test
Install Leak Down Tester Tool #19413

1. Run engine for approximately 5 minutes to allow engine to reach operating temperature.

   NOTE: If engine is cold or cannot be started, compression components are not at normal operating temperatures and gauge readings may be lower.

2. Remove spark plug from engine. Remove air cleaner and disconnect crankcase breather tube from air cleaner base (if equipped). Remove spacers (2) from 1” diameter crankshafts.
3. Rotate crankshaft *in direction of operation* until piston is at top dead center of **compression** stroke.
4. Assemble Tool #19415, Clamping Tool, on crankshaft. Torque screws (1) to 150 in. lbs. (17 Nm). Insert a 1/2” drive breaker bar into square hole in clamp (3), Fig. 1.

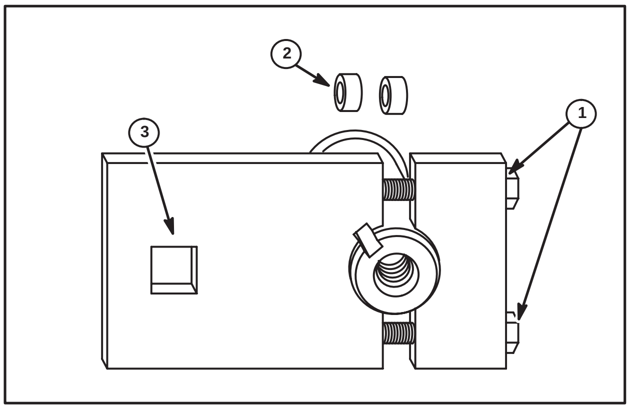

Fig. 1

CAUTION

Unintentional rotation may result in entanglement or laceration.

- INJURY MAY occur if the crankshaft is not positively locked from rotating, and the engine is not securely fastened to a stand or an application. The air pressure can create a rotational force of up to 60 ft. lbs. (81 Nm) if the crankshaft is not locked with the piston at top dead center. If the engine is installed in an application, many times the equipment can positively lock the crankshaft from moving.

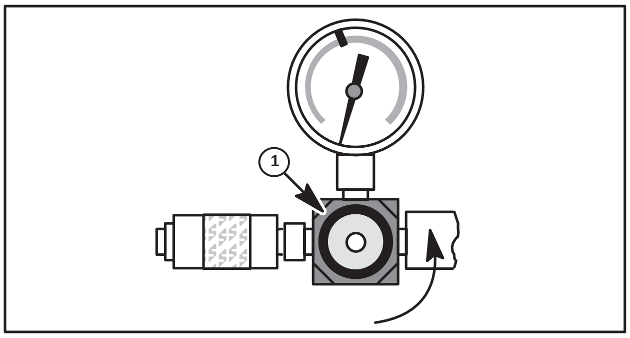

Fig. 2

5. Pull regulator lock nut out and turn adjustment knob counterclockwise as far as it will go (1), Fig. 2. Inlet gauge set point (1) is shown in Fig. 3.
6. Connect tester to the shop air source (minimum air pressure of 70 psi.) (49.2 KG/cm^2).
7. Install outlet hose into spark plug hole of cylinder being tested. Be sure O-Ring is seated to prevent air leak at spark plug hole. Connect other end to tester.
8. With breaker bar held securely, slowly turn regulator adjustment knob clockwise until tester’s inlet gauge needle is on the set point. Push in regulator lock nut. Note position of outlet gauge needle (2), Fig. 3 and refer to TABLE NO. 1, Specifications.

   NOTE: (AIR LEAKS) Any air leaks at connections or fittings will affect the accuracy of test. If a high flow of air is leaking from exhaust and carburetor, verify that piston is at TDC on compression stroke.

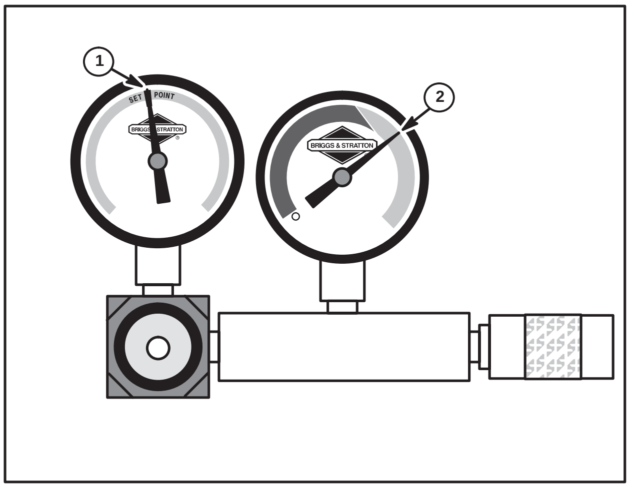

Fig. 3

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 11 OF THIS SECTION.

9. Complete test by performing steps 10 through 11.
10. Listen for air leaking from cylinder head gasket, carburetor, exhaust system and either crankcase breather or high oil fill dipstick tube.
    a. Air flowing between cylinder and cylinder head indicates that cylinder head gasket is leaking.
    b. Air flowing from carburetor indicates air is leaking past intake valve and seat.
    c. Air flowing from crankcase breather tube or high oil fill dipstick tube indicates air is leaking past piston rings.
    d. Air flowing from exhaust system indicates air is leaking past exhaust valve and seat.
11. Disconnect outlet hose from tester before removing from spark plug hole.
12. When test is complete, push regulator lock nut in and turn regulator lock nut counterclockwise as far as it will go to release pressure in combustion chamber.

Remove Cylinder Head and Shield

Note the position of individual cylinder head bolts during removal to ensure proper reassembly. Bolts used in the wrong position may be too short and not engage enough threads, or may be too long and bottom on a fin, either breaking the fin or leaving the cylinder head loose. Position of long bolts (1), Fig. 4.

Cylinder Head Assembly and Torque Procedure

Assemble the cylinder head with the cylinder head shield and a new head gasket.

Do not use sealer of any kind on gasket. Install head bolts and snug up evenly. Then use a torque wrench to tighten head bolts to the torque specified in Table No. 2, page 11, in the sequence shown, Fig. 4.

A: Model 100700, **B**: Aluminum cylinder engines 15 cu. in. and less except 100700. **C**: Aluminum cylinder engines 17 – 28 cu. in. **D**: Cast iron Models 230000, 240000, 300000, 320000.

If head bolts are not tightened in sequence, the result could be a warped head.

VALVES

Remove Valves

CAUTION

ALWAYS wear Safety Glasses during valve spring removal and installation.

Fig. 5 shows three methods used to hold valve spring retainers or rotators.
Stem (1)
Pin (2)
Collars (3)
Retainer (4)

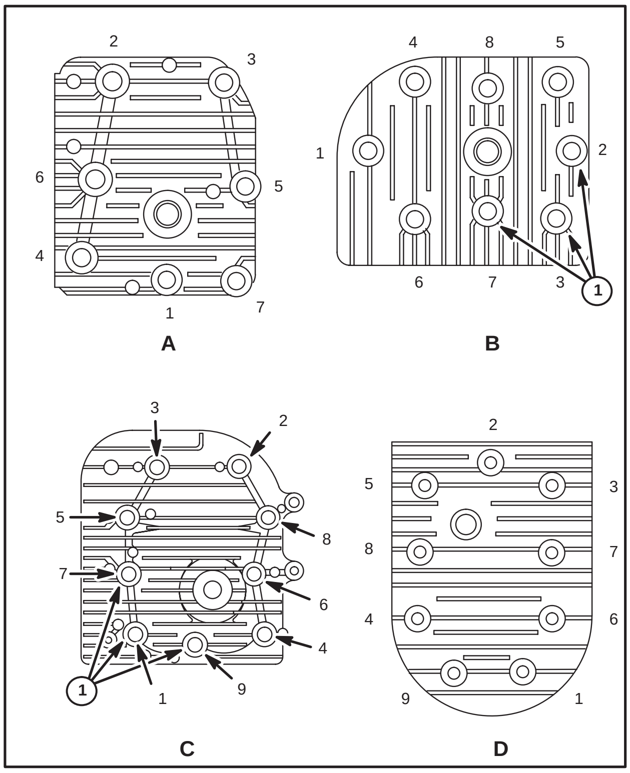

Fig. 4

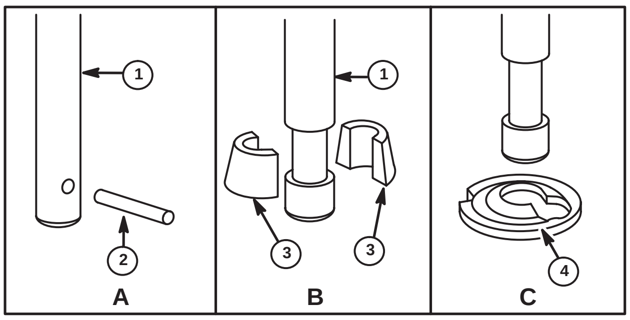

Fig. 5

6

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 11 OF THIS SECTION.

1. Use Valve Spring Compressor, Tool #19063, (see [1], Figs. 6, 7), adjusting jaws until they just touch the top and bottom of the valve chamber. Push the compressor in until the upper jaw slips over the upper end of the spring, Figs. 6, 7. Apply grease where shown (6). Inset, Fig. 6 – Cup (2), Spring (3), Collar (4), Valve (5).
2. Tighten the jaws to compress the spring.
3. Remove collars (4) or retainers, Fig. 6, pull pins (3) with needle nose pliers (2), Fig. 7, and lift out valve. Pull out compressor and spring.

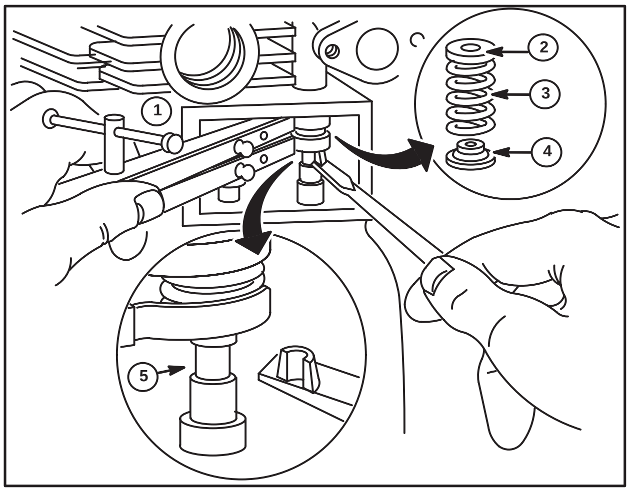

Fig. 6

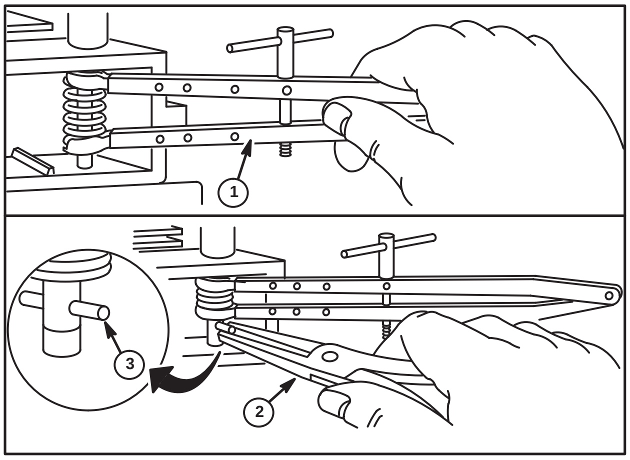

Fig. 7

Reface Valves and Seats

Valve faces can be resurfaced on a commercially available valve grinding tool. Briggs & Stratton does not recommend this practice as a high quality repair procedure. Valve replacement is recommended for damaged or worn valves. Valve seats are cut using Tool #19237 or #19343, Neway Valve Seat Cutter Kit, to 45° on exhaust and some intake seats. Other intake seats are cut to 30°. Valve and seat are lapped in using Tool #19258, Valve Lapping Tool, and Part #94150, Valve Lapping Compound, to assure a good seal between the valve face and the seat.

Valve seat width should be 3/64 to 1/16” (1.17 to 1.57 mm), Fig. 8. If the seat is wider, a narrowing cutter should be used. If valve face or seat are badly burned, the burned part should be replaced. Replace valve if margin (3) is damaged, 1/64” (.40 mm) or less (2). Acceptable wear (1), Fig. 8.

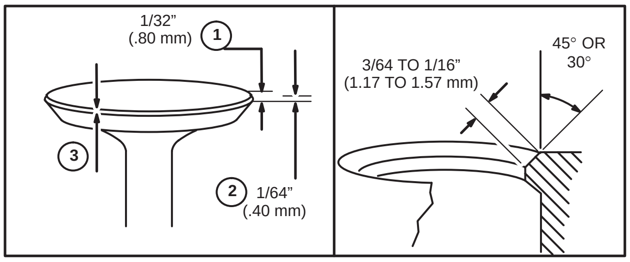

Fig. 8

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 11 OF THIS SECTION.

Check and Adjust Tappet Clearance

NOTE: Check valve clearances while engine is cold.

1. Place valves in their correct guides in cylinder.
2. Turn crankshaft (counterclockwise as viewed from PTO) until piston comes to top dead center, compression stroke. Both valves should be closed.
3. Check clearance of intake and exhaust valves to tappets with feeler gauge, Table No. 7, page 13.
4. Turn crankshaft past top dead center until piston is 1/4” (6.4 mm) down from top of cylinder.
5. If there is insufficient clearance, grind ends of valves square until correct clearance is obtained.
6. If clearance is too great, cut valve seat until correct clearance is obtained.
7. Narrow the seat, if required, to maintain 3/64 to 1/16” (1.17 to 1.57 mm) seat width.

Install Valves

CAUTION

ALWAYS wear Safety Glasses during valve spring removal and installation.

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.

NOTE: Apply “LED-PLATE” or Part #93963, Valve Guide Lubricant, to valve stems and guides before installing. Be sure that no “LED-PLATE” or Part #93963 is on the ends of the valve stems or tappets.

Install Valves, Pin or Collar Retainers Fig. 9

1. If retainers are held by a pin (2) or collars (3), place valve spring and retainer (and cup on Model Series 230000, 240000, 300000 and 320000) into Tool #19063, Valve Spring Compressor.
2. Compress spring until it is solid.
3. Insert the compressed spring and retainer (and cup when used) into valve chamber (1).
4. Drop the valve into place, pushing the stem through the retainer (4).
5. Hold the spring up in the chamber, and the valve down.
6. Insert the retainer pin with a needle nose pliers or place the collars in the groove in the valve stem.
7. Lower the spring until the retainer fits around the pin or collars, then pull out the spring compressor.
8. Be sure pin or collars are in place.

Self-Lock Retainers Fig. 9, Illus. C

1. If self-lock retainer is used, compress retainer and spring with Valve Spring Compressor, Tool #19063, until spring is solid.
2. Large hole of retainer should face toward opening in Tool #19063, Valve Spring Compressor, Figs. 6, 7.
3. Insert compressed spring and retainer into valve chamber.
4. Lower valve stem through large hole of retainer slot and then push down and in on compressor until retainer bottoms on valve stem shoulder.
5. Release valve spring compressor until it is just free of spring tension and withdraw compressor.

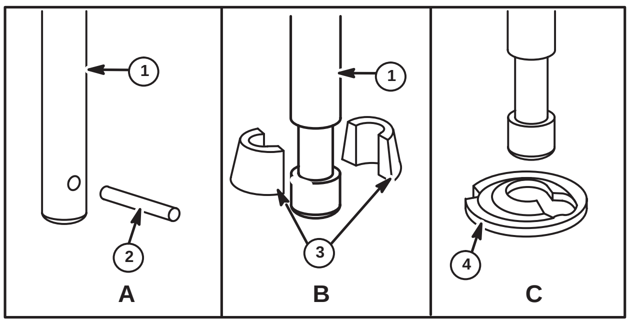

Fig. 9

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 11 OF THIS SECTION.

VALVE GUIDES

Service 1/4” (6.40 mm) Valve Guides Model Series 60000, 80000, 90000, 100000, 110000, 120000, 130000

If flat end of Valve Guide Plug Gauge, Tool #19122 (1), can be inserted into valve guide a distance of 5/16” (7.92 mm), Fig. 10, A, the valve guide is worn and should be rebushed.

Rebush Worn Aluminum Guides

1. Place pilot of Tool #19064, Counterbore Reamer (2), in valve guide.
2. Slide Tool #19191, Pilot Bushing (4), down over reamer until bushing rests on valve seat.
3. Hold a replacement guide bushing (3), Part #63709, on top of pilot bushing and mark reamer 1/16” (1.57 mm) above it (5), Fig. 10, Illus. B.
4. Ream worn guide until mark on counterbore reamer is even with top of pilot bushing. Use kerosene or equivalent to lubricate reamer.
5. After counterboring guide, continue to turn reamer in same direction while withdrawing it, Fig. 10, Illus. C.
6. Position replacement bushing in guide.
7. Press bushing with Tool #19367, Valve Guide Bushing Driver (6), until bushing is flush with top of guide, Fig. 10, Illus. D.
8. Finish ream bushing through to breather chamber with Tool #19066. Finish Reamer, using kerosene or equivalent to lubricate reamer, Fig. 10, Illus. E.
9. Flush all chips away and remove reamer, as in step 5.

NOTE: Tool #19191 (1), Pilot Bushing, can be modified to provide more accurate alignment with the valve seat. Counterbore with Tool #19064, Counterbore Reamer. Use #19367 Driver to press in bushing Part #63709, and finish ream with Tool #19066, Finish Reamer, Fig. 11.

Rebush Brass or Sintered Valve Guides

NOTE: To assure accurate alignment of Tool #19273, 7 mm Tap, Tool #19191 may need to be modified. Measure shank of Tool #19273, and either drill or bush Tool #19191 for best fit and alignment.

1. Lubricate Tool #19273, 7 mm Tap, and bushing with engine oil or kerosene.
2. With a tap wrench and Tool #19191, (modified), turn tap into bushing clockwise until tap is 1/2” (13 mm) deep. DO NOT tap more than 3/4” (19 mm) deep.

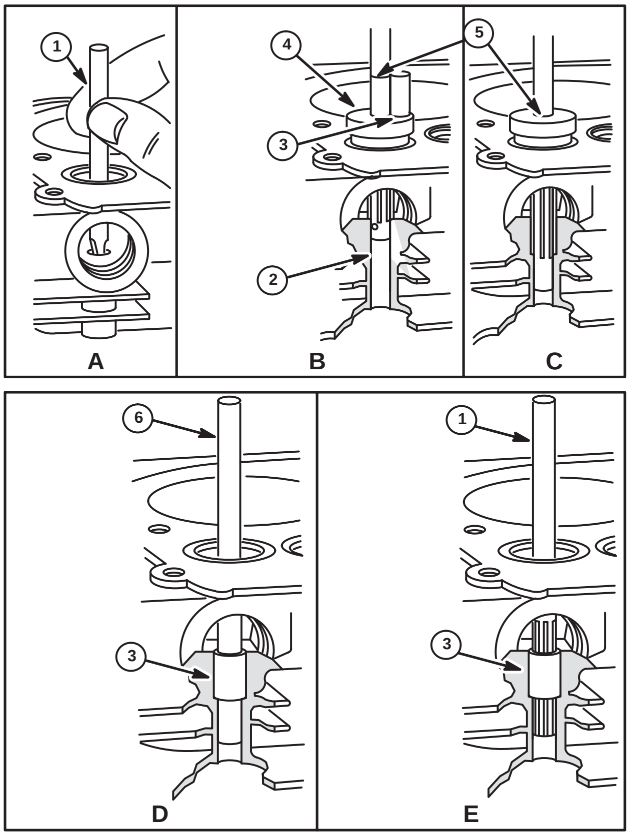

Fig. 10

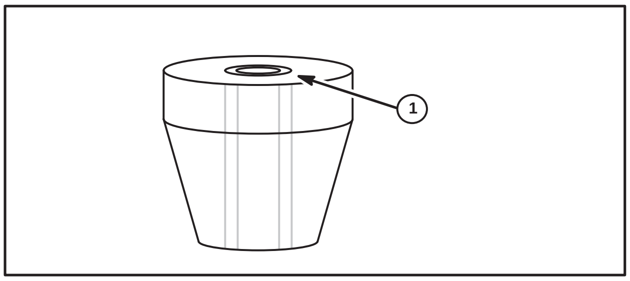

Fig. 11

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 11 OF THIS SECTION.

3. Remove tap and flush chips out of bushing.
4. Assemble Tool #19272, Puller Nut (2), Tool #19271, Puller Screw (1), and Tool #19270 Puller Washer (3), Fig. 12.
5. Thread puller screw into tapped bushing until screw bottoms in tapped hole.
6. Back off screw 1/8 to 1/4 turn and place a drop of engine oil on threads of puller screw.
7. Hold puller screw stationary and turn puller nut down on washer until bushing is removed.
8. Use Table No. 3, page 11 to select correct service bushing.
9. Place grooved or tapered end of new bushing into guide.
10. Press bushing into guide with Tool #19065 or #19274, Bushing Driver, until bushing bottoms. Rotate driver while pressing in bushing.

    NOTE: #19065 drivers purchased before October 1983 must be modified by reducing driver's tip to .240" (6.09 mm) when used to press in sintered bushings.

11. Finish ream bushing with Tool #19066, Finish Reamer, and Tool #19191, Reamer Guide Bushing, (modified), Fig. 11.
12. Before removing reamer, flush all chips away.
13. Remove reamer, turning in same direction as reaming while pulling up on reamer.

Service 5/16" (7.92 mm) Valve Guides Model Series 170000, 190000, 220000, 230000, 240000, 250000, 280000, 300000, 320000

If flat end of Valve Guide Plug Gauge, Tool #19151, can be inserted into guide a distance of 5/16" (7.92 mm), the guide is worn and should be rebushed.

Rebush Aluminum Guides and Cast Iron Guides (Cast Iron Cylinders)

1. Place pilot of Counterbore Reamer #19231 (1) in valve guide.
2. Slide Tool #19234, Reamer Guide (2), down over counterbore reamer until Guide rests on valve seat.
3. Hold replacement guide bushing, Part #231218, on top of reamer guide and mark reamer (4) 1/16" (1.57 mm) above replacement guide bushing, Fig. 13.
4. Ream worn guide until mark on counterbore reamer is even with top of reamer guide. Use kerosene or equivalent to lubricate reamer.
5. After counterboring guide, continue to turn reamer in same direction while removing it.

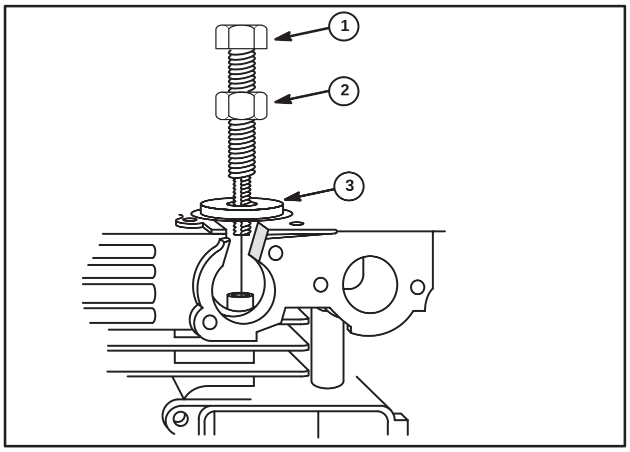

Fig. 12

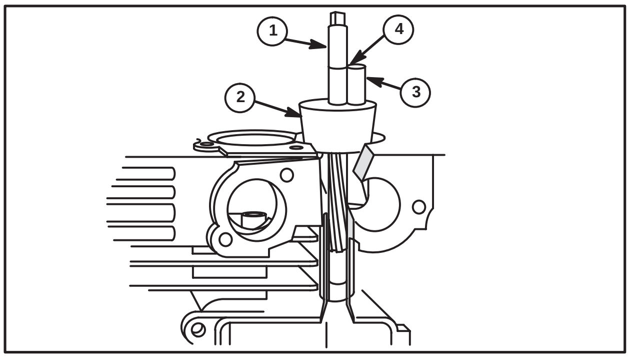

Fig. 13

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 11 OF THIS SECTION.

6. Position bushing in counterbored guide. Press bushing with Tool #19204, Bushing Driver, until bushing is flush with top of guide.
7. Finish ream bushing with Tool #19233, Finish Reamer, using kerosene or equivalent to lubricate reamer.
8. Before removing reamer, flush all chips away.
9. Flush all chips and remove reamer as in step 5.

Replace Brass or Sintered Valve Guides

1. Lubricate Tool #19264, 9 mm Tap, and bushing with engine oil or kerosene.
2. With a tap wrench, turn tap into bushing clockwise until tap is 1/2" (13 mm) deep. DO NOT tap more than 1" (50.8 mm) deep.
3. Remove tap and flush chips out of bushing.
4. Assemble Tool #19239, Puller Nut, Tool #19238, Puller Screw, and Tool #19240, Puller Washer, ref. Fig. 12 (typ.).
5. Thread puller screw into tapped bushing until screw bottoms in tapped hole.
6. Back off screw 1/8 to 1/4 turn. Place a drop of engine oil on threads of puller screw.
7. Hold puller screw stationary and turn puller nut down on washer until valve guide bushing is removed, Fig. 12.
8. Use Table No. 4, page 11, to select correct service bushing.
9. Place grooved or tapered end of new bushing into guide.
10. Press bushing into cylinder with Tool #19204, Bushing Driver, until bushing bottoms. Rotate driver while pressing in bushing.
11. Finish ream bushings, Part #261961 and #231218 with Finish Reamer, Tool #19233, and Reamer guide Bushing, Tool #19234 until reamer goes through entire guide, Fig. 13.

    NOTE: Bushing, Part #230655 does not need to be reamed.

12. Before removing finish reamer, flush all chips away.
13. Remove reamer, turning in same direction as reaming while pulling up on reamer.

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

VALVE SEAT INSERT REPLACEMENT

Model Series 233400, 243400, 300000, 320000

Cast iron cylinder engines are equipped with a removable exhaust valve seat insert. The intake side must be counterbored to allow installation of a valve seat insert.

Aluminum alloy cylinder models are equipped with removable inserts on both exhaust and intake side. See Table No. 5, page 12.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 11 OF THIS SECTION.

Remove Valve Seat Insert

1. Use Tool #19138, Valve Seat Puller, as shown in Fig. 14, and select the proper puller nut (2). See Table No. 5, page 12.
2. Be sure the puller body (1) does not rest on the valve seat insert, Fig. 14.
3. Turn the 5/16” bolt with a wrench until insert (3) is pulled out of the cylinder.

NOTE: On aluminum alloy cylinder models, it may be necessary to grind the puller nut until the edge is 1/32” (.80 mm) thick in order to get the puller nut under the valve insert, Fig. 14.

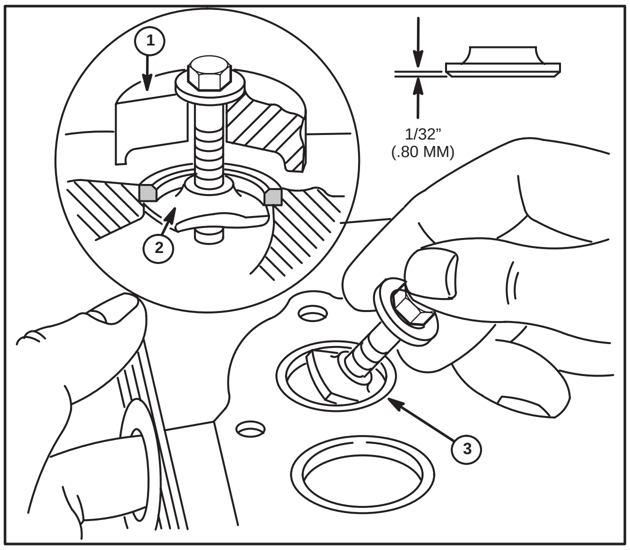

Fig. 14

Install Valve Seat Insert

1. Select the proper valve seat insert and the correct pilot and driver according to Tables 5 and 6, pages 12 and 13. You will note that one side of the seat insert is chamfered at the outer edge. This side should go down into the cylinder.
2. Insert the pilot (1) into the valve guide.
3. Drive the valve insert (2) into place with the driver (3), as shown in Fig. 15.
4. Reface seat using Tool #19237 or #19343, Neway Valve Seat Cutter Kit. Then lap valves and seat lightly with grinding compound. Clean thoroughly.

NOTE: For aluminum alloy cylinder models only, use the old valve seat insert as a spacer between the driver and the new insert, Fig. 15.

5. Drive new insert until it bottoms. Top of insert will be slightly below cylinder head gasket surface. Loose valve seat can be turned or moved up or down. Check with feeler gauge (1). Use center punch to tighten insert at three points, equally spaced (2), Fig. 16.
6. Use a flat punch to peen over the edge so metal squeezes around the entire insert (3) Fig. 16.

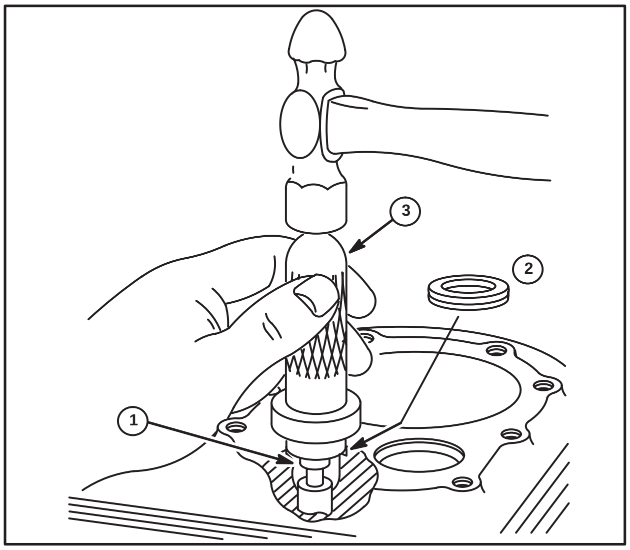

Fig. 15

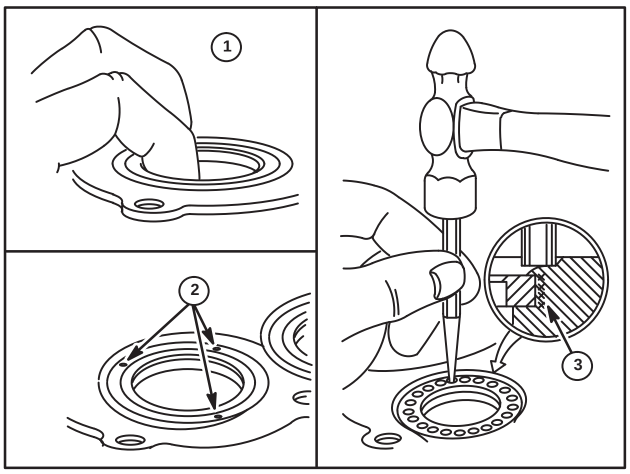

Fig. 16

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 11 OF THIS SECTION.

Counterbore Cylinder for Intake Valve Seat Installation
Cast Iron Cylinder Models

Cast iron cylinder models must be counterbored to allow installation of the intake valve seat insert.

1. Select proper seat insert, cutter shank, counterbore cutter, pilot and driver according to Table 6.
2. Insert pilot (1) in intake valve guide, Fig. 17.

NOTE: The Model Series 320000 intake valve seat is part of the cylinder. There is no replacement valve seat.

3. Assemble correct counterbore cutter (1) to cutter shank (2) as shown in Figs. 18, 19.
4. Counterbore cylinder by hand until stop (3) on cutter (1) touches top of cylinder, Fig. 19.

NOTE: Do not force the cutter to one side or it will cut oversize.

5. Blow out all chips.
6. Use Knockout Pin, Tool #19135, to remove cutter from cutter shank.

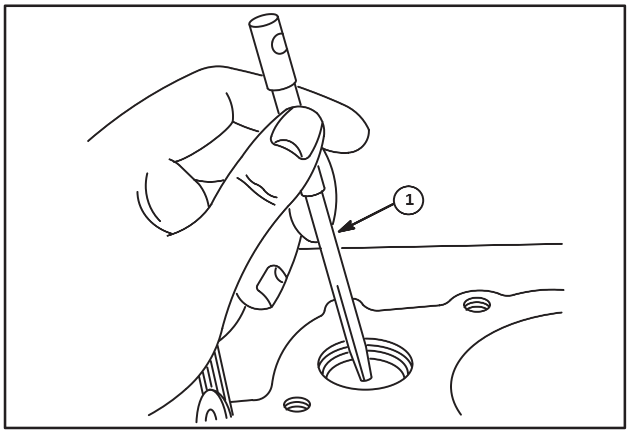


Fig. 17

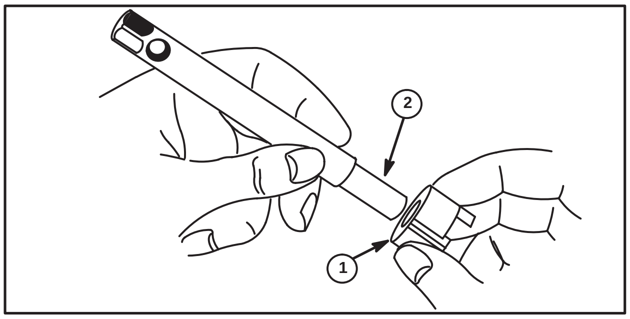


Fig. 18

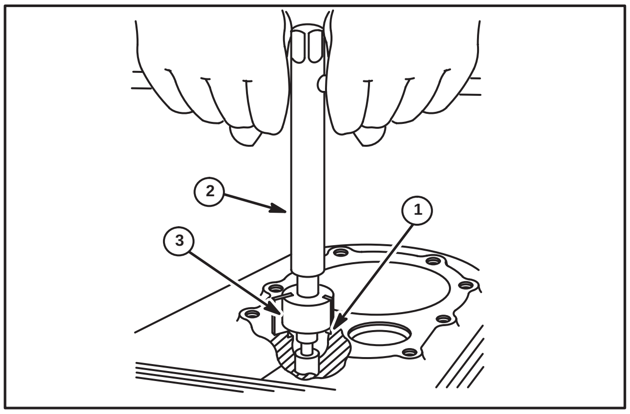


Fig. 19

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:

a. A valve rotator turns the exhaust valve a slight bit on each lift, wiping away any deposits which tend to lodge between the valve face and seat, Table No. 8, page 14 and Fig. 20 or,
b. For LP or Natural gas, use a Cobalite™ valve without rotator, see Table No's. 11 or 12, pages 17 or 18, using Fig. 21 or Fig. 22 to determine type of retainer being used.
c. A Cobalite™ exhaust valve which has a greater resistance to heat, Table No. 9, page 15 or,
d. Or a combination of both the rotator and Cobalite™ valve, Table No. 10, page 16.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 11 OF THIS SECTION.

SPECIFICATION TABLES

TABLE NO. 1
Results

Reading is Green. A small amount of air is leaking from head gasket.	Replace head gasket, then re-test.
Reading is Green Minimum air leakage.	Look for other problems that are not compression related.
Reading is Green/Red or Red, and all the air is leaking from one component.	Look for a possible problem with that component.
Reading is Red, and air is leaking from several components.	Check that piston is at TDC, on compression stroke. If reading does not change, look for problems beginning with component that appeared to leak the most air. Re-test after repair.

TABLE NO. 2
Cylinder Head Torque

BASIC MODEL SERIES	
ALUMINUM CYLINDER	**Inch Pounds (Nm)**
60000, 80000, 90000, 100000, 110000, 120000, 130000	140 (16)
170000, 190000, 220000, 250000, 280000	165 (19)
CAST IRON CYLINDER	**Inch Pounds (Nm)**
230000, 240000, 300000, 320000	190 (22)

TABLE NO. 3
Guide Bushing Identification

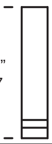
BUSHING REMOVED FROM CYLINDER				
Sint-ered Guide Gray or Copper Col-ored	Brass Guide 1 or 2 Grooves	Brass Guide 1 or 2 Grooves	Brass Guide No Grooves	Alum. Guide or Cast Iron Cylin-der
3/4" (19.00 MM) 	3/4" (19.00 MM) 	1-1/16" (26.97 MM) 	3/4" (19.00 MM) 	3/4" (19.00 MM) 
REPLACEMENT BUSHING				
Use Part #262001	Use Part #231348	Use Part #231349	Use Part #63709	Use Part #63709

TABLE NO. 4
Guide Bushing Identification

BUSHING REMOVED FROM CYLINDER			
Sintered Guide Gray or Copper Colored	Brass Guide 1 or 2 Grooves	Brass Guide No Grooves	Alum. Guide or Cast Iron Cylinder
			
REPLACEMENT BUSHING			
Use Part #261961	Use Part #231218	Use Part #230655	Use Part #231218

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 11 OF THIS SECTION.

TABLE NO. 5
Valve Seat Inserts

BASIC MODEL SERIES	INTAKE STANDARD	EXHAUST STANDARD	EXHAUST COBALITE ™	INSERT* PULLER ASSEMBLY	PULLER NUT
ALUMINUM CYLINDER					
60000, 80000	210879• ♦ 211172•	211291	210452	19138	19140 Ex. 19182 In.
90000, 110000	210879• 211172•	211291	210452	19138	19140 Ex. 19182 In.
100200, 100900, 130000	211787	211172	263094	19138	19182 Ex. 19139 In.
120000	213512	213513	None	None	None
170000, 190000	211661	211661	213316▪	19138	19141
220000, 250000, 280000	261463	211661	213316	19138	19141 Ex.
CAST IRON CYLINDER					
230000	21880	21880	21612	19138	19141
240000	21880	None	21612	19138	19141
300000, 320000	None	None	21612	19138	19141 Ex.

♦ 211291 used before Serial No. 5810060; 210808 used from Serial No. 5810060 to No. 6012010.
* Includes puller and No. 19182, 19140 and 19139 nuts.
▪ Before Code No. 7101260 replace cylinder.
• Use 210879 if seat is 1.097” (27.80 mm) O.D.; Use 211172 if seat is 1.079” (27.41 mm) O.D.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 11 OF THIS SECTION.

TABLE NO. 6 Valve Seat Insert and Counterbore Tools				
BASIC MODEL SERIES	**COUNTER-BORE CUTTER**	**SHANK**	**CUTTER & DRIVER PILOT**	**INSERT DRIVER**
ALUMINUM CYLINDER				
60000, 80000	NONE	NOT USED	19126	19136
90000	NONE	NOT USED	19126	19136
100000, 130000	NONE	NOT USED	19126	19136
170000, 190000	NONE	NOT USED	19127	19136
CAST IRON CYLINDER				
230000, 240000	19131	19129	19127	19136
300000, 320000	NONE	NOT USED	19127	19136

TABLE NO. 7
Valve Tappet Clearance

BASIC MODEL SERIES	**INTAKE**		**EXHAUST**	
ALUMINUM CYLINDER**	**MIN.**	**MAX.**	**MIN.**	**MAX.**
60000, 80000, 90000*, 100000, 110000, 120000	.005 (.13)	.007 (.18)	.007* (.18)*	.009* (.23)*
130000, 170000, 190000, 220000, 250000●, 280000***	.005 (.13)	.007 (.18)	.009 (.23)	.011 (.28)
CAST IRON CYLINDER				
230000, 240000, 300000, 320000	.007 (.18)	.009 (.23)	.017 (.43)	.019 (.48)

*Some Model Series System 2®, System 3®, System 4® have been built with .005 (.13) to .007 (.18) exhaust valve clearance. The breather on these engines are stamped on the inside surface.
●On Model Series 253400, 255400 engines equipped with "**both**" electric start and rewind start, set **VALVE TAPPET clearance** to "Rewind Start" specifications as listed in **TABLE NO. 7.** For **Electric Start ONLY** engines, set valve clearance to .009" (.23) to .011" (.28).
**Includes Cylinders with Cast Iron Sleeves
****Model Series 286700 engines, set **INTAKE VALVE TAPPET clearance** to .004" (0.10) to .006" (0.15).

6

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 11 OF THIS SECTION.

6

TABLE NO. 8

TO CONVERT FROM STANDARD EXHAUST VALVE (WITHOUT ROTATOR) TO STANDARD EXHAUST VALVE WITH (ROTATOR)						
	REMOVE		ADD			
BASIC MODEL SERIES	SPRING	RETAINER	SPRING	ROTATOR	RETAINER	PIN
60000, 80000, 90200, 92000, 93000, 94000, 95000, 96000	26478	93312	26826	292259	230127	230126
100200, 100900, 130000	26478	93312	26826	292259	230127	230126
170000, 190000, 200000, 250000	Reuse	221596	26828	292260	91257	
CAST IRON CYLINDER						
230000	65906	Reuse	26828	292260	68283	

NOTE: Rotator not to be used with LP fuel or natural gas.

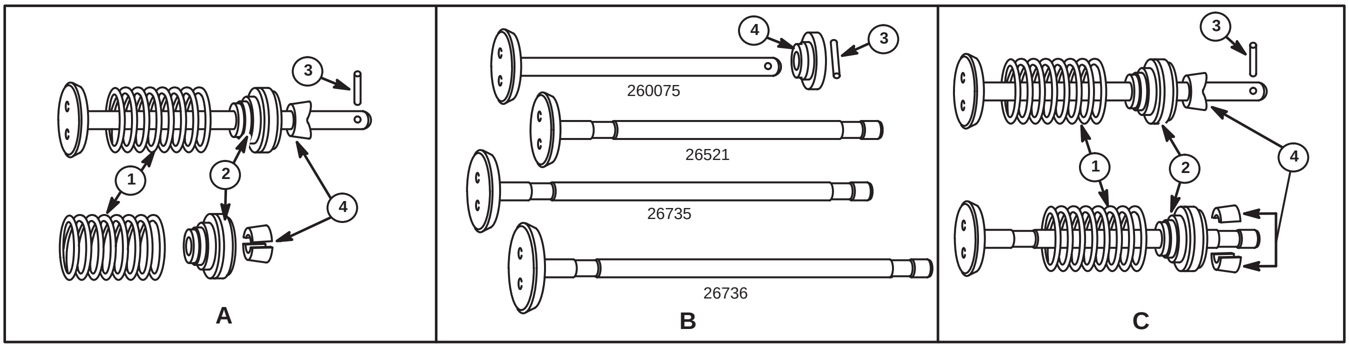


Fig. 20

Fig. 20: “A” shows standard valve and rotator, “B” shows Cobalite™ valve only, “C” shows Cobalite™ valve and rotator.

Springs (1)
Rotators (2)
Pins (3)
Retainers (4)

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 11 OF THIS SECTION.

TABLE NO. 9

TO CONVERT FROM STANDARD EXHAUST VALVE TO COBALITE™ EXHAUST VALVE (WITHOUT ROTATOR)								
	REMOVE			ADD				
Model Series	**Standard Exhaust Valve**	**Retainer or Rotator**	**Spring**	**Cobalite™ Exhaust Valve**	**Retainer Collar**	**Retainer**	**Spring**	**Pin**
60000▪ 80000▪ 90000▪	296676	93312	26478	262580		224450	26478	
100200▪ 100900▪ 130000▪	211119	93312	26478	262464		224450	26478	Not Used
170000•▪ 190000•▪	390419	Reuse Split Retainers (93630)	Reuse Spring (26828)	390420	68293	Reuse Split Retainers (93630)	Reuse Spring (26828)	Not Used
220400* 221400* 250000* 280000*		**Cobalite™ Exhaust Valve and Seat with Rotator Standard**						
		292260	Reuse Spring (26828)	Reuse 261185	68293	Reuse Split Retainers (93630)	Reuse Spring (26828)	Not Used
280000		**Cobalite™ Exhaust Valve and Seat with Rotator Standard**						
		292260	Reuse Spring 26828	Reuse 262246	68293	Reuse Split Retainers 93630	Reuse Spring (26828)	Not Used
233000	394434	68293 (Collar Type)	65906	394436 Includes Retainers	68293	Reuse Split Retainers (68283)	26828	Not Used
243000* 300000* 320000*		**Cobalite™ Exhaust Valve and Seat with Rotator Standard**						
		Reuse Split Retainers (93630)	Reuse Spring (26828)	Reuse 394436	68293	Reuse Split Retainers (93630)	Reuse Spring (26828)	Not Used

▪ Some standard with Cobalite™ exhaust valve and seat with Rotator. Cobalite™ valves are usually marked "TXS," "XS" or "PP-XS" on head.

• Valve Rotator standard with standard exhaust valve.

* Standard with Cobalite™ exhaust valve and seat with Rotator.

NOTE: Apply Briggs & Stratton "Valve Guide Lubricant," Part #93963 to valve stems and guides before installing valves especially when operating with LP fuel or natural gas. Rotator should not be used with LP fuel or natural gas.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 11 OF THIS SECTION.

TABLE NO. 10

TO CONVERT FROM STANDARD EXHAUST VALVE TO COBALITE™ EXHAUST VALVE (WITH ROTATOR)								
	REMOVE			ADD				
Model Series	**Standard Exhaust Valve**	**Retainer**	**Spring**	**Cobalite™ Exhaust Valve**	**Rotator**	**Retainer**	**Spring**	**Pin**
60000■ 80000■ 90000■	296676	93312	26478	494187	292259	230127 (Sleeve Type)	26826	230126
110000■	212004 or 261913	93312	Reuse 260552	261912	292259	230127 (Sleeve Type)	Reuse 260552	230126
100200■ 100900■ 130000■	211119	93312	26478	494191	Part of 494191		Part of 494191	Not Used
170000●■ 190000●■	390419	Reuse Split Retainers (93630)	Reuse Spring (26828)	390420	Reuse Rotator (292260)	Reuse Split Retainers (93630)	Reuse Spring (26828)	Not Used
220400* 221400* 250000* 280000*	**Cobalite™ Exhaust Valve and Seat with Rotator Standard**							
233000	23923	69293 (Collar Type)	65906	394436 Includes Retainers	292260	Reuse Split Retainers (68283)	26828	Not Used
243000* 300000* 320000*	**Cobalite™ Exhaust Valve and Seat with Rotator Standard**							

■ Some standard with Cobalite™ exhaust valve and seat with Rotator. Cobalite™ valves are usually marked “TXS,” “XS” or “PP-XS” on head.
● Valve Rotator standard with standard exhaust valve.
* Standard with Cobalite™ exhaust valve and seat with Rotator.

NOTE: Apply Briggs & Stratton “Valve Guide Lubricant,” Part #93963 to valve stems and guides before installing valves especially when operating with LP fuel or natural gas. Rotator should not be used with LP fuel or natural gas.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 11 OF THIS SECTION.

TABLE NO. 11

TO CONVERT FROM COBALITE™ EXHAUST VALVE (WITH ROTATOR AND PIN OR SPLIT RETAINERS) TO COBALITE™ EXHAUST VALVE (WITHOUT ROTATOR)							
	REMOVE				ADD		
Model Series	Rotator	Retainer	Spring	Pin	Retainer	Spring	Pin
60000▪ 80000▪ 90000▪	292259	230127 (Sleeve Type)	26826	230126	23184 (Collar Type)	26478	23187
110000▪	292259	230127 (Sleeve Type)	Reuse Spring (260552)	230126	23184 (Collar Type)	Reuse Spring (260552)	23187
100200▪ 100900▪ 130000▪	292259	230127 (Sleeve Type)	26826	230126	23184 (Collar Type)	26478	23187
170000●▪ 190000●▪	292260	Reuse Split Retainers (93630)	Reuse Spring (26828)	Not Used	68293 (Collar Type)	Reuse Spring (26828)	Not Used
220400* 221400* 250000* 280000*	292260	Reuse Split Retainers (93630)	Reuse Spring (26828)	Not Used	68293 (Collar Type)	Reuse Spring (26828)	Not Used
233000	292260	Reuse Split Retainers (68283)	26826	Not Used	68293 (Collar Type)	65906	Not Used
243000* 300000* 320000*	292260	Reuse Split Retainers (68283)	26826	Not Used	68293 (Collar Type)	65906	Not Used

▪ Some standard with Cobalite™ exhaust valve and seat with Rotator. Cobalite™ valves are usually marked “TXS,” “XS” or “PP-XS” on head.
● Valve Rotator standard with standard exhaust valve, not to be used with LP fuel or natural gas.
* Standard with Cobalite™ exhaust valve and seat with Rotator.

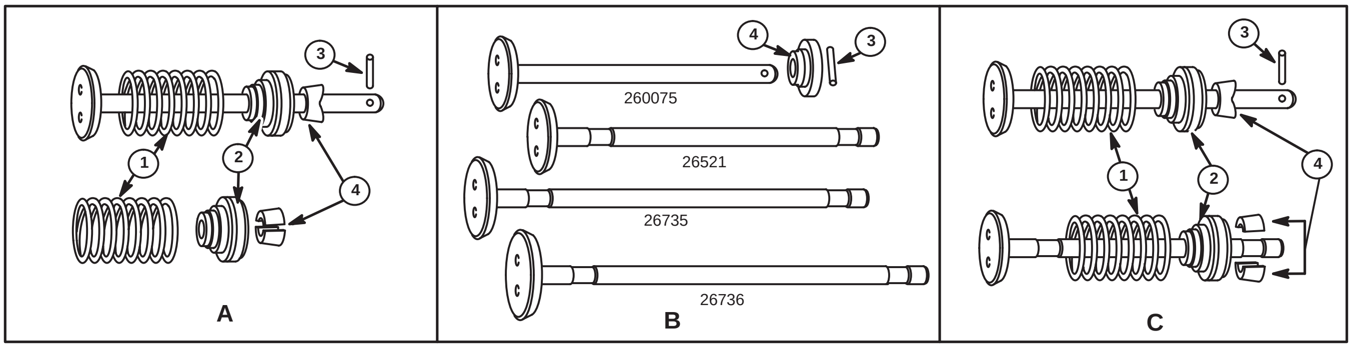


Fig. 21

Fig. 21: “A” shows standard valve and rotator, “B” shows Cobalite™ valve only, “C” shows Cobalite™ valve and rotator.
Springs (1)
Rotators (2)
Pins (3)
Retainers (4)

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 11 OF THIS SECTION.

TABLE NO. 12

TO CONVERT FROM COBALITE™ EXHAUST VALVE (WITH KEYHOLE ROTATOR) TO COBALITE™ EXHAUST VALVE (WITHOUT ROTATOR)							
	REMOVE				ADD		
Model Series	Rotator	Retainer	Spring	Pin	Retainer	Spring	Pin
60000▪ 80000▪ 90000▪	491442	Not Used	262750	Not Used	224450	26478	Not Used
110000▪	491442	Not Used	262750	Not Used	224450	26478	Not Used
100200▪ 100900▪ 130000▪	491442	Not Used	262750	Not Used	224450	26478	Not Used
▪ Some standard with Cobalite™ exhaust valve and seat with Rotator. Cobalite™ valves are usually marked "TXS," "XS" or "PP-XS" on head.							

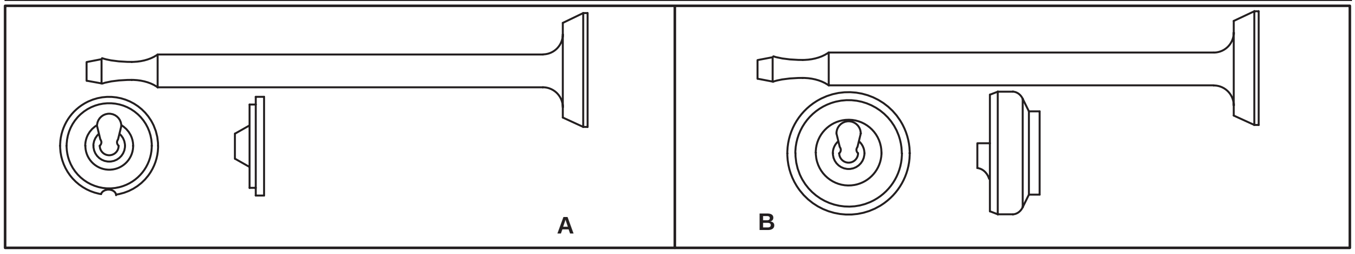


Fig. 22

Fig. 22: "A" shows Cobalite™ valve only, "B" shows Cobalite™ valve and rotator.

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 11 OF THIS SECTION.

SECTION 7A
Rewind Starters

Section Contents

7A

Rewind starter identification

Various rewind starter assemblies are illustrated below and on the next page.

Fig. 1: Old Style
Model Series 60000, 80000, 90000, 100200, 100900 and 110000

Fig. 2: Model Series 60000, 80000, 90000, 100200, 100900 and 110000

Blower housing (1)
Unused tang (2)
Rewind housing (3)
Old-style rewind spring (4)
Current style rewind spring (5)
Rewind starter grip (6)
Nylon bumper (7)
Twisted tang (8)
Pulley (9)
(Figs. 1 and 2)

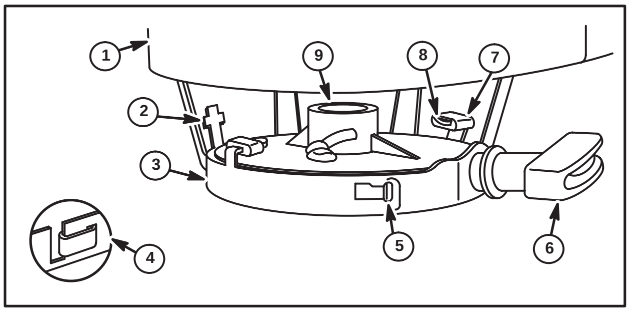

Fig. 1

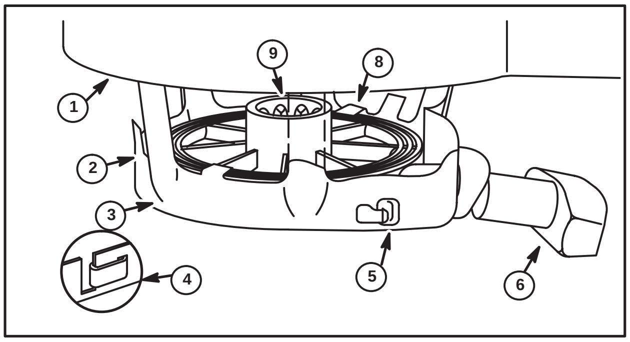

Fig. 2

Fig. 3: Model Series 100700

Starter shaft (1)
Starter gear pulley assembly (2)
Brake spring retainer (3)
Rewind starter grip (4)
Starter rope (5)
Spring brake (6)

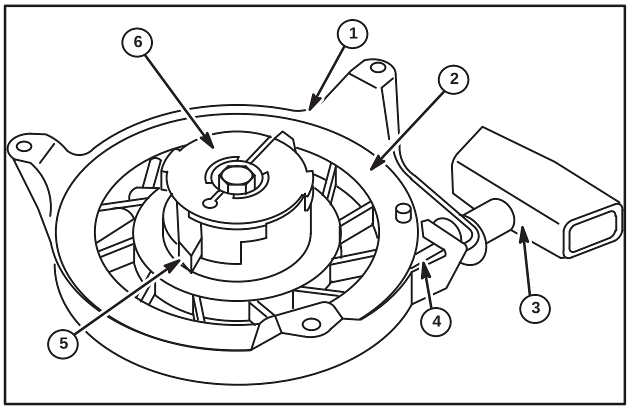

Fig. 3

Fig. 4: Early Model Series 120000 with Metal Pawls

Starter housing (1)
Starter gear and pulley assembly (2)
Rope (3)
Rewind starter grip (4)
Starter rope (5)
Metal pawls (6)

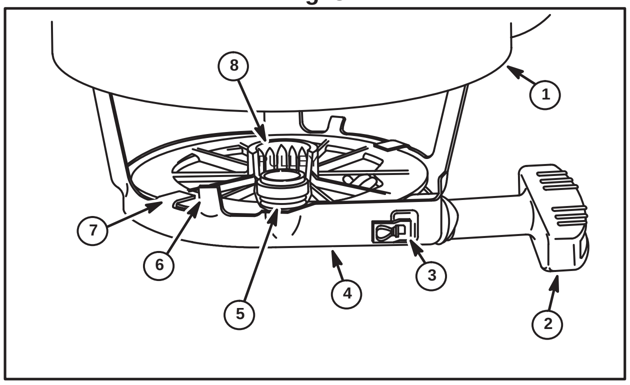

Fig. 4

7A

Fig. 5: Current Model Series 90000, 10B900, 10C900, 120000 with Plastic Pawls

Starter housing (1)
Pulley and spring assembly (2)
Rope (3)
Rewind starter grip (4)
Plastic pawls (5)
Retainer (6)

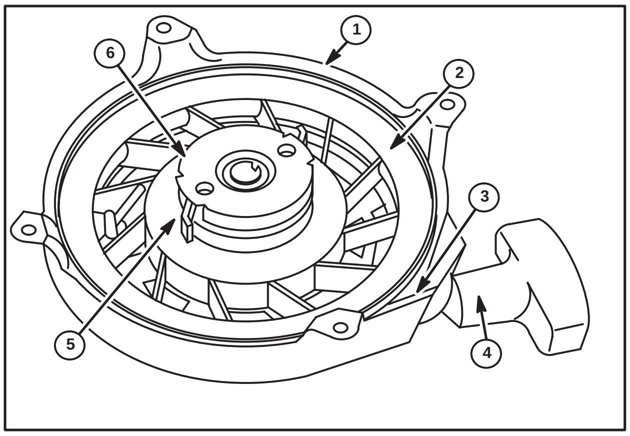

Fig. 5

Fig. 6: Model Series 130000, 170000, 190000, 220000, 250000 and 280000

Blower housing (1)
Rewind starter grip (2)
Rewind spring (3)
Rewind housing (4)
Tension spring and hub (5) (not used on Model Series 130000)
Unused pulley tang (6)
Pulley tang (7)
Pulley (8)

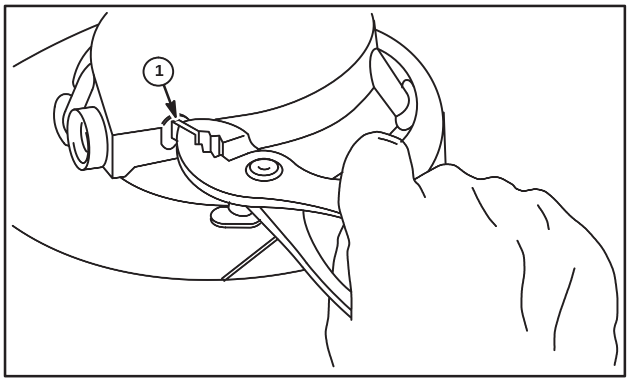

Fig. 6

Fig. 7: Model Series 170000, 190000, 250000, 300000 and 320000

Blower housing (1)
Pulley (2)
Alternate style (3)
Rewind starter grip (4)
Rewind spring (5)
Rewind housing (6)
Pulley tang (7)

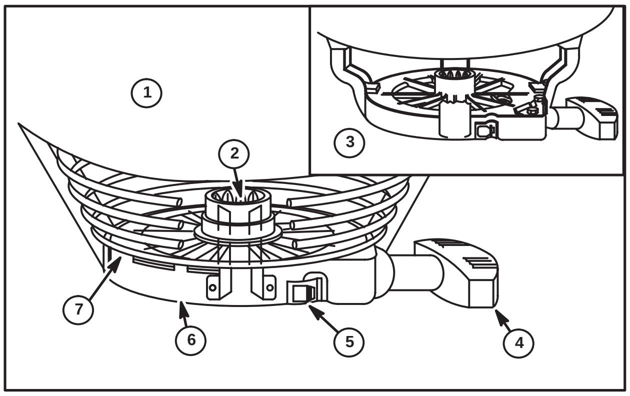

Fig. 7

7A

Remove Rope or Spring
Models Not Otherwise Specified

CAUTION

ALWAYS wear Safety Glasses while performing any rewind starter repair.

1. Pull starter rope out as far as it will go.
2. While holding pulley and starter housing, pull pulley end of rope out and untie or cut knot at end of rope.
3. With rope removed, grasp outer end of rewind spring (1) with pliers, Fig. 6, and pull out of housing as far as possible.
4. Turn spring 1/4 turn and remove from pulley or bend one of the tangs with Tang Bender, Tool #19229, up and lift out starter pulley to disconnect spring.

Install Spring

1. Clean rewind housing, pulley, and spring in solvent.
2. Wipe clean with cloth.
3. Straighten spring to allow easier installation and restore tension.
4. Oil spring.
5. Insert either end of spring into blower housing slot and hook into pulley, Fig. 8. Hole in pulley (1), hub (2). Insets show: **A, B, C:** Early styles, **D:** Current style – bend tang to create minimum 1/16 in. (1.6 mm), gap.
6. Place a dab of grease (3) on steel pulley only.
7. Set pulley into housing and bend tang down, Fig. 8. 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

1. Place square end of Tool #19409 (2) into center of pulley hub as shown in Fig. 9. Rod (1).
2. With a wrench, wind pulley COUNTER CLOCKWISE UNTIL SPRING IS WOUND TIGHTLY and end of spring is located in smaller portion of tapered hole (1), Fig. 10.
3. Back off pulley one turn or until hole in pulley for rope knot and eyelet in blower housing align, Figs. 11 and 12.
4. Install rod in tool to brace against starter housing leg and hold spring tension.

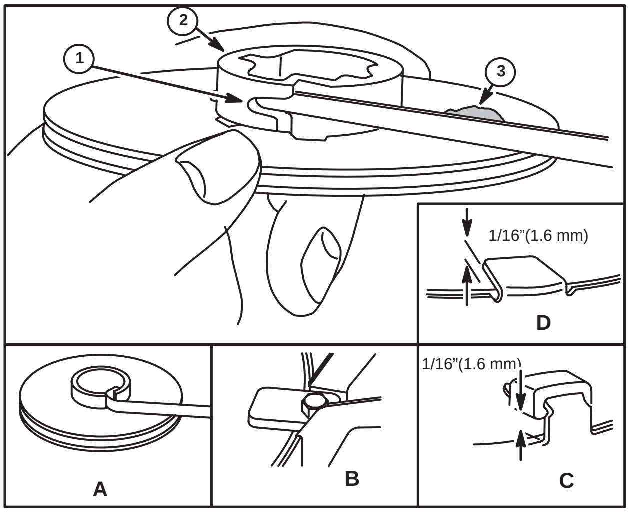

Fig. 8

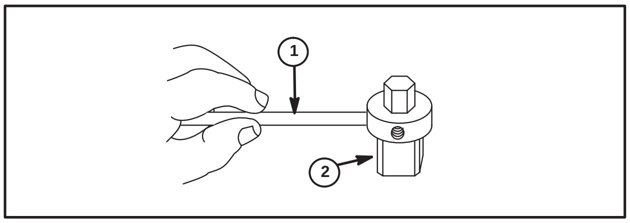

Fig. 9

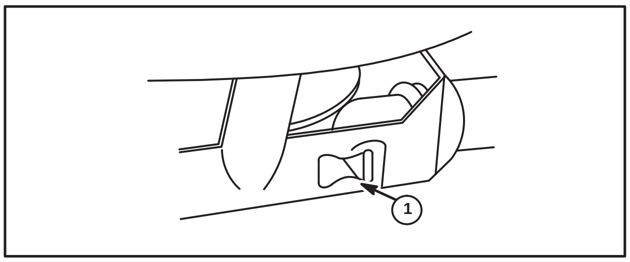

Fig. 10

7A

Fig. 11:
Bumper tang (1)
Hole in pulley (2)
Guide lug (3)
Eyelet (4)

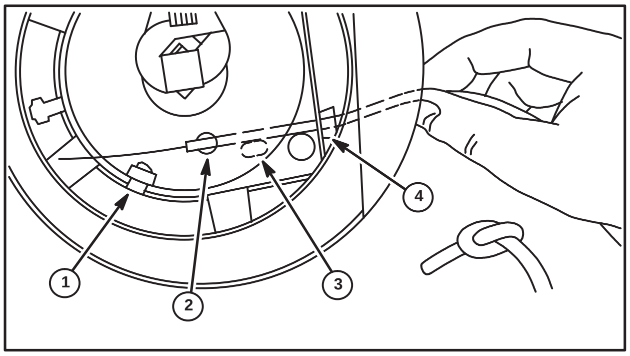

Fig. 11

Fig. 12:
Rope eyelet (1)
Hole in pulley (2)

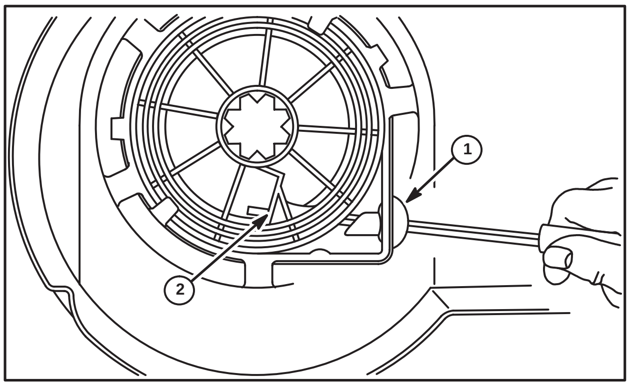

Fig. 12

Install Rope

A rope inserter tool may be made by using a piece of music wire or spring wire 1/16” diameter, and flattening the end (2) as shown in Fig. 13.

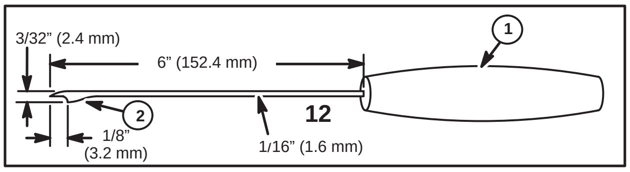

Fig. 13

1. Inspect rope. Replace if frayed.
2. Insert rope through wood handle (1) and tie a figure eight knot, Fig. 13.
3. Insert pin (1), Fig. 14, through knot and pull tightly into handle (3), Fig. 14. ALWAYS SEAL BOTH ENDS OF KNOT.
4. If re-using old rope, burn ends of rope with a match.
5. Using caution, wipe with waste cloth while it is still hot to prevent swelling and unraveling.

NOTE: When installing a new rope, check parts list to be sure correct diameter and length rope are used.

6. Thread wire and rope through rope eyelet in housing and out pulley hole. (NOTE: Rope must pass inside a guide lug on metal pulley, [3].) Fig. 11.

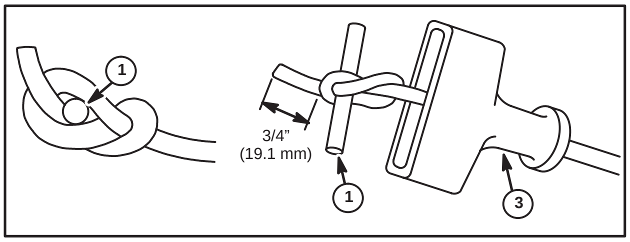

Fig. 14

Old Style with Guide Lug

Tie a knot in rope and pull tight. Make sure knot in pulley does not contact bumper tangs, Fig. 11.

7A

Current Style without Guide Lug

Tie a knot in rope and pull tight. Manipulate knot with needlenose pliers (2) so it can be pulled down into knot cavity (1), Fig. 15.

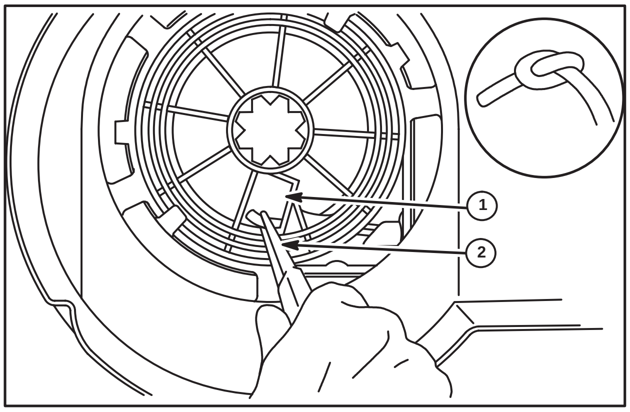

Fig. 15

Replace Rewind Assembly (For Engines 5 HP & Up)

1. If original starter housing is spot welded to blower housing, drill out spot welds using a 3/16” (4.8 mm) diameter drill. ONLY drill deeply enough to loosen spot welds.
2. Locate replacement rewind assembly in desired position and drill mounting holes.
3. Install screws from inside blower housing up through starter housing mounting leg.
4. Fasten securely with nuts as shown in Fig. 16.

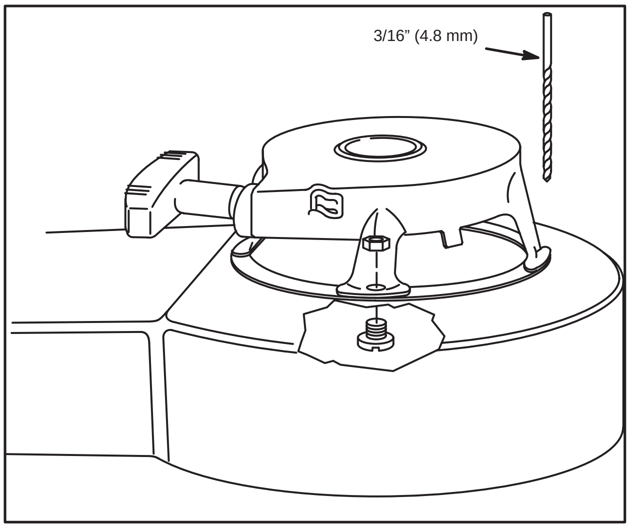

Fig. 16

Starter Clutch (Early Style, Fig. 17)

Inspect and clean starter clutch assembly as necessary. Do not oil ball cavity area (3).
Ratchet (1), check for wear at (2).

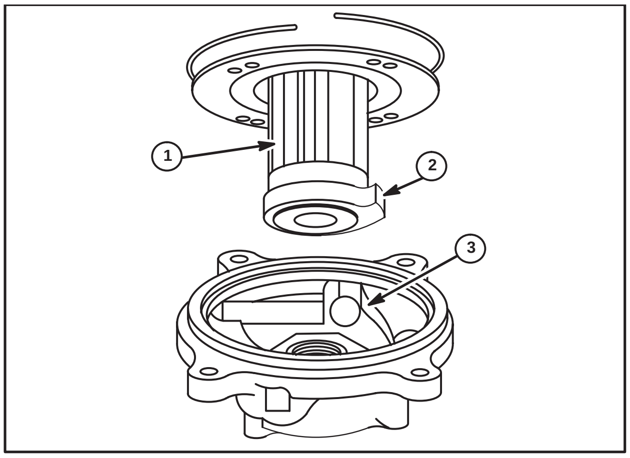

Fig. 17

Starter Clutch (Sealed, Fig. 18)

Seal (1)
Ratchet (2)
Clutch housing (3)
Retainer cover (4)
Six balls (5)

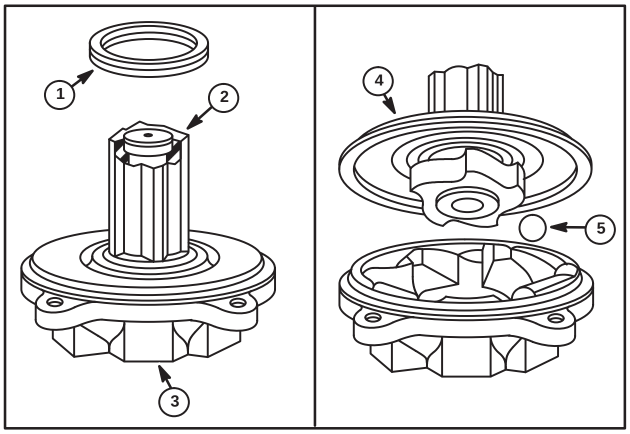

Fig. 18

1. 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. 19.
2. Place one drop of a synthetic type engine oil on end of crankshaft before replacing clutch assembly on crankshaft.
3. Tighten clutch to torque noted on specification sheet for your model engine.

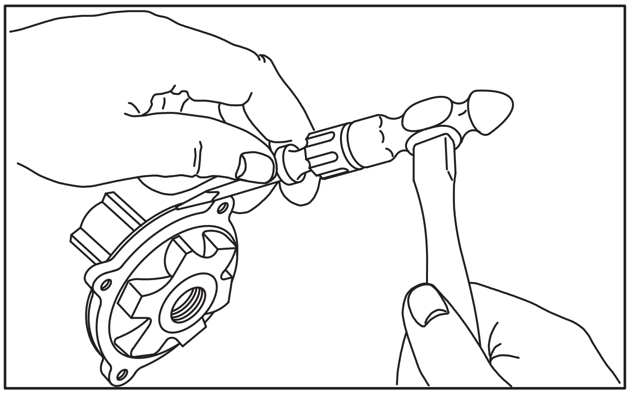

Fig. 19

CAUTION

DO NOT run engine without screen screws assembled to clutch.

7A

NOTE: Clean ratchet by wiping with cloth only.

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” (12.7 mm) as shown in Fig. 20.

The crankshaft must be shortened 3/8” (9.5 mm) (2) and the end chamfered as shown in (1) Fig. 21. A new screen #221661 is required with the new clutch.

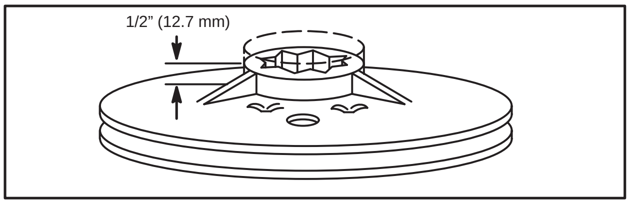

Fig. 20

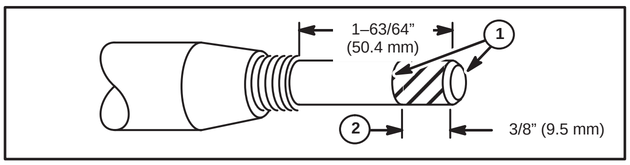

Fig. 21

CAUTION

ALWAYS wear Safety Glasses while performing any rewind starter repair.

Model Series 100700 Starter

Disassemble

To remove the starter, it may be necessary to remove or raise the fuel tank.

1. Loosen starter mounting screw (1) and remove starter, Fig. 22.

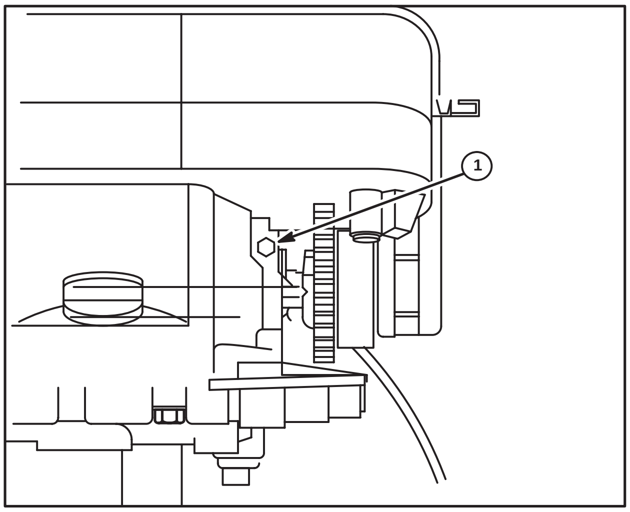

Fig. 22

2. Pull rope out as far as it will go and while holding pulley and cover, remove rope from pulley.
3. Then slowly relieve spring tension by releasing cover or pulley.
4. Remove and save decal.
5. Remove cover screw (1) by turning screw clockwise (2): left hand thread.
6. Remove screw and washer, Fig. 23.

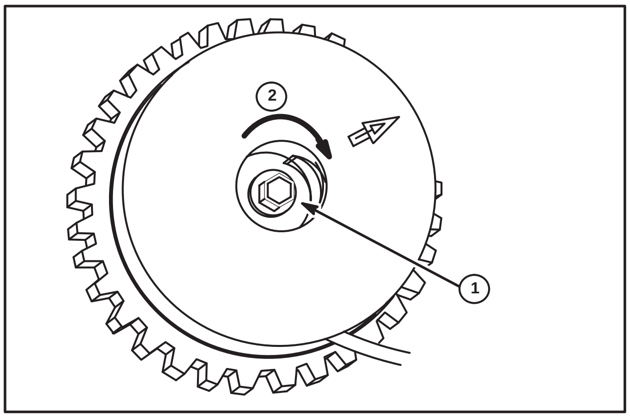

Fig. 23

7. Bend anchor tang (1) out and turn cover counterclockwise to disengage spring hook from cover notch, Fig. 24.

   NOTE: On early production starters, the tang was bent in to retain the spring hook.

8. Lift cover off assembly.

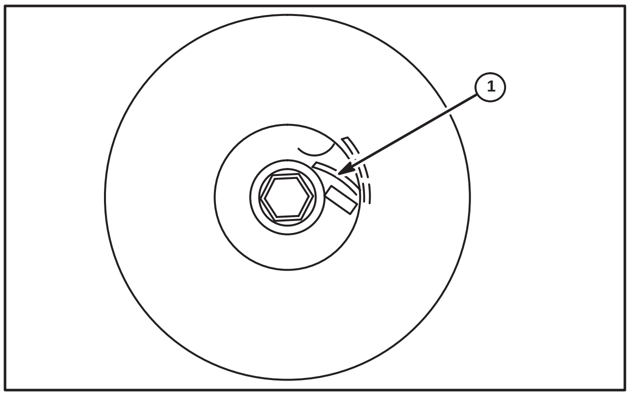

Fig. 24

7A

9. With a pair of needle nose pliers grasp spring as close to spring hook on outside edge of pulley and lift out spring, Fig. 25.
10. While gripping spring with pliers, slowly relieve spring tension.

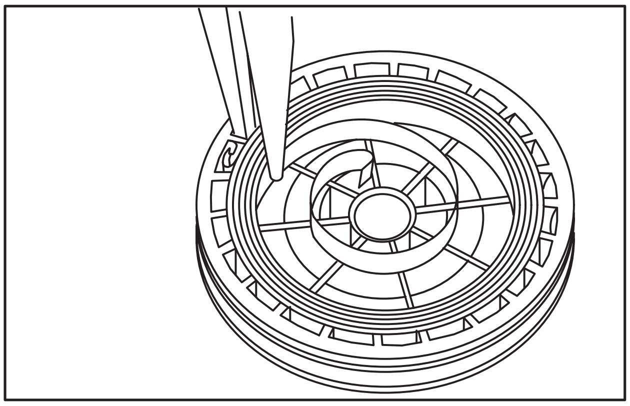

Fig. 25

11. Remove plastic washers (1), steel washer (3), pulley and gear (2) from starter shaft, (Fig. 26).

Inspect

Inspect pulley for cracks, sharp edges and nicks. Inspect gear for broken or cracked teeth. Inspect washers for cracks and sharp edges. Inspect spring for kinks, cracks and nicks. Replace all damaged parts.

Assemble

1. Clamp starter shaft in vise with vise jaw protectors or a shop rag to protect shaft.
2. Lubricate with a small amount of grease under steel washer (4), Fig. 26.
3. Place steel washer and plastic washer on shaft, Fig. 26.

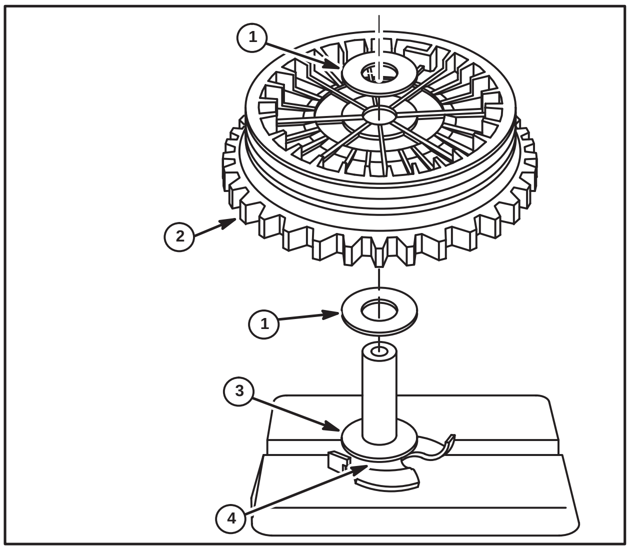

Fig. 26

4. Assemble pulley to gear with gear hub (2) and brake spring (1) toward end of helix (3), Fig. 27.

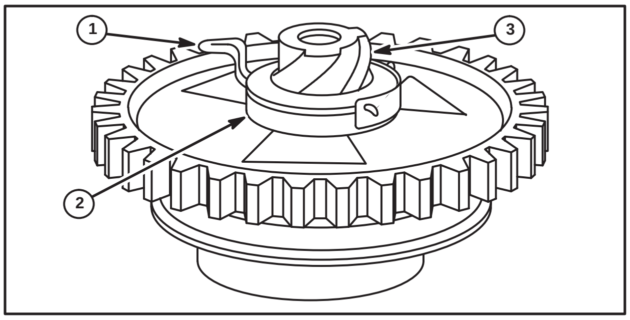

Fig. 27

5. Place gear and pulley assembly on shaft with brake spring (1) between two posts on shaft (2), Fig. 28.
6. Place plastic washer in center of pulley.

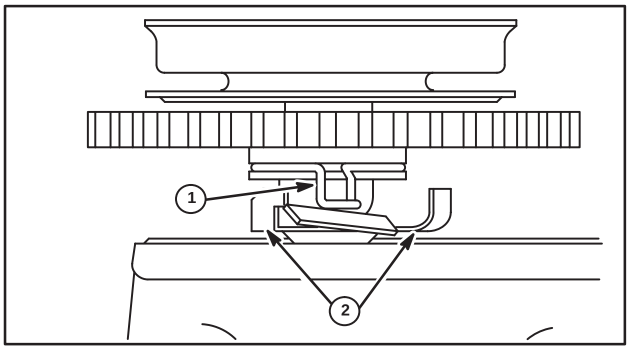

Fig. 28

7A

NOTE: Service springs are held in a retainer (1). For ease of assembly, outer hook (2) of spring should be against end of retainer, Fig. 29. If not, rotate spring until hook is against retainer.

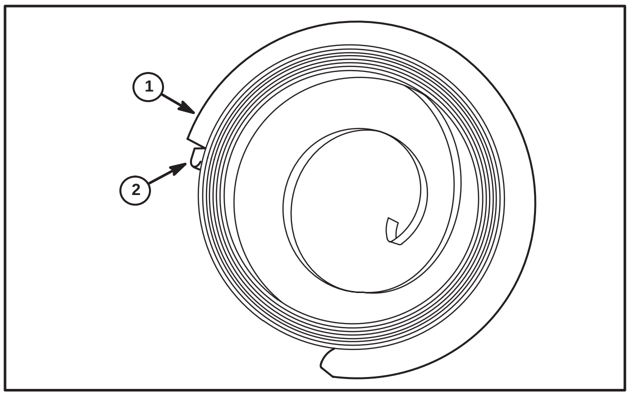

Fig. 29

7. Place spring and retainer on pulley with hook over spring notch (1) in pulley, Fig. 30.
8. Push spring down into pulley.
9. When reusing original spring, straighten spring. Hook outer end of spring in spring notch and wind spring into pulley.
10. Place a dab of grease in pulley.
11. Lay cover over pulley and start cover screw and washer.
12. Turn screw counterclockwise (left hand thread) until finger tight.

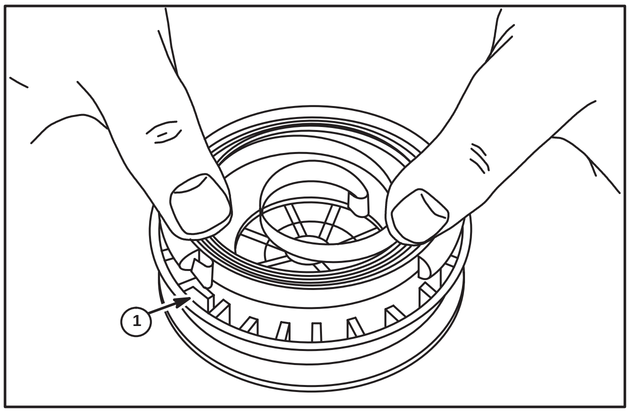

Fig. 30

7A

13. Locate Cover (Starter Handle on Top): Turn cover clockwise until “O” or “Arrow” on cover (1) is in line with starter shaft cam (2), Fig. 31.
    Locate Cover (Starter Handle and Rope Come Out Rope Guide on Cylinder Head): Turn cover clockwise until “O” or “Arrow” is 90˚ from cam on starter shaft, Fig. 32.

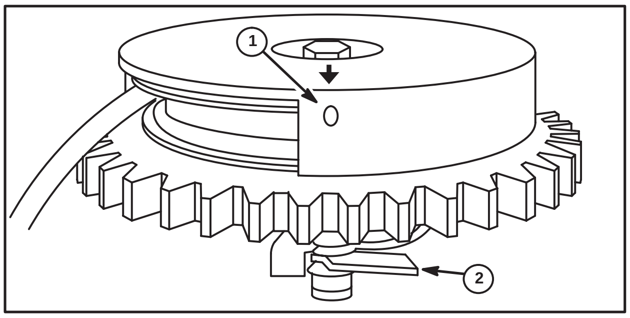

Fig. 31

14. Hold cover in correct position and torque screw to 55 in. lbs. (6 Nm).
15. Install decal over cover hole.
16. Hold starter cover and turn gear and pulley assembly clockwise until spring is tight.

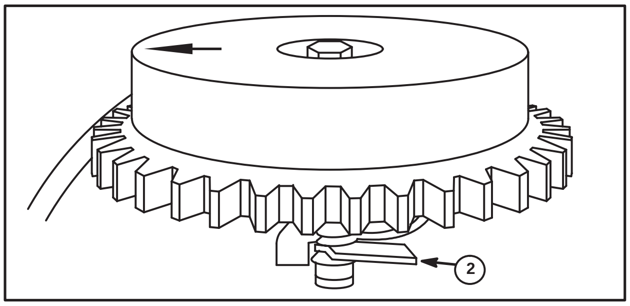

Fig. 32

17. Turn gear and pulley back 1/2 to 1-1/2 turns until rope knot pocket is in line with cover opening.
18. Insert unknotted end on rope thru rope pocket (1) and pull rope thru until knot is seated in rope pocket, Fig. 33.
19. While holding pulley and cover assembly, tie a slip knot in rope and slowly let rope wind into pulley.
20. Install starter assembly on engine with “O” or “Arrow” pointing at rope eyelet.
21. Torque starter mounting screw to 80 in. lbs. (9 Nm).
22. Thread rope thru eyelet(s), handle and rope handle insert.
23. Tie a single overhand knot in rope. Tail on knot should not be more than 1/4 inch (6.4 mm) long.
24. Pull knot into insert and insert into handle.

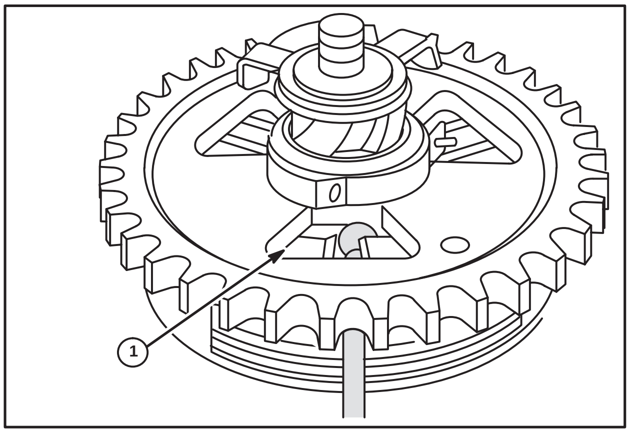

Fig. 33

Model Series 90000, 10A900,10B900, 10C900, 120000 with Plastic Pawls

CAUTION

ALWAYS wear Safety Glasses while performing any rewind starter repair.

Remove Rope

1. Pull starter rope out as far as it will go.
2. While holding pulley and starter housing, pull pulley end of rope out and untie knot at end of rope.
3. Remove rope and handle from starter.
4. Slowly release pulley to release spring tension.

Inspect Rope

1. Inspect rope. Replace if frayed.
2. If re-using old rope, burn ends of rope with a match.
3. Using caution, wipe with waste cloth 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 rope length is used. The service replacement rope is cut to length as required: see Table No. 1 on page 20.

Remove Pulley And Spring

1. Remove shoulder screw (1) and retainer (2), Fig. 34.
2. Lift out pawls (3) and pawl springs (4), Fig. 34.
3. Rotate pulley (5) on pivot post (6) until it turns freely.
4. Carefully lift out pulley with spring, Fig. 35.

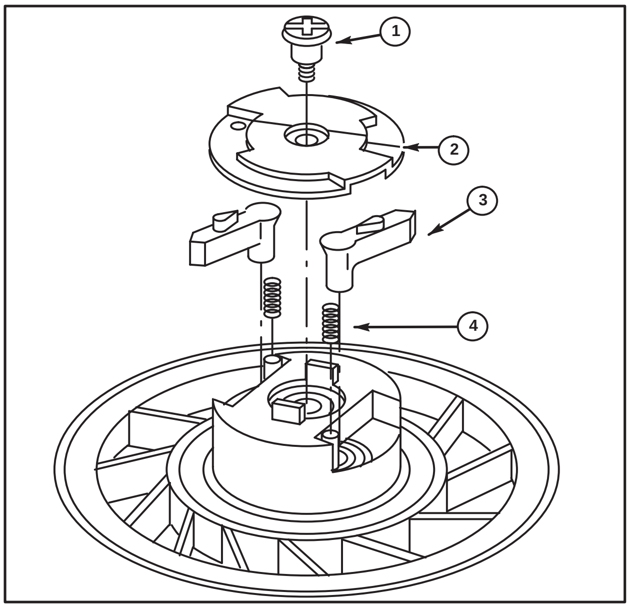

Fig. 34

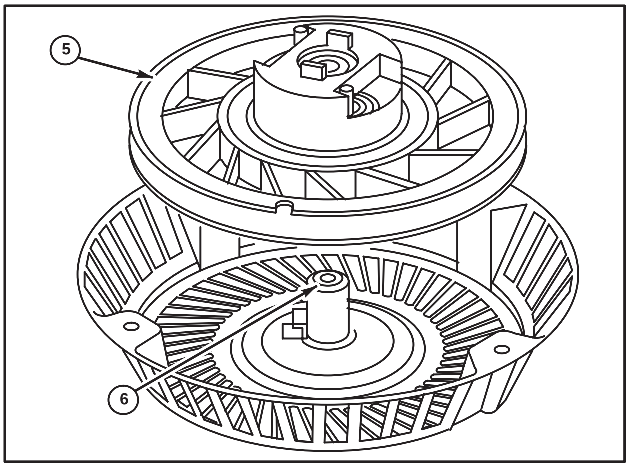

Fig. 35

7A

Inspect Housing, Pulley and Spring

1. Inspect pulley for wear, cracks, rough edges or burrs in pulley groove and wear on center hole.
2. Replace if damaged or worn.
3. Inspect spring for broken ends, kinks and burrs. Replace if damaged.

> **CAUTION**
>
> **ALWAYS** wear Safety Glasses while performing any rewind starter repair.
>
> - Pulley and spring is serviced as an assembly.
> - **DO NOT REMOVE SPRING FROM PULLEY.**
> - The starter spring is still under tension after the rope has been removed and the pulley has unwound.

4. Inspect starter housing for wear or sharp edges at rope eyelet (2), center pivot post (3), and inner spring anchor tab (1), Fig. 36.
5. Replace if worn or damaged.

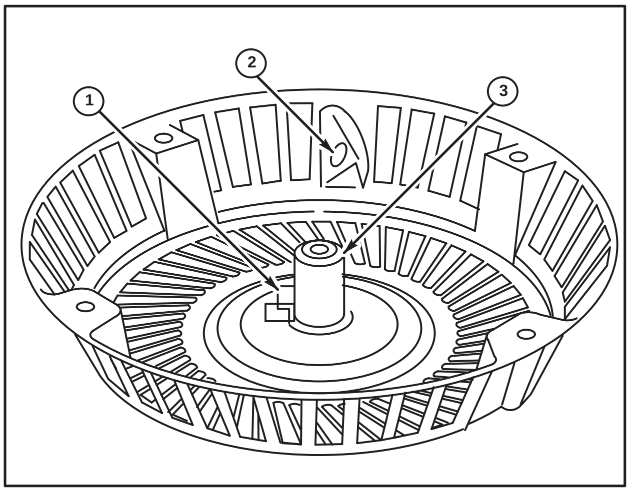

Fig. 36

Assemble Starter

Install Pulley and Spring

1. Lay starter housing on bench.
2. Assemble starter pulley to center pivot post in housing, Fig. 35.
3. Rotate pulley counter clockwise until slight resistance is felt, indicating that spring is engaged in spring tab in housing.

Install Pawls, Pawl Springs and Retainer Assembly

1. Position springs (2) over posts in pulley (1) marked “R”, then install pawls (3), Fig. 37.
2. Install retainer (1) making sure that slots in retainer (2) engage tabs on pulley (3), Fig. 38.
3. Hold retainer down, compressing pawl springs and install retainer screw. Torque screw to 70 in. lbs. (8 Nm).

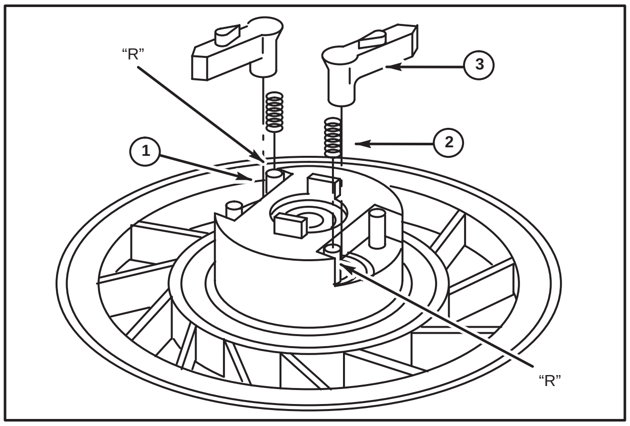

Fig. 37

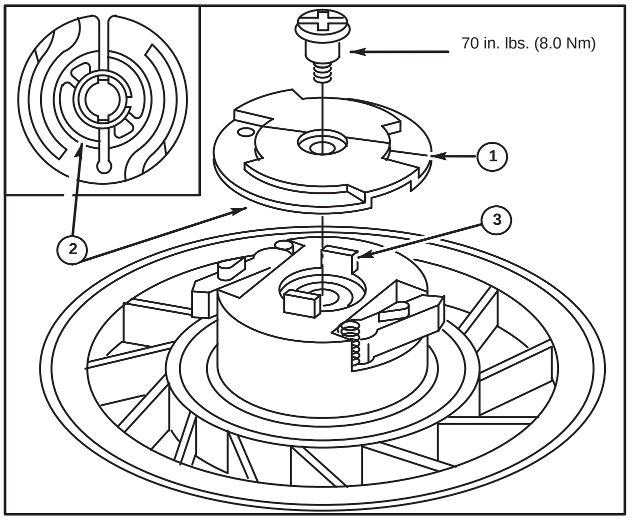

Fig. 38

7A

Wind Spring & Install Rope

1. Turn pulley counterclockwise (B) until spring is wound tightly, Fig. 39.
2. Then rotate pulley CLOCKWISE (A) until rope hole in pulley is in line with starter housing eyelet (1) and hold pulley, Fig. 39.
3. Insert unknotted end of rope through knot cavity and rope hole (2) in pulley.
4. Thread end of rope through starter housing eyelet and pull rope until knot is in rope cavity.

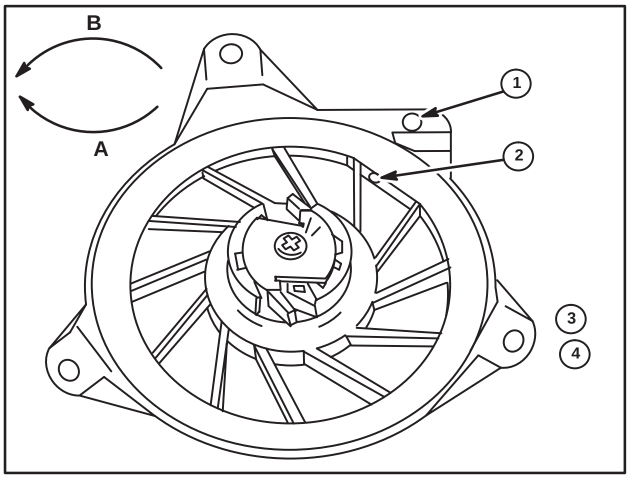

Fig. 39

5. While holding starter rope handle, slowly let pulley pull starter rope into starter.

NOTE: If starter handle was removed, perform the following steps:

1. While still holding pulley, tie a temporary knot (3) part way out on rope.
2. Let pulley and spring slowly pull rope against temporary knot.
3. Insert rope (2) through starter handle (1) and starter handle insert, Fig. 40.
4. Tie knot on end of rope. Pull knot into handle insert and pull insert into starter handle.
5. Untie temporary knot and slowly let rope rewind into starter.
6. Operate starter to check for smooth operation, Fig. 40.

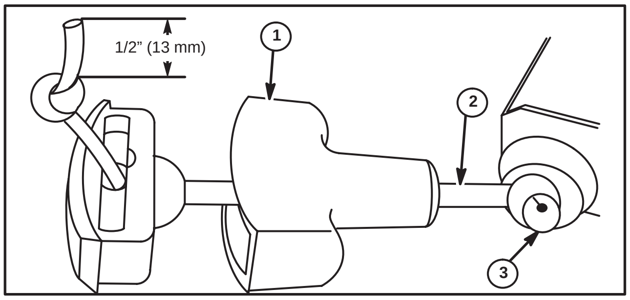

Fig. 40

7A

Model Series 120000 with Metal Pawls

CAUTION

ALWAYS wear Safety Glasses while performing any rewind starter repair.

Disassemble

1. Remove spark plug wire, finger guard and fuel tank, Fig. 41.
2. Remove dipstick, oil fill tube (1), blower housing (2), and starter (3).

NOTE: On early engines the starter housing must be removed from the blower housing by drilling out the four pop rivets holding the starter on the blower housing. Service starters include mounting hardware to replace pop rivets.

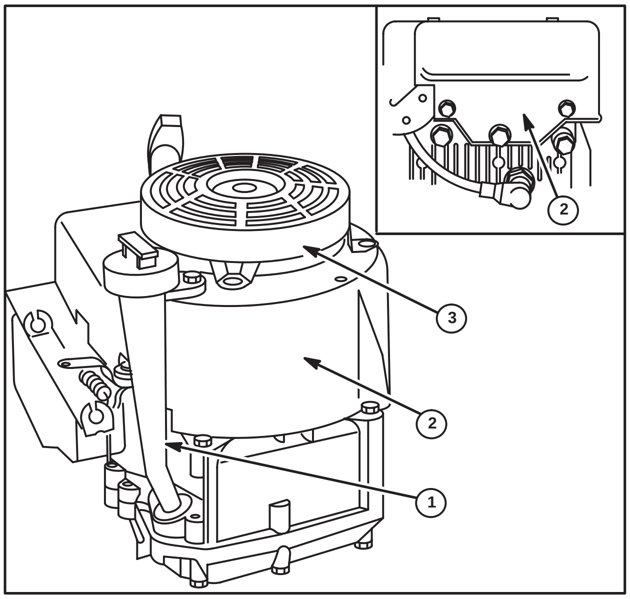

Fig. 41

Remove Rope

1. Pull starter rope out as far as it will go.
2. While holding the pulley and starter housing, pull pulley end of rope out and untie knot at end of rope.
3. Remove rope and handle from starter.
4. Slowly release pulley to release spring tension.
5. Support blower housing on Tool #19227, Cylinder Support (2), and drive out center pin with 5/16” (7.9 mm) dia. pin punch (1), Fig. 42.

   NOTE: On some models it may be necessary to remove the label before center pin can be removed.

6. Remove starter housing (9) from support tool while holding rewind starter retainer and starter housing.
7. Place starter upside down on bench.
8. Lift off retainer (4), by disassembling starter pin (1), steel washer (2), torsion spring (3), dog (6), and dog spring (5). Remove starter pawls and springs.
9. Lift off pulley and spring assembly (8). Note plastic washer on pulley (7), Fig. 43.

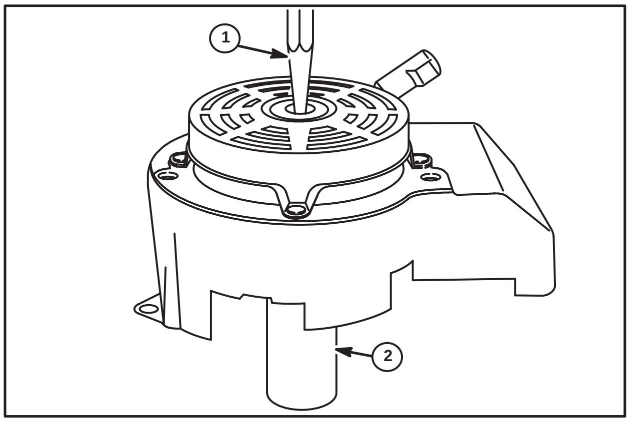

Fig. 42

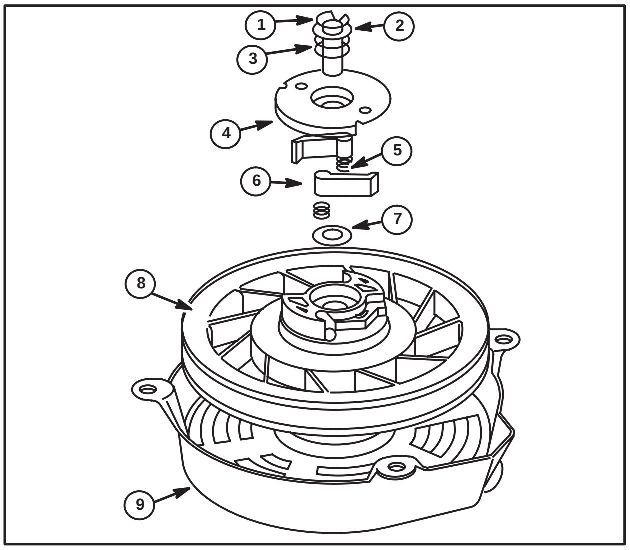

Fig. 43

CAUTION

ALWAYS wear Safety Glasses while performing any rewind starter repair.

- Pulley and spring is serviced as an assembly.
- **DO NOT REMOVE SPRING FROM PULLEY.**
- The starter spring is still under tension after the rope has been removed and the pulley has unwound.

Inspect Rope

1. Inspect rope. Replace if frayed.
2. If re-using old rope, burn ends of rope with a match.
3. Using caution, wipe with waste cloth while it is still hot, to prevent swelling and unravelling.

Inspect Starter Housing and Pulley

Inspect pulley for cracks, rough edges, or burrs in pulley groove (1), wear or cracks in center hole (2) or loose spring retainer (3), Fig. 44. Replace pulley if damaged or worn.

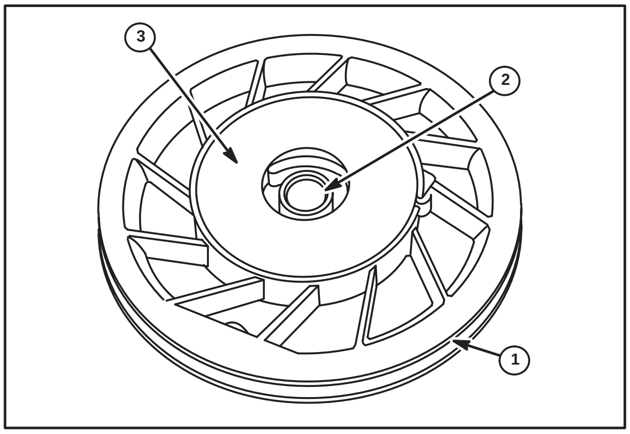

Fig. 44

Inspect starter housing for wear or burrs at rope eyelet (1), center pivot post (2), and at inner spring retainer (3), Fig. 45. Replace if worn.

Assemble Starter Housing and Pulley

1. Note location of free end of spring in pulley assembly (2) and location of spring retainer (1) in starter housing, Fig. 46.
2. Line up free end of spring with spring retainer in housing and assembly pulley in housing.
3. Rotate pulley counterclockwise until spring engages retainer.
4. Install dogs (3) and dog springs (4) in pulley assembly, Fig. 46.
5. Place plastic washer in center of pulley hub.
6. Place retainer on pulley with pierced holes between dogs and stops on pulley, Fig. 46.
7. Place metal washer and brake spring on new starter pin and start pin in center hole.
8. Press or drive pin in until flush with retainer.

Install Rope

1. Wind spring and pulley counterclockwise until spring is tight.
2. Back pulley off until rope eyelet in housing and rope hole in pulley are in line.
3. Install end of rope through eyelet and pulley hole and tie a single overhand knot.
4. Slowly let pulley and spring unwind.

Install Starter on Blower Housing

1. If starter housing was removed from blower housing, use four (4) Part #92987 nuts and four Part #94128 screws to attach rewind starter to blower housing.

Install Blower Housing and Rewind Starter

1. Place blower housing on engine and start one screw in extruded hole.
2. Hold blower housing with extruded hole in recess of cylinder block, Fig. 47.
3. Tighten screw and then install three remaining screws. Install dipstick tube and dipstick.
4. Install fuel tank, finger guard and spark plug wire.
5. Tighten screw and then install three remaining screws. Install dipstick tube and dipstick.
6. Install fuel tank, finger guard and spark plug wire.

CAUTION

ALWAYS wear Safety Glasses while performing any rewind starter repair.

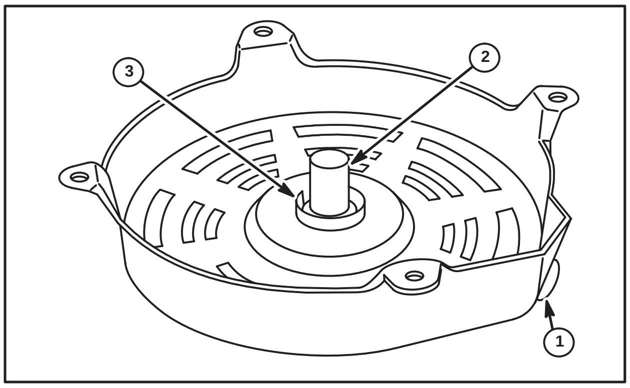

Fig. 45

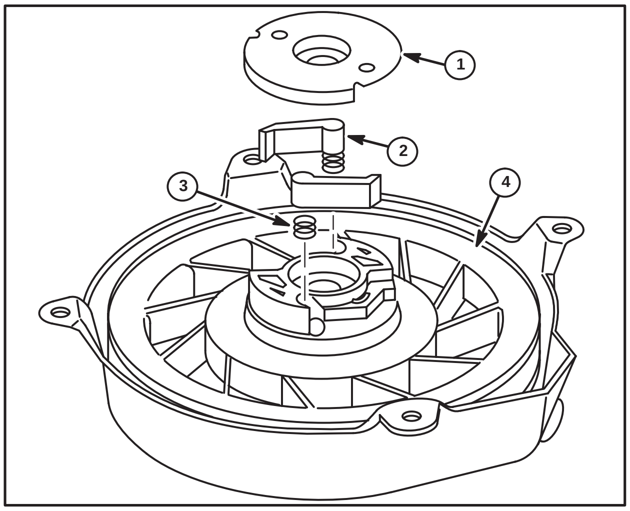

Fig. 46

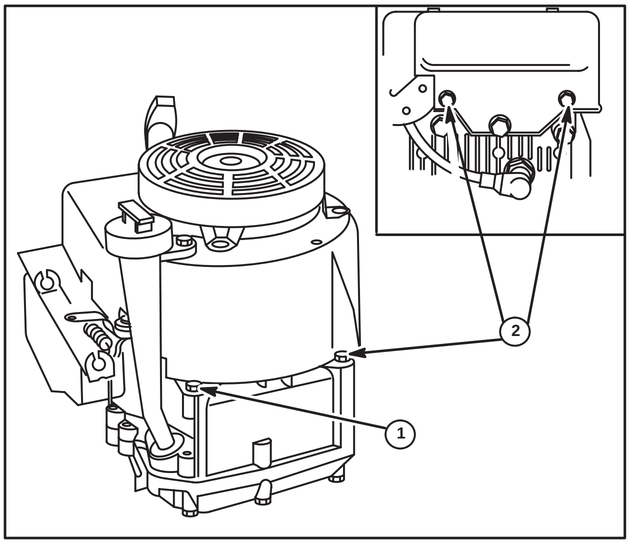

Fig. 47

7A

VERTICAL PULL STARTER

Vertical pull starters have been made in two versions: standard, Fig. 48, and alternate, Fig. 49.

> **NOTE**: Before removing alternate style starter, measure length of rope from starter housing to rope handle at equipment handle bar.

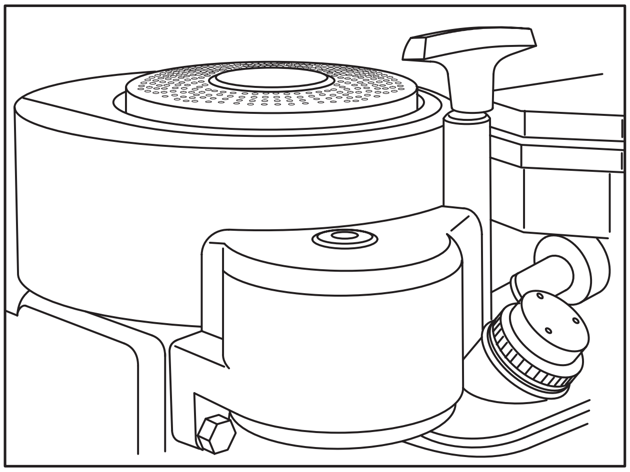

Fig. 48

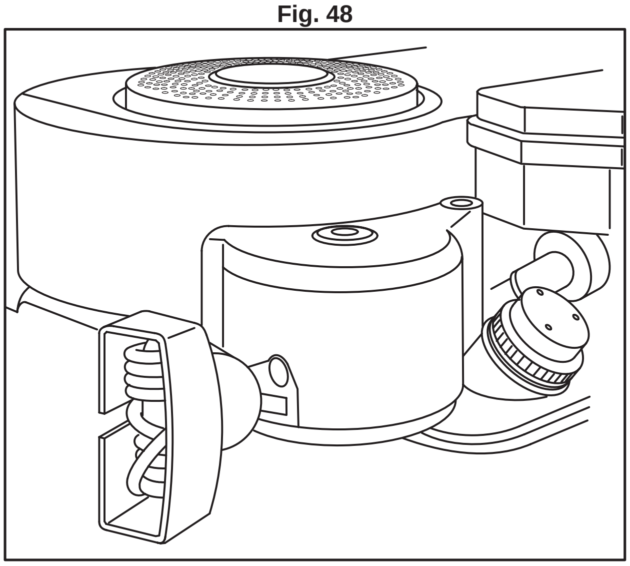

Fig. 49

DISASSEMBLE

Remove Rope or Spring

1. Before servicing starter, all tension must be removed from rope and spring.

CAUTION

DO NOT pull rope with the pulley cover removed, unless the spring is detached from spring anchor.

2. Use a screwdriver to lift the rope up approximately one foot, Fig. 50.
3. Wind rope and pulley counterclockwise 4 turns, as shown in Fig. 50. This will completely release tension from the starter spring.

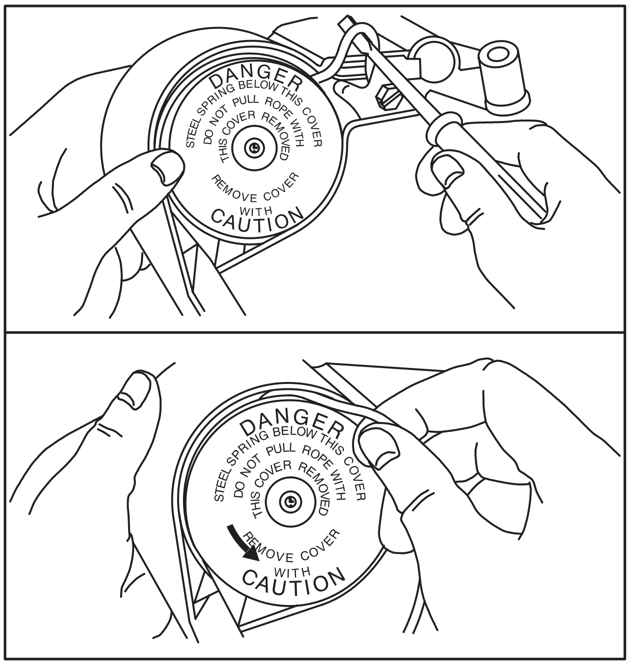

Fig. 50

4. Note the warning on the plastic cover, then use a screwdriver as shown in Fig. 51 to remove the cover.
5. Remove anchor bolt (1) and anchor (2), Fig. 52.
6. Inspect starter spring for kinks or damaged ends. Replace if damaged, carefully removing it from the housing, and installing new spring per assembly text.

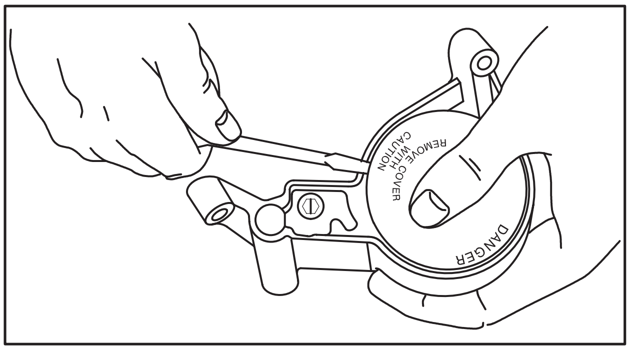

Fig. 51

7. Otherwise, replace cover to keep spring in housing.
8. Remove rope guide and note position of link before removing assembly from housing, Fig. 53.

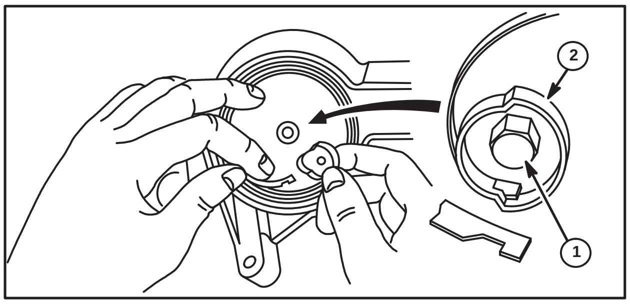

Fig. 52

9. Rope pulley and pin (Inset “A”), when used, may be replaced if worn or damaged. Inset “B” shows alternate style link. Typical link (1), rope guide (2), Fig. 53.

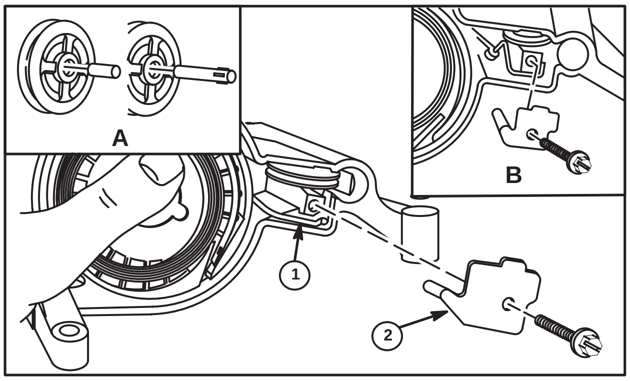

Fig. 53

10. Use a rope inserter tool and/or pliers to remove rope from pulley, Fig. 54, Typical. You can make a rope inserting tool as shown in Fig. 13, page 5.
11. Untie knot and remove rope from pulley.

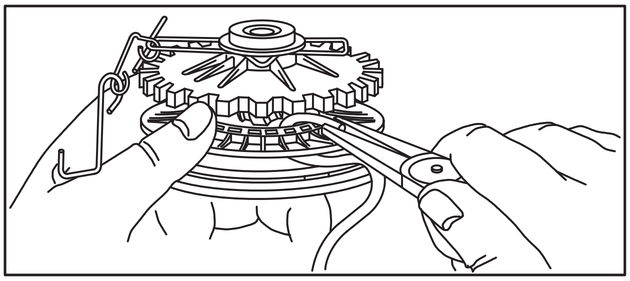

Fig. 54

12. Remove rope from grip by prying out insert (1), Fig. 55.

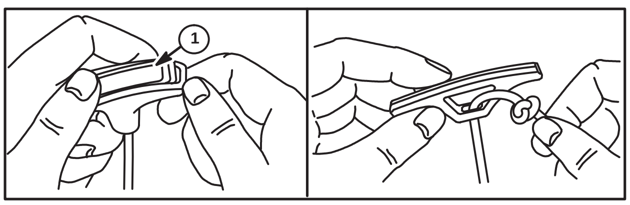

Fig. 55

13. If pulley or gear is damaged, replace with new assembly.

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14. Assemble end of link loop (1) toward gear on link assembly (2). Clean all dirty or oily parts and check link for proper friction. Link should move gear to both extremes of its travel. If not, replace link assembly, Fig. 56.

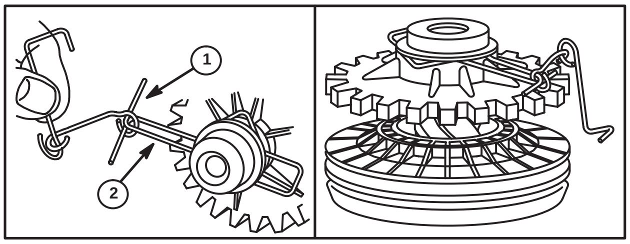

Fig. 56

NOTE: To repair vertical pull starters with INTERLOCK SYSTEM, follow equipment manufacturers' interlock repair procedure.

Assemble

Install Spring

1. Place pulley and gear assembly in starter housing.
2. Hook end of spring into spring retainer on outside diameter of pulley, Fig. 57.
3. Rotate pulley clockwise to wind spring into pulley while holding end of spring in outer spring retainer.

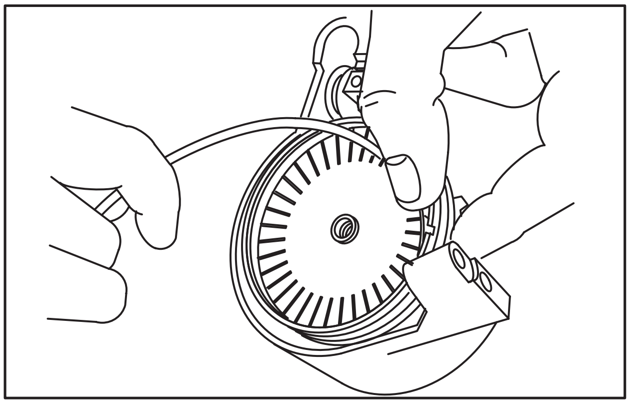
Fig. 57

4. Install spring anchor (1) on free end of spring and install pulley cover, Fig. 58. Do not install anchor screw at this time.

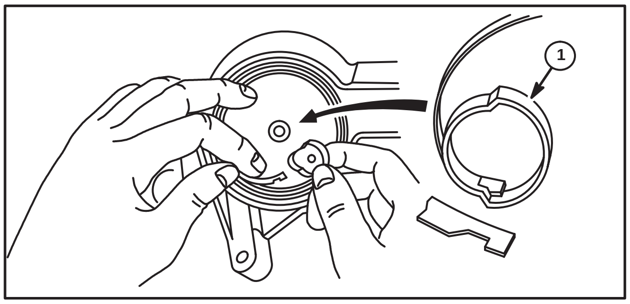

Fig. 58

7A

Install Rope

NOTE: When installing a new rope, check parts list to be sure correct diameter and length rope is used.

1. Insert rope through housing and into pulley, using rope inserter tool.
2. Tie a small knot, heat seal and pull tight into recess in rope pulley. Maximum size shown. Rope must not interfere with gear motion, Fig. 59.

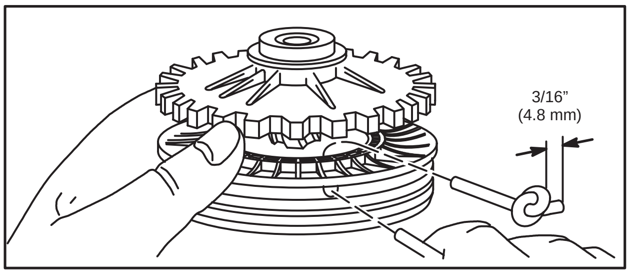

Fig. 59

3. Install pulley and gear assembly in housing, with link (1) in pocket or hole of casting, as shown. Inset “A” shows current style link, “B” shows alternate style.
4. Install small pulley (3), rope pulley pin, and rope guides (2, 4), Fig. 60.
5. Thread rope through grip and into insert.
6. Tie a small, tight knot.
7. Heat seal the knot to prevent loosening.

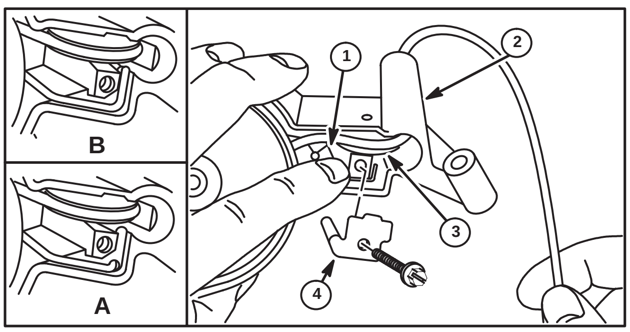

Fig. 60

8. Pull knot into insert pocket and snap insert (1) into grip (2), Fig. 61.

   NOTE: On alternate style starter, measure rope from handle end to guide on starter, the same distance as before it was removed from engine. Tie a slip knot in the rope at this point. DO NOT INSTALL HANDLE AND INSERT AT THIS TIME.

9. Rotate pulley in a counterclockwise direction until rope is fully retrieved, Fig. 62.
10. Remove cover from pulley.
11. If not already done, hook free end of spring to spring anchor, and install screw.

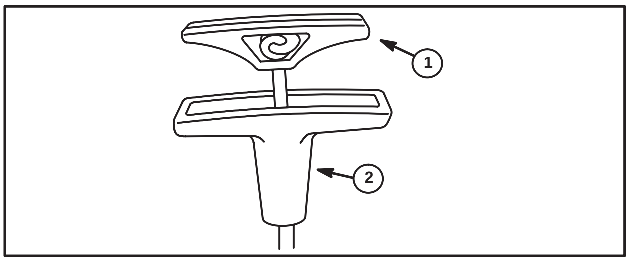

Fig. 61

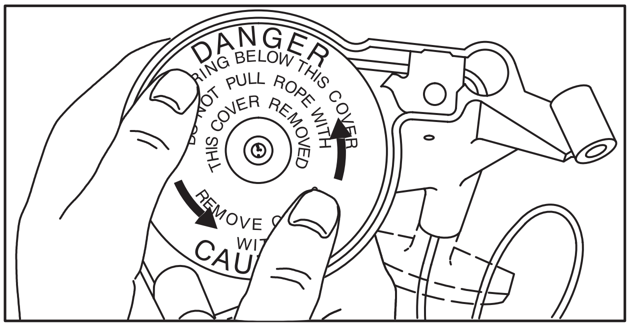

Fig. 62

12. Torque to 75 to 90 in. lbs. (9 to 10 Nm), Fig. 63.
13. Lubricate spring with a small quantity of engine oil or lubricant.
14. Snap cover in place.

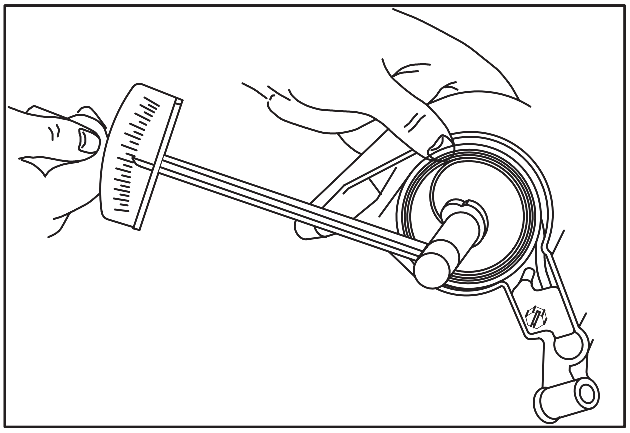

Fig. 63

15. Tension starter spring by pulling rope out approximately one foot, and winding rope and pulley 2 or 3 turns clockwise, Fig. 64.
16. Install starter on engine.
17. After installing alternate style starter on engine, route rope up to equipment control handle and install handle and insert, Fig. 61.

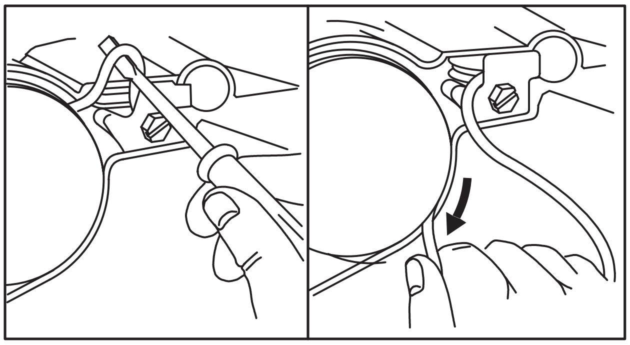

Fig. 64

7A

TABLE No. 1

Rewind Starter Rope Length					
Model Series	Rewind Position	Rope Size	Starter Pawls	Length	
				Inches	Meters
90100	ALL	#6	Plastic	67	1.7
90200	ALL	#4	Metal	88–5/8	2.25
91200	ALL	#4	Plastic	88–5/8	2.25
92200	6 o'clock	#4	Metal	100	2.54
93200	9 o'clock	#4	Metal	68	1.7
93400	9 o'clock	#4	Metal	68	1.7
9B900	ALL	#4	Metal or Plastic	88–5/8	2.25
9D900	ALL	#4	Metal	88–5/8	2.25
98900	ALL	#6	Plastic	67	1.7
10A900	ALL	#4	Metal	88–5/8	2.25
10B900	ALL	#5-1/2	Metal	72	1.8
10C900	ALL	#6	Metal or Plastic	78–3/4	2.0
120000	ALL	#6	Metal	72 or 99	1.8 or 2.5

7A

SECTION 7B
Electric Starter Systems

Section Contents

7B

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

Section Contents, Cont'd.

7B

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

EQUIPMENT AND TOOLS TO TEST STARTER MOTORS

Digital Multimeter (DMM)

Available from Briggs & Stratton. Order Tool #19464. The meter may be used to read volts, ohms or amperes, and test diodes (rectifiers), Fig. 1.

Volt, Ohm, Ammeter (VOA Meter)

Not shown. Similar usage as DMM.

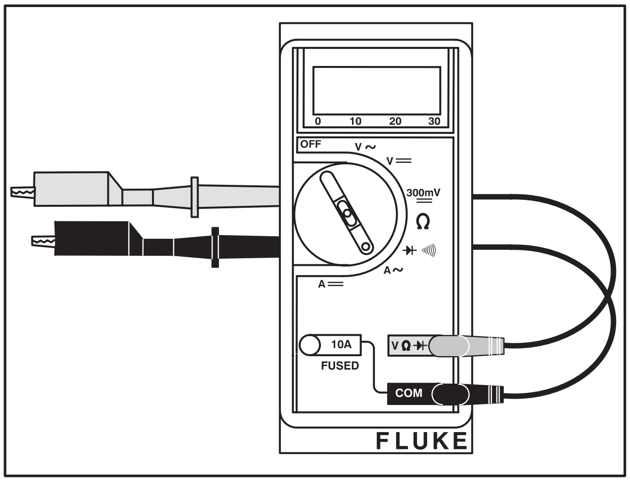

Fig. 1

DC Shunt

Use with Digital Multimeter. The DC Shunt may be used to read starter motor current draw on 12 volt starter motors. Order as Tool #19359, Fig. 2.

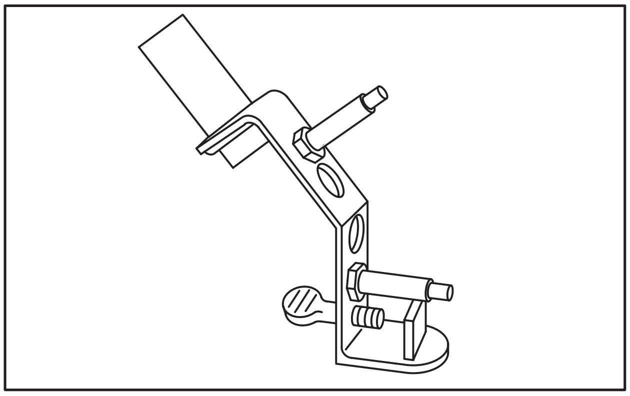

Fig. 2

AC Shunt

Use with Digital Multimeter. The AC Shunt may be used to read starter motor current draw on 120 volt starter motors. Order as Tool #19358, Fig. 3.

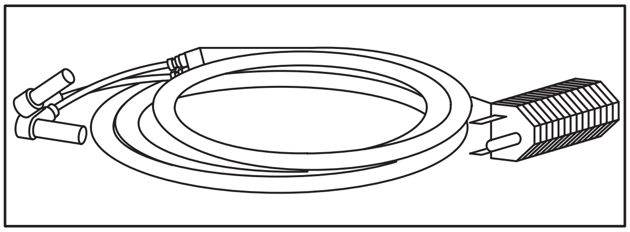

Fig. 3

Tachometer

A Trysit Sirometer (Tachometer) is available from a Briggs & Stratton source of supply. Order Part #19200. The Sirometer measures from 800 to 25,000 revolutions per minute (RPM), Fig. 4.

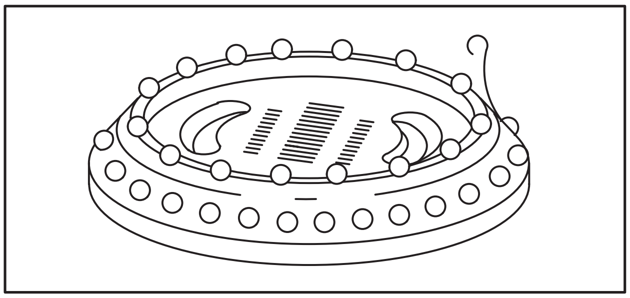

Fig. 4

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

Test Fixture

A starter motor test fixture may be made of steel 1/4" (6.0 mm) thick as shown in Fig. 5. Extra hole for mounting starter brackets (1), two 3/8" (9.5 mm) holes for starter mounting bracket (2), two #7 tap holes for 1/4–20 NC screws for mounting B&S #19200 Tachometer (3), Fig. 5.

A known good 6 volt or 12 volt battery is required when testing 6 or 12 volt starting systems.

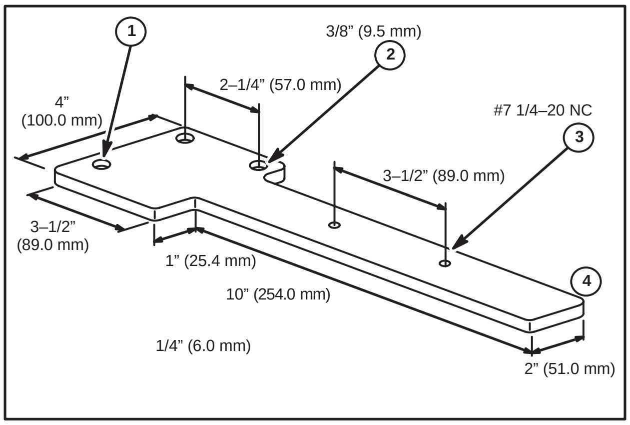

Fig. 5

Brush Retainers

Brush retainers may be made from scrap pieces of rewind starter spring as shown in Fig. 6. Select the retainer required.

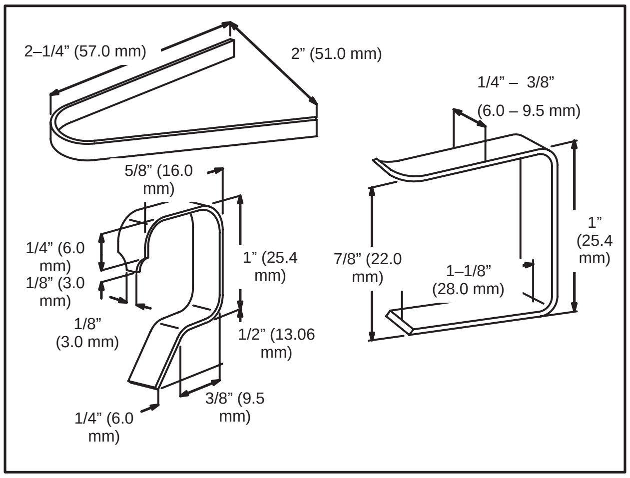

Fig. 6

7B

General Information on Batteries

This section describes the different types of electric starter motors used on the engines covered in this manual. The starters are powered by either 6V DC batteries, 12V DC batteries or 120V AC household current. 12V systems are either lead-acid wet cell or Nickel-Cadmium. Special battery, charger and test procedures are covered by starter/system type.

The battery used to operate starter motors on most Briggs & Stratton engines above 4 horsepower is the 12 volt, lead acid – wet cell type. This type is available as a maintenance free or dry charged battery.

The maintenance-free battery is sealed and the level of electrolyte cannot be checked.

The dry charge battery is manufactured with fully charged plates. Electrolyte must be added when the battery is placed in service. Before activating a dry charge battery, read and follow the manufacturer's recommended procedure.

Battery Recommendations

These battery size recommendations are based on minimum temperature expected and correct weight of oil being used. See Section 8.

30 Amp. Hr. +20° F (-6.6° C) or higher
40 Amp. Hr. –5° F (-20.5° C) or higher
50 Amp. Hr. –15° F (-26.1° C) or higher

Battery Cable Recommendations

These cable sizes are based on total length of cable from battery positive post to starter switch or solenoid, and to starter plus ground return to battery negative post.

#6 AWG – 4 ft. (1.2 M) or less
#5 AWG – 5 ft. (1.5 M) or less
#4 AWG – 6 ft. (1.8 M) or less

NOTE: A battery of higher amperage may be required for extremely cold weather starting conditions.

WARNING

Batteries produce hydrogen, an explosive gas.

DO NOT store, charge or use a battery near an open flame or devices which utilize a pilot light or can create a spark.

Batteries contain corrosive fluids and toxic materials and should be handled with care.

- Do not puncture, disassemble, mutilate or incinerate.
- As with all rechargeable batteries, explosive gases could be vented during charge or discharge. Use in a well ventilated area, away from sources of ignition.
- Battery should be recharged by adults only.
- Use only the battery charger specified. Do not make direct contact between the positive and negative terminals as this could cause high current flow, and the possibility of fire.

Checking Battery

1. Physical check – clean if necessary.
   a. Corrosion
   b. Dirt
   c. Terminal and clamps (secure/good condition)
2. Bring battery to full charge.

CAUTION:

DO NOT exceed charge rate of 1/10 ampere for every ampere of battery rating. Consult battery manufacturer for charging recommendations.

   a. Use a taper charger (automatically reduces charge rate). Check all cells after charging (1). Use a temperature compensated hydrometer.
   b. Fill battery cells with distilled water or tap water (unless maintenance free type).

   NOTE: If battery gets “Hot” to the touch or is spitting acid (gassing) excessively, unplug charger periodically.

3. With battery fully charged, check specific gravity readings of each cell (1) with a Battery Hydrometer and record readings, Fig. 7. All readings should be above 1.250 (compensating for temperature). If specific gravity readings varied .050 or if ALL cells read less than 1.225, replace battery.

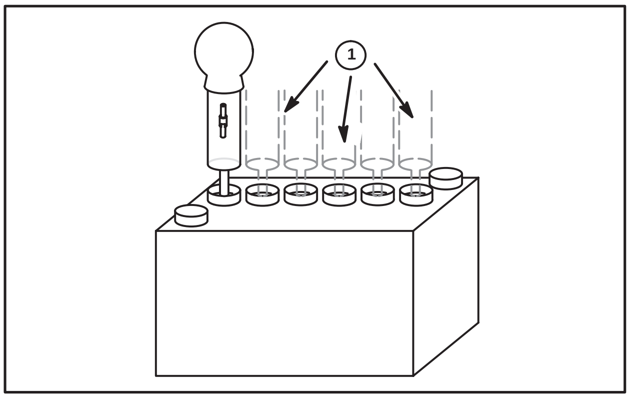

Fig. 7

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

7B

Installation:

1. Before installing battery, connect all equipment to be operated.
2. Place battery in holder with a flat base. Tighten hold down device evenly until snug. DO NOT over-tighten.
3. Connect positive cable first to prevent accidental grounding. Tighten connectors securely.
4. Connect negative cable to negative battery terminal. Tighten connectors securely.
5. Use DMM (#19464) or VOA Meter.
6. Attach RED meter test clip to positive (+) battery terminal.
7. Attach BLACK meter test lead to negative (-) battery terminal.
8. With ignition switch "OFF," press starter button.

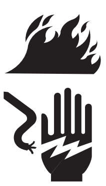
   NOTE: If ignition switch and starter switch are combined, disconnect wire from spark plug and ground ignition using Ignition Tester, Tool #19051 or #19368.

9. Turn switch to "START." Meter should display 9 volts or more while cranking engine. If less than 9 volts, replace battery.

Power Cords, 120 Volt Starting Systems

The 120 volt electric starter is equipped with a three-prong safety plug. The longer prong in this plug is connected to the starter motor housing. When the supplied three-wire cord is plugged into a properly grounded receptacle, it will protect the user from shock should the starter-motor insulation fail. If an extension cord is used, it should also be a three-wire safety cord. **DO NOT USE** extension cords longer than 25 feet (7.6 m).

Troubleshooting 6, 12, and 120 Volt Starting Systems



WARNING

Unintentional sparking can result in fire or electric shock.

- IMPROPER TROUBLESHOOTING of electrical systems can lead to electric shock.

The following list is given to aid in diagnosing problems for 6, 12, and 120 volt starting systems.

NOTE: If a starting problem is encountered, check engine for freedom of rotation by removing the spark plug and turning the crankshaft over by hand.

1. Cranks Engine Slowly

a. Additional load affecting performance.
b. Discharged, defective, or incorrect size battery (also, see alternators).
c. Faulty electrical connection (battery circuit).
d. Dirty or worn starter motor commutator, bearing, weak magnets, etc.
e. Worn brushes or weak brush springs.
f. Wrong engine oil viscosity for ambient temperature.
g. Defective starter clutch.
h. Band brake misadjusted.
i. Battery leads too long or wire diameter too small.
j. Extension cord longer than 25 feet (7.6 m) (120 volt AC only).

2. Engine Will Not Crank

a. Faulty safety interlocks.
b. Discharged or defective battery.
c. Faulty electrical connections.
d. Faulty starter motor switch (open circuit).
e. Open circuit in starter motor.
f. Defective rectifier assembly (120 Volt AC only).
g. Brushes sticking, etc.
h. Faulty solenoid.
i. Power source inoperative (120 Volt AC only).

3. Starter Motor Spins; But Does Not Crank Engine

a. Sticking pinion gear.
b. Damaged pinion or ring gear.
c. Starter motor clutch slipping.
d. Incorrect rotation due to reversed polarity (all motors rotate counterclockwise viewed from pinion gear).

4. Starter Motor Blows Fuses – (120 Volt Starter Motor Only)

a. Parasitic load.
b. Shorted rectifier assembly.
c. Shorted 120 volt extension cord to starter motor.
d. Armature shorted.
e. Overloaded circuit.

5. Starter Motor Spins; Will Not Stop

a. Defective starter switch.
b. Defective starter solenoid.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

STARTER ELECTRICAL INFORMATION AND TEST PROCEDURES, BY SYSTEM

Note: Interpreting Starter Motor Test Results, All Systems (Typical)

1. RPM below minimum and higher than normal amps.

System 3®, System 4®

Briggs & Stratton System 3® and System 4® consist of a starter motor (4), starter switch and/or starter solenoid (5), wiring harness, (wire #6 goes to engine alternator), 6 or 12 volt battery (rechargeable) (3), alternator, and separate trickle type battery charger (2). A typical System 3® or System 4® engine is shown in Fig. 8.

NOTE: Some equipment manufacturers use a battery and trickle charger of a different style than illustrated. In such cases, follow the equipment manufacturer's recommendations.

The alternator maintains charge during operation. If the battery needs additional recharging, plug the trickle charger into a 120 volt AC household outlet, then connect to the battery. The battery will be fully charged within 72 hours. Charging is not recommended if temperatures are below 40° F (4.0° C). For best results, charge the battery within temperature limits of 40° F (4.0° C) to 105° F (40.0° C). Charge overnight every two months during periods of storage.

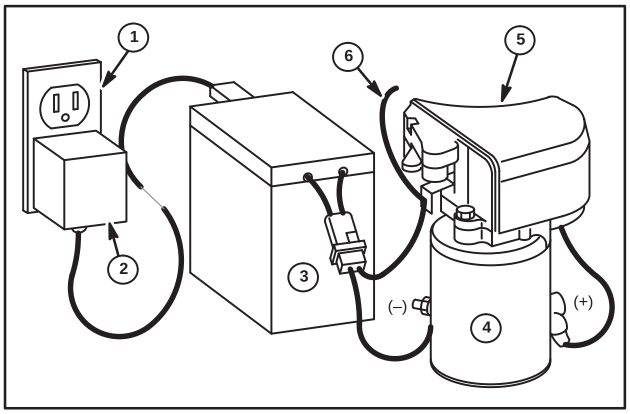


Fig. 8

Battery Load Test (6 volt only)

For 12 volt test procedures, contact the battery manufacturer or the original equipment manufacturer.

Parts required:

14 AWG stranded wire test leads with #70 alligator clips, red (1), and black (2).

Resistor (3) – 0.15 ohms x 240 watts (minimum).

DMM (#19464) or VOA Meter.

Briggs & Stratton Part #396372 wire harness.

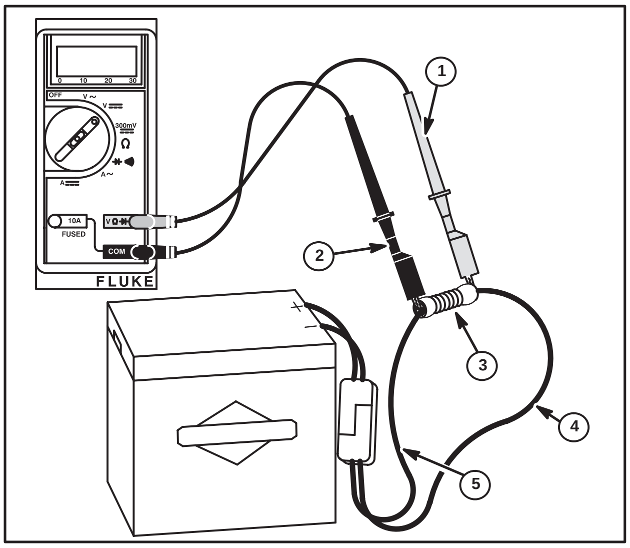


Fig. 9

Set meter to DC volts as shown in Fig. 9.

a. Excessive Friction. Check for tight, dirty, or worn bearings, bent armature, misalignment of motor bearings.
b. Shorted armature.
c. Grounded armature.
d. Broken magnets.

2. Higher than normal amps and starter does not turn.
   a. Direct ground of brush leads.
   b. Armature can not turn, binding.
3. Starter does not turn and no amps.
   a. Open armature windings.
4. RPM below minimum and low amps.
   a. Open armature windings.
   b. Burned commutator bars.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

5. Place red wire (4) from Harness Wire Terminal #396392 on one resistor lead and use alligator clip on RED test lead wire from meter to hold it in place.
6. Place black wire (5) from Harness Wire Terminal on resistor lead opposite from red wires and use alligator clip on BLACK test lead wire from meter to hold it in place.

WARNING

The resistor will become hot during this test procedure.

Severe thermal burns can occur on contact.

7. Assemble connector from wire harness to battery. After one minute, battery should read 5.5 volts DC, minimum.
8. If after one minute, test voltage reads less than 5.5 volts DC, charge battery as described in “Battery – Fast Charge.” (Battery may also be charged 72 hours with trickle charger.)
9. Remove battery from charger and allow to normalize for two hours.
10. Retest battery.

NOTE: A meter reading of 4.5 volts DC or less after charging and retest indicates a failed battery cell. Replace battery.

A fully charged battery will have a minimum NO-LOAD reading of 6.4 volts DC. During normal operation, the alternator will keep the battery charged. During storage, the battery should be recharged 72 hours every two months using Part #395569 or #395585 trickle charger.

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Fast Charge Battery – 6 Volt Charger

1. Attach red (1) positive charger lead to positive battery connector terminal, Fig. 10.
2. Attach black (2) negative charger lead to negative battery connector terminal.
3. Charge battery at a rate not to exceed 1 ampere for 12 hours.

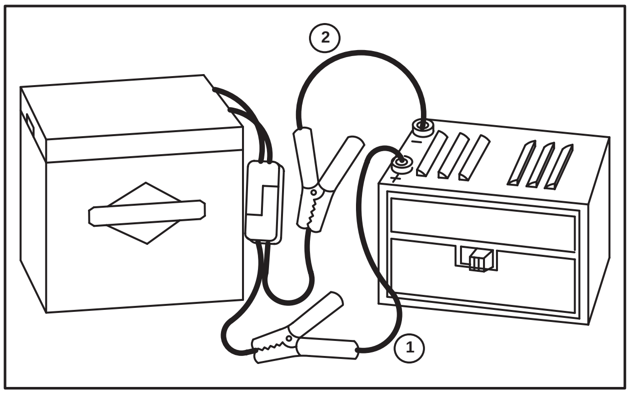

Fig. 10

Fast Charge Battery – 12 Volt Charger

1. Attach positive charger lead (1) to a #4001 sealed beam headlight terminal as shown in Fig. 11.
2. Connect alligator clips of test lead from other terminal of headlight to positive terminal of battery connector (2).
3. Attach negative charger lead to negative battery connector terminal (3).
4. Attach harness to battery connector (4). Charge battery at a rate not to exceed 1 ampere for 12 hours.

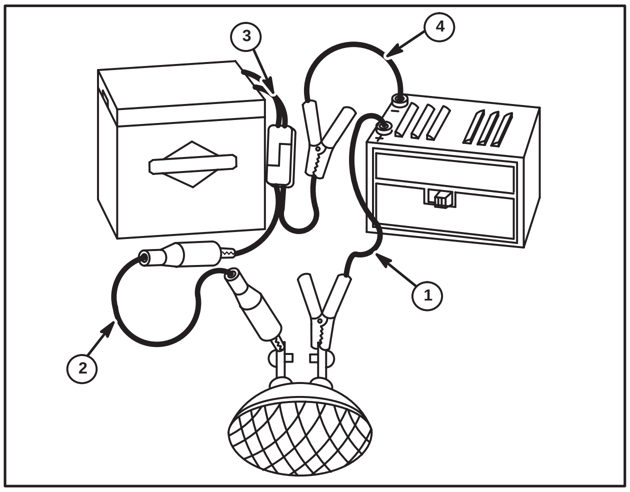

Fig. 11

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

Starter Switch Test

1. Set DMM or VOA meter to “Diode Test” position. In ths position the meter will emit a continuous tone, indicating continuity (complete circuit). No continuity (incomplete circuit) is displayed as “OL” and no tone will be heard.
2. Set meter to Ohms position and set selector to Rx1 scale, when required.
3. Zero the meter.
4. Test switch as shown in Fig. 12. With switch lever in “RUN” (A) or “STOP” (brake) (B) position, there should be NO continuity.
5. Place lever (1) in “START” position. Meter should indicate a continuity reading.
6. If there is NO continuity in “START” position, the wire and brush assembly (1) may be serviced as shown in Figs. 13 and 14, by removing 3 screws (2) and the switch cover assembly.

Fig. 14
Braided wire (fuse) (3)
Spring (4)
Brush (5)
Switch lever (6)
Brush retainer (7)
Top (8)

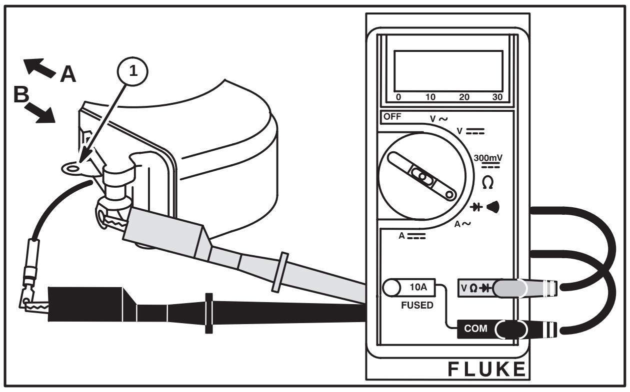

Fig. 12

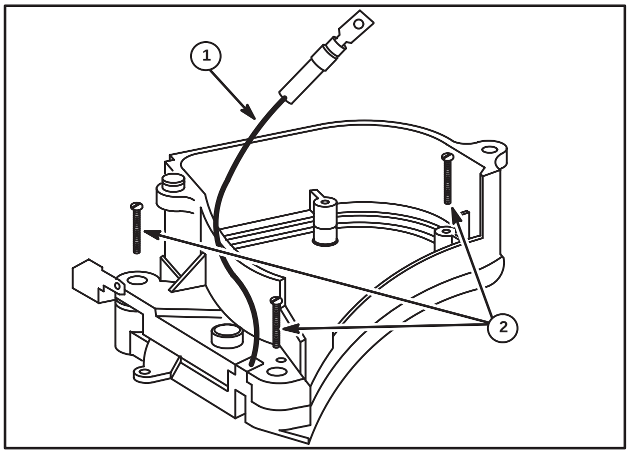

Fig. 13

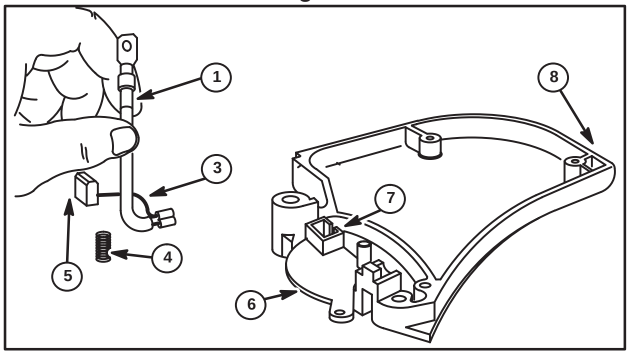

Fig. 14

Test Interlock Switch Model Series 120000

1. Disconnect interlock switch wires from spade terminals on switch.
2. Set meter to read Ω ohms.
3. Connect meter test leads or continuity light to two spade terminals of switch, Fig. 15. Light should not be on or meter should read no continuity.
4. Push switch lever in until switch clicks. The light should be on and the meter should read low resistance.

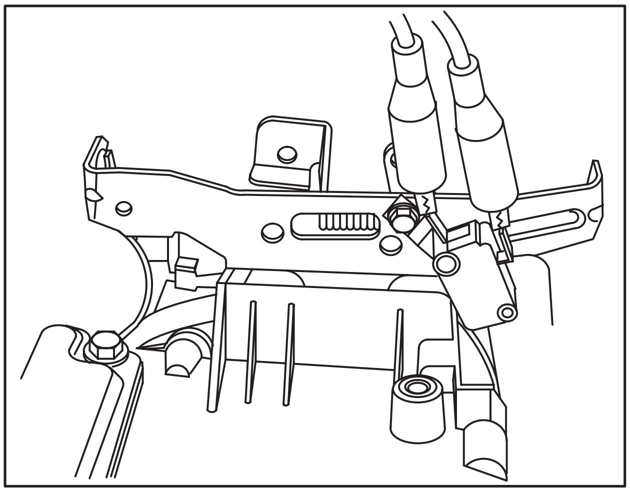
Fig. 15

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

7B

Test Interlock Switch Wiring
Model Series 120000

1. Disconnect interlock switch wires from spade terminals on switch and at starter motor connector.
2. Set meter to read Ω ohms.
3. Connect one meter test lead to end of one wire inside connector and other test lead to second connector terminal for the same wire. Light should be on or meter should read low or no resistance. Wiggle wire inside connector. Light should stay constant or meter should not change value. Replace or repair wiring if there is no continuity or intermittent. Repeat for each wire in harness.

NOTE: Some equipment manufacturers provide a key operated ignition switch. For servicing, contact equipment manufacturer.

Test 6 or 12 Volt Starter Motor

Tools, Procedure

DMM (#19464)

Tachometer capable of reading 10,000 RPM.

Fully charged 6 or 12 volt battery.

See Table No. 2, Specifications.

Fig. 16 – Starter motor exploded view:
Roll pin (1)
Clutch retainer assembly (2)
Pinion gear (3)
Helix and drive assembly (4)
Thrust washer (5)
Spring washer (6)
Drive end cap (7)
Armature (8)
Thru bolts (9)
Housing (10)
Seam (11)
End cap (12)

1. Set the meter to read DC amps.
2. Connect the starter motor, battery and meter, Fig. 17.
3. Place the tachometer on the starter motor and activate the motor.

If the motor does not perform satisfactorily, see Interpreting Starter Motor Test Results, P. 7.

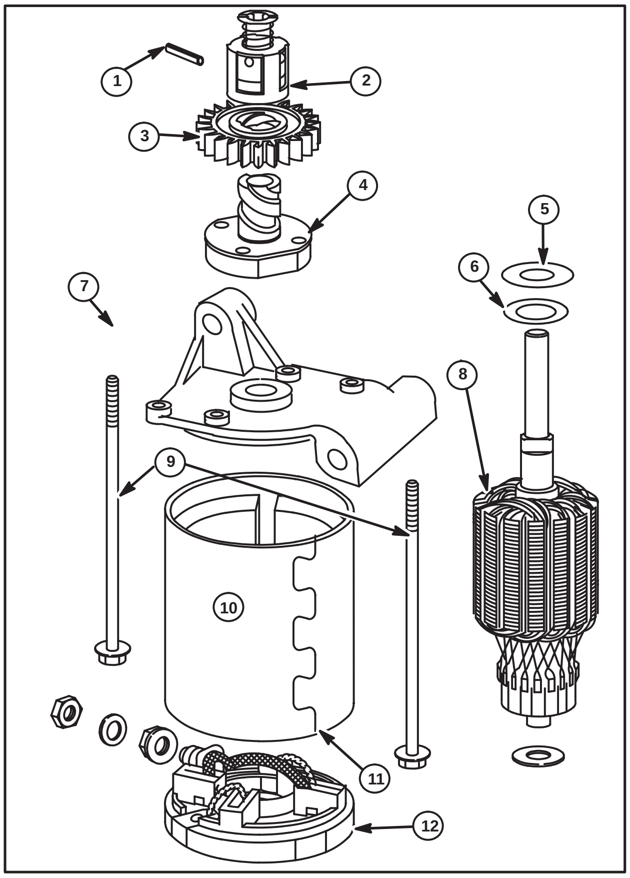

Fig. 16

12 Volt DC Starter Motor
Nylon Pinion
Model Series 130000

Test

Tools, Procedure

DC Shunt, Tool #19359 and DMM (#19464) or VOA Meter.

Tachometer capable of reading 10,000 RPM.

Fully charged 12 volt battery.

See Table No. 3 (Nylon Pinion), Specifications.

1. Connect the starter motor, battery and meter as shown in Fig. 17.
2. Activate the starter motor and note readings of meter (Amps DC) and tachometer (RPM). If the motor does not perform satisfactorily, see Interpreting Starter Motor Test Results on page 7, Fig. 17.

Fig. 17:
Optional starter switch (1)
Test fixture from P. 4 (2)
Black lead (3)
Red lead (4)
DC shunt terminal (5)
12 volt battery (6)

120 Volt AC Starter Motor, Steel Drive Pinion MODEL SERIES 130000 Test

Tools, Procedure

DMM (#19464) with AC Shunt, Tool #19358

Tachometer capable of reading 10,000 RPM.

See Table No. 5, page 41, Specifications, for maximum allowable amperage.

WARNING

Unintentional sparking can result in fire or electric shock.

- Extreme care should be used in making this test to minimize the hazard of electrical shock.

1. Clamp the starter motor in a vise as shown in Fig. 18. Sirometer (1), AC Shunt Tool #19358 (2).
2. Set meter to AC amps.
3. Insert leads into meter and plug starter motor cord into AC adapter.
4. Connect AC adapter to a 120 volt outlet.
5. Depress starter switch button. When meter reading stabilizes (approximately 3 seconds), amperage should not exceed the specification shown.

CAUTION:

If amperage is higher than specification shown, immediately stop the test! An amperage reading higher than number in chart indicates a shorted starter motor, which could be dangerous.

6. If amperage is within specification, check RPM of starter motor using tachometer.

NOTE: If the 120 volt AC starter motor does not meet the specifications listed, the motor must be replaced.

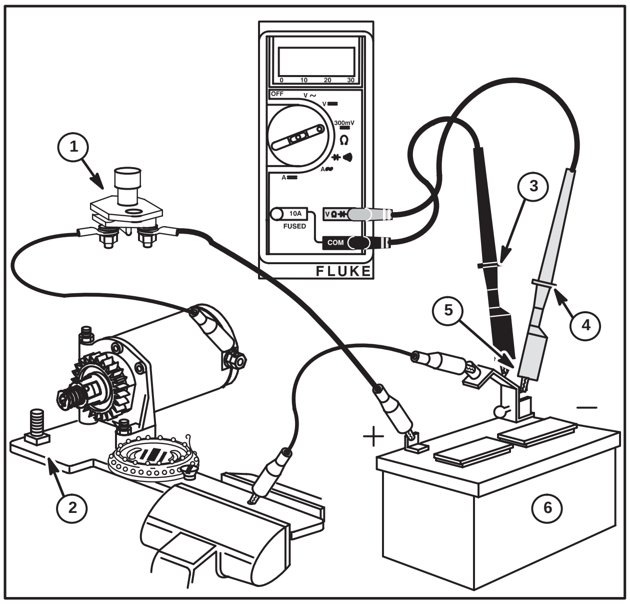

Fig. 17

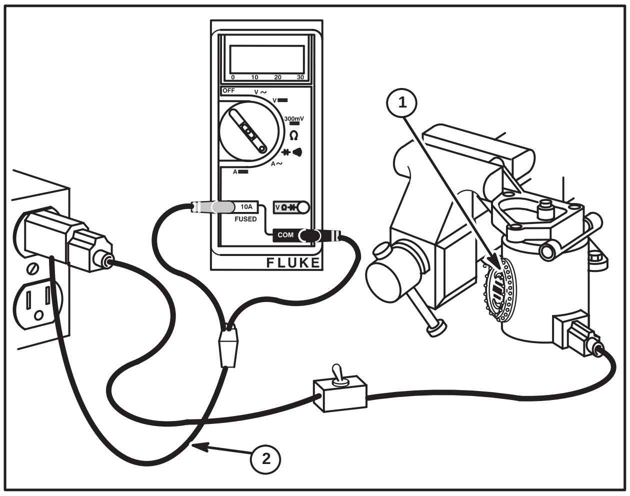

Fig. 18

7B

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

Briggs & Stratton Starter Motors

120 Volt AC; 12 Volt DC with Housings 3–1/16” (78.0 mm) to 4–9/16” (115.9 mm) long
Model Series 170000, 190000, 220000, 240000, 250000, 280000 and 320000

See Figs. 19 and 20, and Tables No. 6 and 7, Specifications, for motor identification and performance standards. Motor identification code shown (1), Fig. 20.

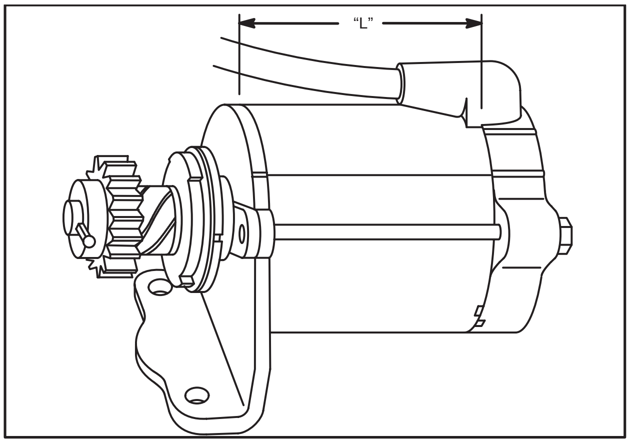

Fig. 19

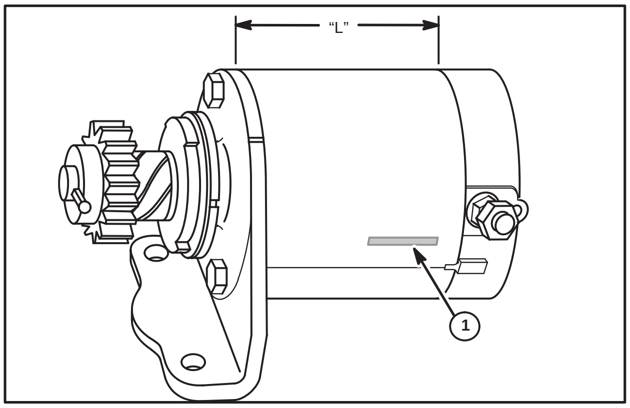

Fig. 20

12 Volt DC Starter Motor Test Starter Motor

Tools, Procedure

DMM (#19464) and Tool #19359, DC Shunt.

Tachometer capable of reading 10,000 RPM.

Fully charged 12 volt battery.

See Table No. 3 (Nylon Pinion) or Table No. 4 (Steel Pinion), Specifications.

1. Connect the starter motor, battery and meter as shown in Fig. 17.
2. Activate the starter motor and note readings of meter (Amps DC) and tachometer (RPM). If the motor does not perform satisfactorily, see Interpreting Starter Motor Test Results page.

Test 120 Volt AC Starter Motor

WARNING

Unintentional sparking can result in fire or electric shock.

- After servicing, the 120 volt starter motor should be Hi-Pot tested by an electric motor repair shop before reinstalling on engine to determine if a shock hazard exists.

See Fig. 5 to make a starter mounting test fixture.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

Tools, Procedure

DMM (#19464) with AC Shunt, Tool #19358.

Tachometer capable of reading 10,000 RPM.

See Table No. 8, Specifications, for maximum allowable amperage.

WARNING

Unintentional sparking can result in fire or electric shock.

- The following test procedure must be used to avoid any accidental shock hazard to the service technician.

1. Set meter to AC amps position.
2. Insert leads into meter and plug starter motor cord into AC shunt, Fig. 21.

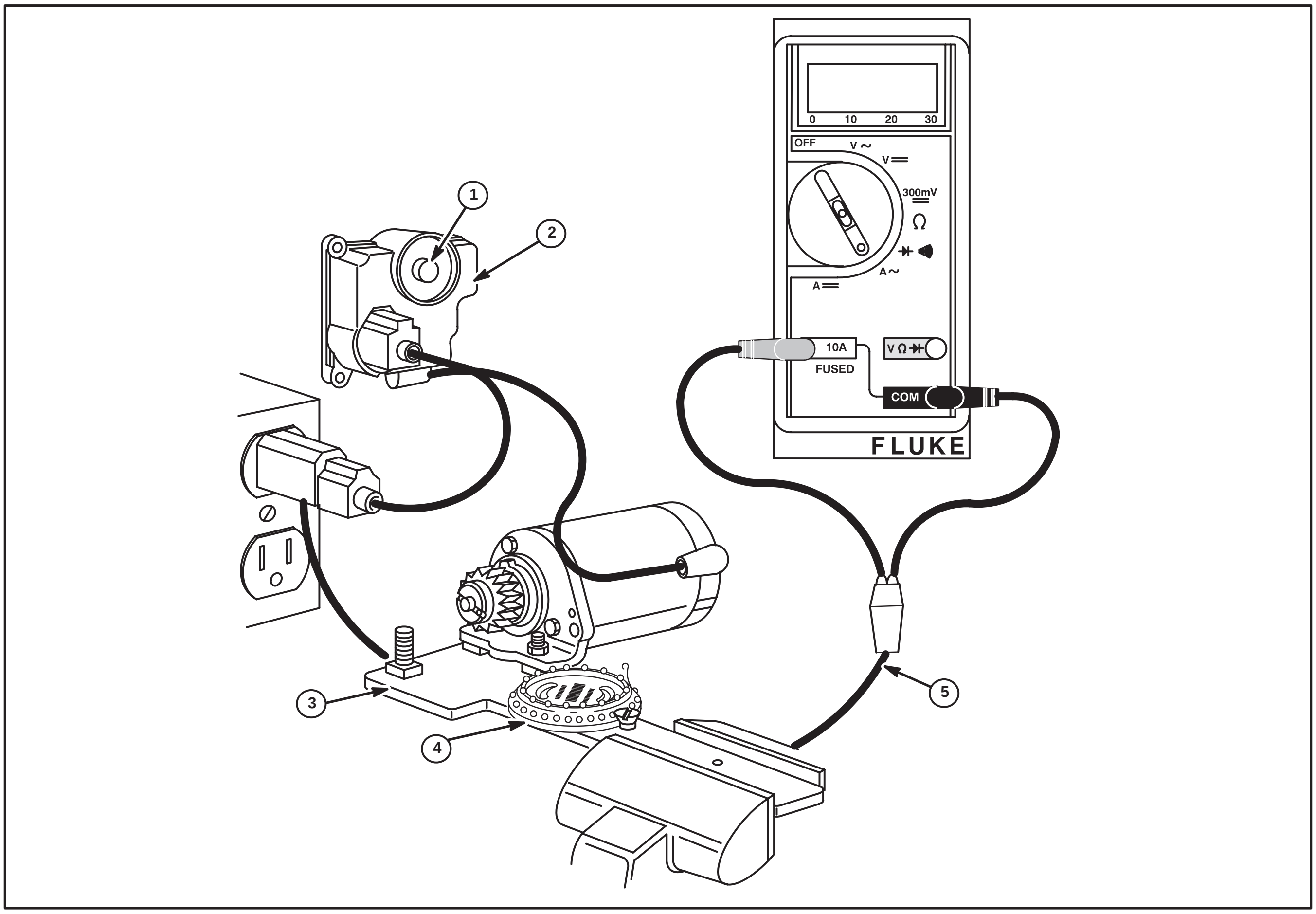

Fig. 21

3. Connect AC shunt (5) to a 120 volt outlet.
4. Depress starter switch button (1) on control box (2). When meter reading stabilizes, (approximately 3 seconds), amperage should not exceed the specification shown.
5. If starter motor amperage is within specification, check RPM with Tachometer. Test fixture.

CAUTION:

If amperage is higher than specification shown, immediately stop the test! An amperage reading higher than number in chart indicates a shorted starter motor, which could be dangerous.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

Testing Rectifier Control Assembly
Briggs & Stratton 120 Volt Starter Motor

The AC control assembly housing contains a spring loaded starter button, cord assembly and rectifier. It is equipped with a three wire grounded receptacle. Fig. 22.

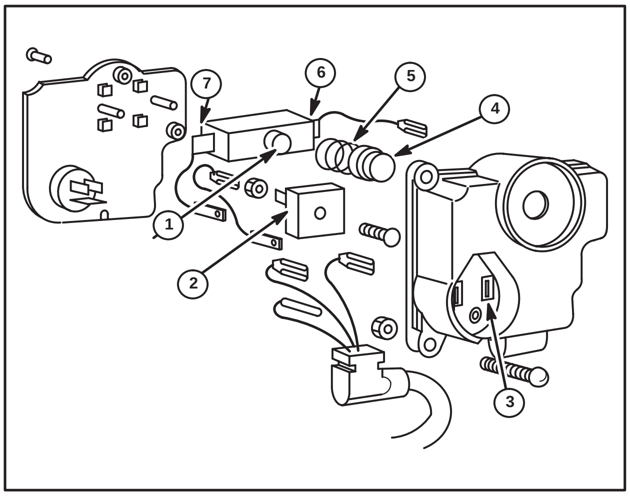

Fig. 22

Disassemble Control Assembly

WARNING

Unintentional sparking can result in fire or electric shock.

- Disconnect extension cord from AC outlet and control assembly before disassembling.

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1. With control assembly removed from mounting surface, remove three screws holding back plate to housing.
2. Note position of wires, Figs. 22 and 23.

Fig. 22, Exploded View:
Push button switch (1)
Rectifier block (2)
Slots for AC spade terminals (3)
Starter button (4)
Return spring (5)
Common side (6)
Normally open (N.O.) side (7)

Fig. 23, Wiring Diagram:
AC spade terminals (1)
Green wire (ground) (2)
Wire harness to starter motor (3)
Attach black wire to positive corner of block (4)
Short black wire (5)
Add white wire to remaining terminal marked "–" (6)
N.O. side of switch (7)
Common side of switch (8)
AC red lead (9)
AC marked on rectifier block (10)

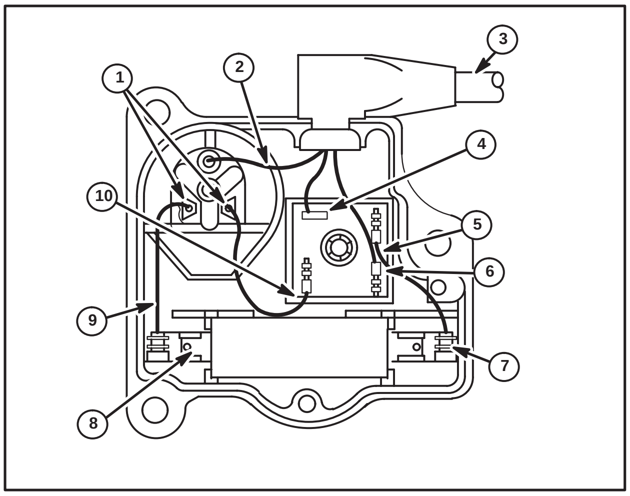

Fig. 23

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

Test Rectifier (Shorts or Opens)

1. Remove all wires from rectifier before checking.
2. Use DMM (#19464) or VOA Meter.
3. Set meter to “Diode Test.”
4. Using test leads, place RED test lead and BLACK test lead on rectifier terminals in sequence shown in Fig. 24, and TABLE NO. 8, Specifications.
5. If test results differ from those shown, the rectifier is defective and must be replaced.

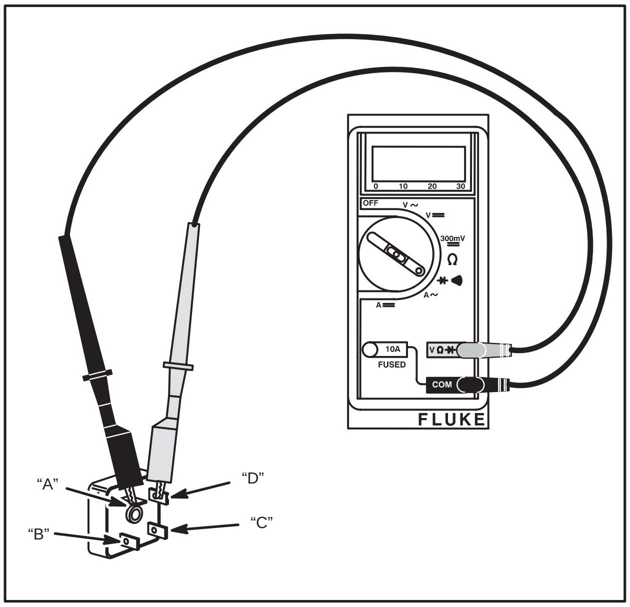

Fig. 24

Test Rectifier (Grounded)

1. Leave DMM in Diode Test position.
2. With BLACK meter test lead contacting metal rectifier case, touch RED meter test lead to each rectifier terminal.
3. Meter should display “OL” at each terminal. If meter makes a continuous tone when any terminal is contacted, the rectifier is grounded and must be replaced.
4. Set VOA meter to Ohms Position.
5. With one lead contacting metal rectifier case, touch other lead to each rectifier terminal. There should be no continuity from any terminal to case.
6. Replace rectifier if grounded.
7. To replace rectifier assembly, remove retainer spring washer (1).

   NOTE: If rectifier post should break, remove post (2) and drill a 3/16” (5.0 mm) diameter hole in post location (3).

8. Locate nut on inside of switch box. Attach rectifier with plastic screw and nut (4). Assemble as shown in Fig. 26.

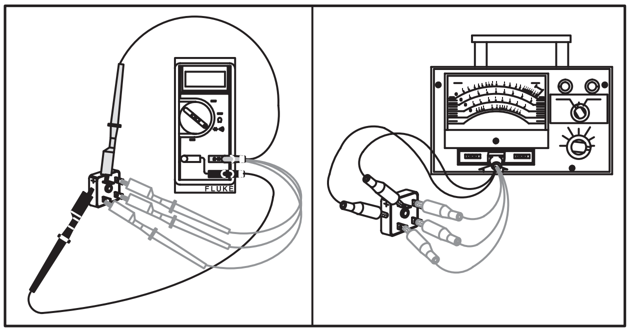

Fig. 25

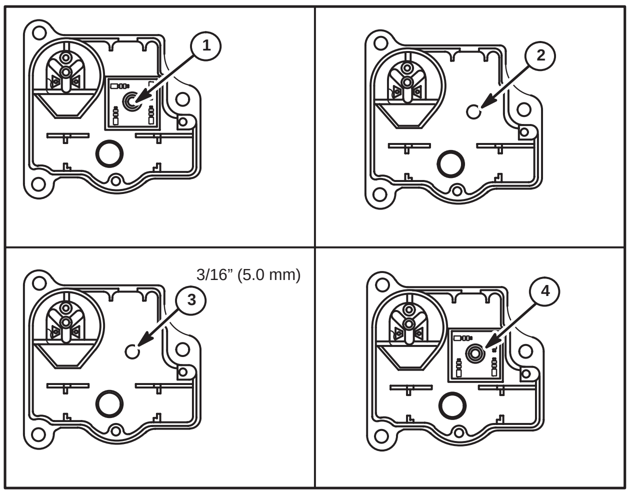

Fig. 26

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

Test Switch

1. Test switch assembly using the DMM, with meter in “Diode Test” position.
2. Attach meter test leads to switch terminals, Fig. 27.
3. Meter should display “OL,” indicating no continuity.
4. When button (1) is depressed, the meter should make a continuous tone, indicating continuity. Meter should indicate continuity only when button is depressed.

When re-assembling switch, position starter button and return spring as noted in Fig. 22.

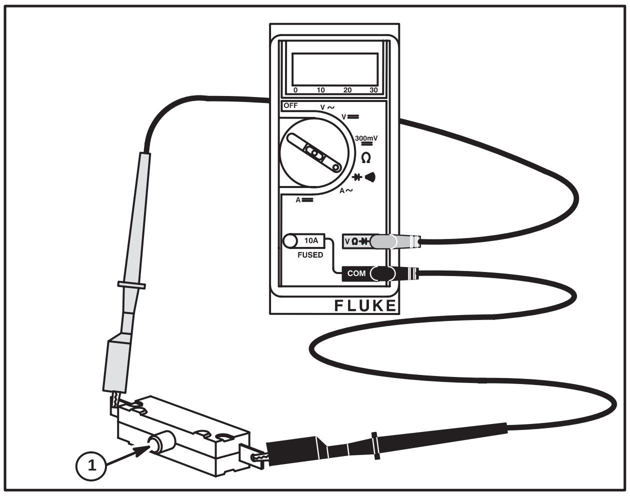

Fig. 27

With the starter motor and controller disassembled, the cord assembly may be tested for continuity using the DMM or VOA meter.

Assemble 120 Volt Control Assembly

1. Connect wires as shown in Fig. 23.
2. Re-assemble back plate to housing using three screws.

CAUTION:
Incorrect connection of black and white wires from cord to rectifier will cause motor to run backwards.

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American Bosch – Mitsubishi Gear Drive Starter Motors

120 Volt AC, 12 Volt DC Model Series 170000, 190000

The 120 volt electric starter is equipped, and must be used with, a three-prong safety plug. Extension cords must also be three-prong.

Service procedures for both the 12 volt and 120 volt starter motors are similar and will be covered together, except where noted.

Test 12 Volt DC, 120 Volt AC Starter Motor

Tools, Procedures (DC)

DC Shunt, Tool #19359 and DMM (#19464) or VOA Meter, #19236.

Tachometer capable of reading 10,000 RPM.

Fully charged 12 volt battery.

See Table No. 10, Specifications.

NOTE: A 6 volt battery is required in some instances for test purposes only. This allows RPM readings to be made on a lower scale.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

1. Set the meter to read **300mV** ⎓ (DC AMPS).
2. Connect the starter motor, battery and meter as Shown in Fig. 28.
   Optional starter switch (1)
   Black lead (2)
   Red lead (3)
   DC shunt to negative terminal (4)
   12 volt battery (5)
   Test fixture (6) from P. 4.

WARNING

Unintentional sparking can result in fire or electric shock.

- After servicing, the 120 volt starter motor should be Hi-Pot tested by an electric motor repair shop before reinstalling on engine to determine if a shock hazard exists.

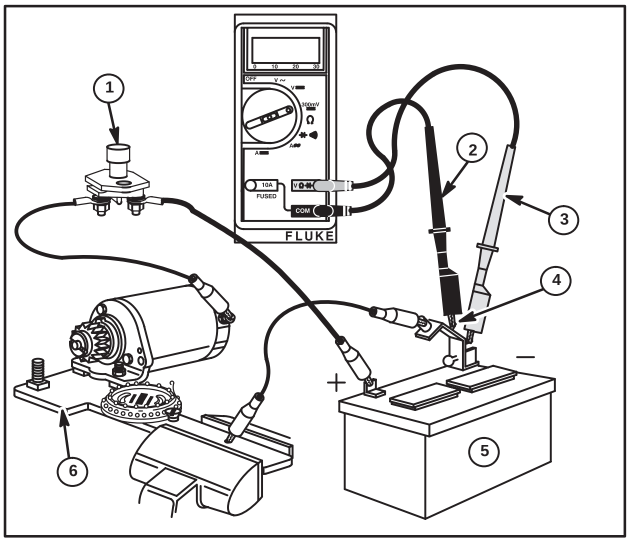

Fig. 28

It is recommended a battery of 32 ampere hour capacity be used with the 12 volt starter. The battery cable size should be #4 or #6.

NOTE: A battery of higher amperage may be required for extremely cold weather starting conditions.

3. Activate the starter motor and note readings of meter and tachometer (RPM). Starter should be within specifications. Disregard surge current.

If the motor does not perform satisfactorily, see Interpreting Starter Motor Test Results, P. 7.

Tools, Procedures (AC)

See Fig. 5 to make a starter mounting test fixture.

DMM (#19464) with AC Shunt, Tool #19358 (1), Fig. 29.

Tachometer capable of reading 10,000 RPM.

See Table No. 10, Specifications, for maximum allowable amperage.

WARNING

Unintentional sparking can result in fire or electric shock.

- Extreme care should be used in making this test to minimize the hazard of electrical shock.

1. Clamp the starter motor test fixture in a vise as shown in Fig. 29.
2. Set meter to AC amps.
3. Insert leads into meter and plug starter motor cord into AC adapter.
4. Connect AC adapter to a 120 volt outlet.

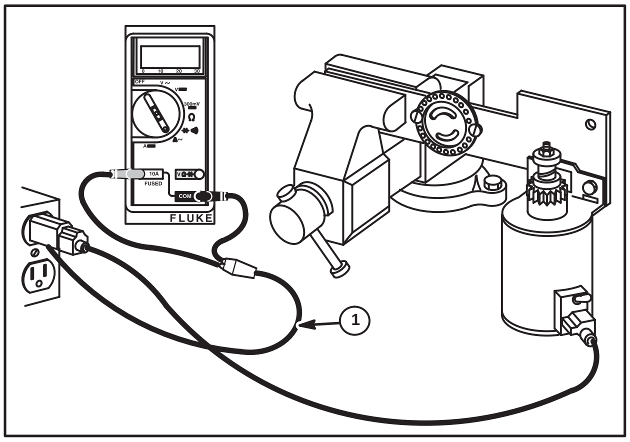

Fig. 29

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5. Depress starter switch. When meter reading stabilizes (approximately 3 seconds), amperage should not exceed the specification shown.

CAUTION:
If amperage is higher than specification shown, immediately stop the test! An amperage reading higher than number in chart indicates a shorted starter motor, which could be dangerous.

6. If amperage is within specification, check RPM of starter motor.

CAUTION, ALL SYSTEMS:
Starter motor housing may contain ceramic magnets that can crack if motor housing is clamped in a vise or struck with a hammer or hard object.

CAUTION, ALL SYSTEMS:
Do not run starter motors for more than one minute without cooling 15 minutes.

Test Starter Motor Drive and Clutch (Typical, 12v and 120v)

When the starter is activated, the pinion gear should engage the flywheel ring gear and crank the engine. This can be observed by removing the starter cover, if present. If the pinion gear does not engage the flywheel, inspect the pinion gear and helix for freeness of operation, Fig. 30. If any sticking occurs, the parts may be washed in a solvent such as Stanisol® or Varsol®. Do not lubricate drive parts except with dry silicone spray. If the problem persists, check disassembly, assembly instructions regarding serviceability of starter drive parts.

Inspect pinion gear for damaged teeth, and replace if damaged.

If the spur gear engages the flywheel, but does not crank the engine, the starter clutch may be defective. The clutch should not slip during normal engine cranking.

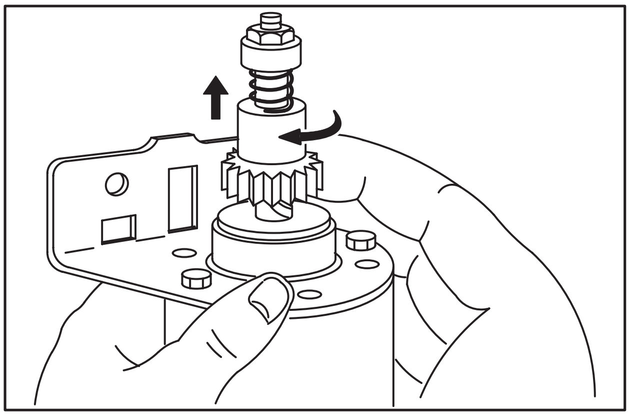


Fig. 30

7B

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

Replace Flywheel Ring Gear (Typical, all systems)

Briggs & Stratton starter motors use either an aluminum or plastic ring gear on the flywheel. American Bosch – Mitsubishi Gear Drive starters use a steel flywheel ring gear with a steel starter pinion gear. Make sure that you get the correct parts for your starter model.

WARNING

Flying objects can cause personal injury or property damage.

- Do not strike flywheel with a hard object or metal tool as this may cause flywheel to shatter in operation.

1. With a center punch, mark the center of the rivets holding the ring gear (1) to flywheel (4).
2. Drill out the rivets using a 3/16” (5.0 mm) drill.
3. Clean holes after drilling, Fig. 31.
4. Attach new gear to flywheel using hardware (2, 3) provided with gear.

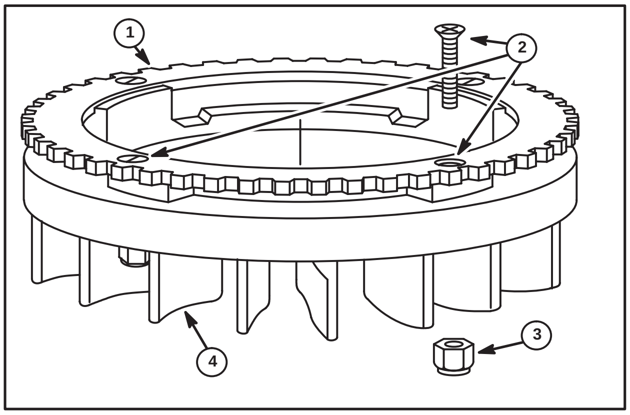


Fig. 31

Starter Motor Disassembly and Assembly, by System

System 3® and System 4® starters wil be covered together here. Individual differences will be noted in the following art and text.

System 3®, System 4® (Fig. 32)

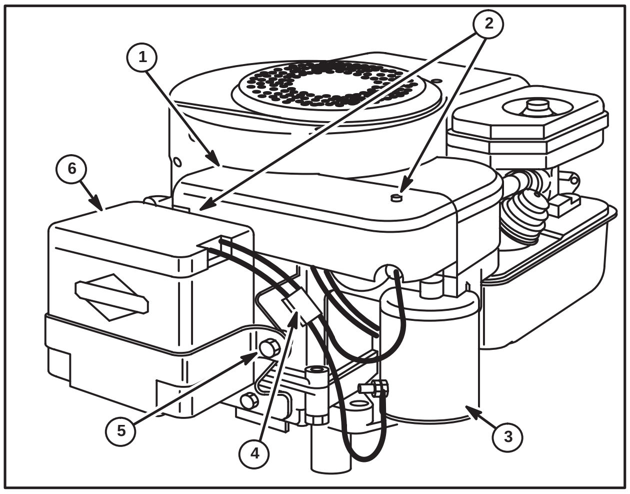


Fig. 32

7B

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

Disassemble, Inspect and Clean Starter Motor

1. Examine Fig. 33, Exploded View prior to disassembly.
2. Remove the starter cover (1), nylon spur gear retainer (2), and the nylon spur gear (4).
3. Remove the three screws (5) holding the starter gear cover (6) and remove the cover.
4. Lift the clutch assembly– (gasket [7], felt washer [8], and drive gear [9]) – and the pinion gear (11) off their respective shafts.

Fig. 33: Starter gear helix (3)
Brake bandmounting post – early Models (10)
Gray plastic end play washers (12)
Armature (13)
Housing (14)
Thrust washer (15)
Insulator (16)
Brush end cap with brushes and springs (17)
Thru bolts (18)

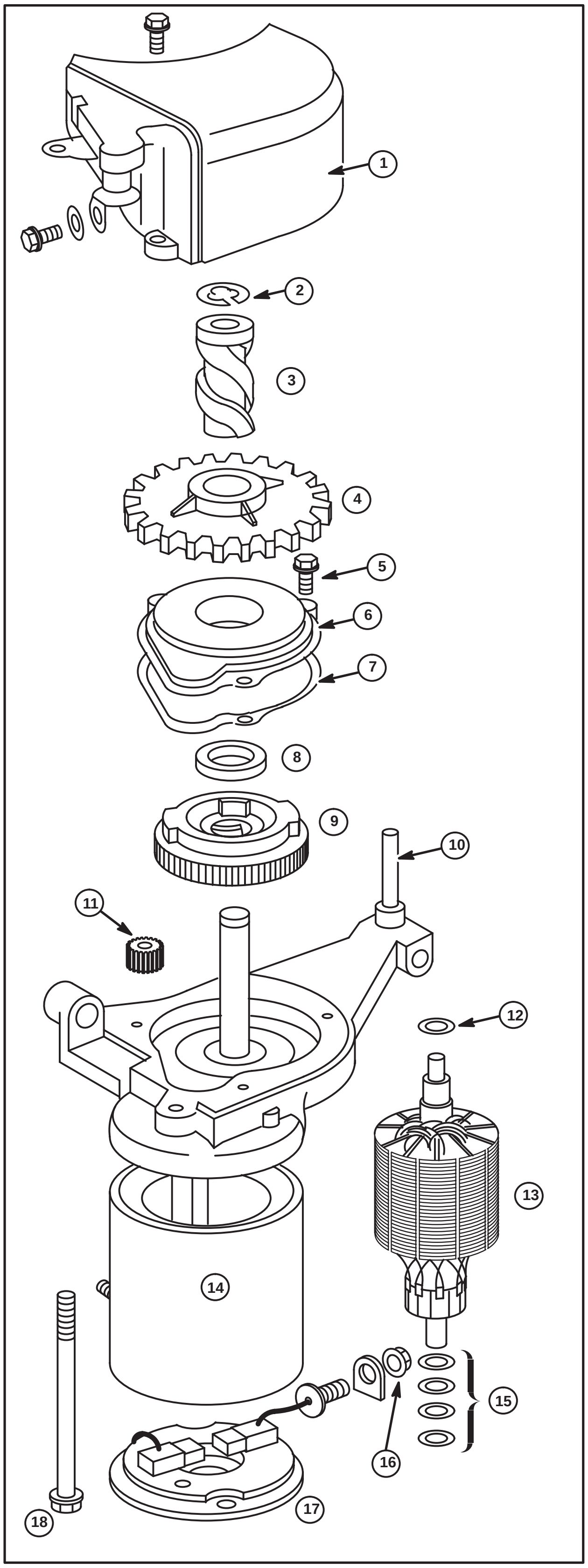


Fig. 33

7B

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

5. Remove both starter motor thru bolts (1), Fig. 34, and separate end cap (2) from housing.

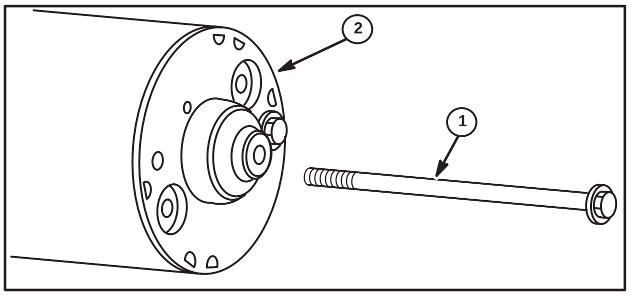


Fig. 34

6. Push motor armature out through bottom of starter housing (3), taking care to slide rubber mounted terminal (1) out of motor housing (3) along with end cap (2), Fig. 35.
Armature shaft (4)

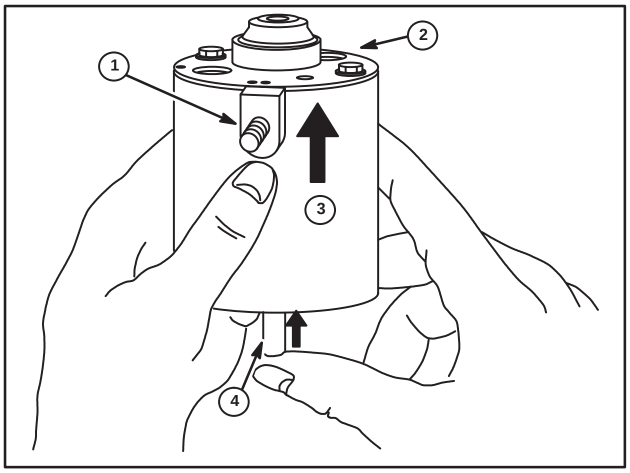


Fig. 35

7. Before removing armature from end cap, check brushes (1) for freedom of movement. If brushes stick in their retainers, repair before reassembly, Fig. 36.
8. If brushes are worn to a length of 5/64" (2.0 mm) (System 3®, 4®) or less, they should be replaced.
9. Check brush springs for proper tension (sufficient force to keep brush in firm contact with commutator).

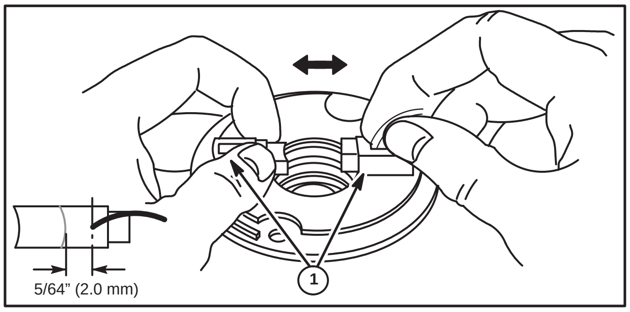


Fig. 36

10. Clean all residue from armature, end cap, motor support, gears, etc. Do Not soak end cap bearings and armature in solvent.
11. The armature commutator may be cleaned with a fine sandpaper or commutator paper. **DO NOT** use emery cloth, emery will embed in the commutator causing rapid brush wear.
12. Slots between commutator bars may be cleaned using aerosol spray carburetor cleaner and compressed air after sanding or machining.
13. If the armature is suspect, and proper equipment is available, test the suspect armature. If not, a new armature should be tried in the motor.
14. Starter motor armatures have very low resistance, usually below detection on available multimeters. To check for shorted armatures, take starter to an electric motor repair facility.
15. If the magnets appear to be weak, a new motor housing should be tried.

7B

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

Assemble Starter Motor – Armature to End Cap Assembly, Fig. 37

Lightly lubricate bearings with a #20 oil and reassemble in the following manner.

1. Insert brush springs and brushes in holders as far as possible, and hold them in position with brush retainers (1), Fig. 37.
2. Place thrust washers on armature shaft in sequence shown, Inset "A": felt washer (4), steel washer (6), and add gray plastic washers (5) to obtain dimension shown in Fig. 37, Inset "B" (System 3®, 4®).
3. Using care to ensure brushes clear commutator, slide armature shaft into end cap bearing, Fig. 37.

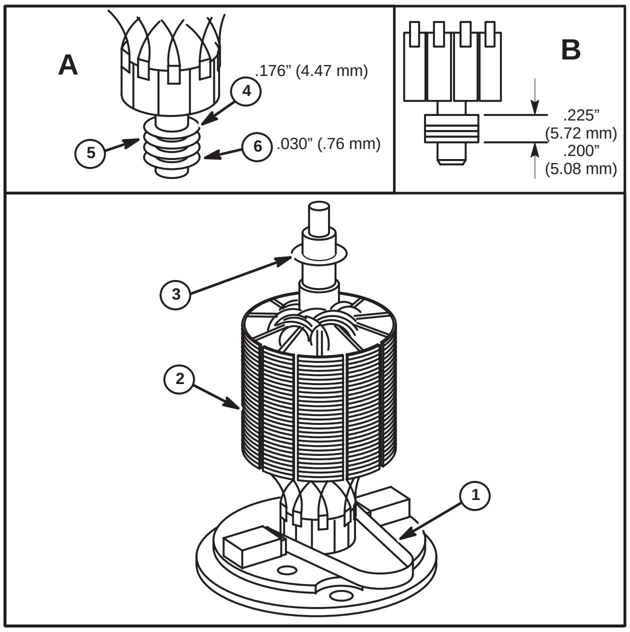


Fig. 37

4. Support armature shaft and slide it slowly into starter housing, as shown in Fig. 38.
5. Insert plastic insulator terminal (1) (System 3®, 4®) into starter housing.
6. Place remaining thrust washers on motor PTO shaft, install end head cover and thru bolts.
7. Notches in end cap, housing and end head must be aligned (2), Fig. 38.
8. Torque bolts to 25 in. lbs. (3 Nm).
9. If necessary, install or remove gray plastic washers between armature and end head to adjust end play for .005" (.13 mm) to .025" (.64 mm) armature movement (System 3®, 4®), Fig. 37.

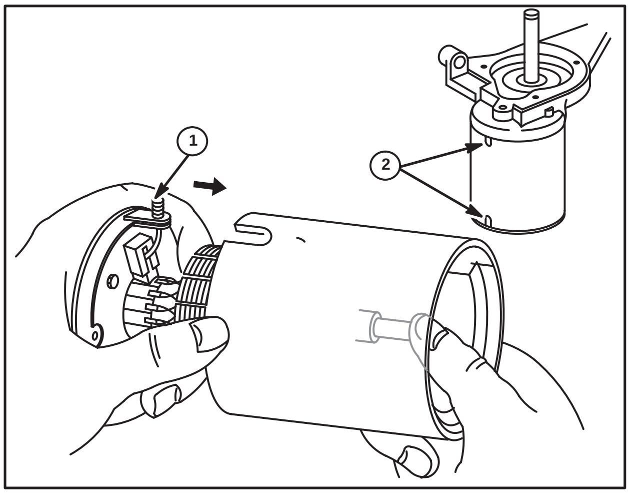


Fig. 38

10. Slip pinion and clutch gear on shaft.
11. Add approximately 3/4 ounce (22 ml) of high temperature gear lubricant under large gear and on gear teeth (1), Fig. 39.
12. Oil felt washer with electric motor oil (System 3®, 4®).
13. Install washer, gasket and cover, Fig. 39 (System 3®, 4®).

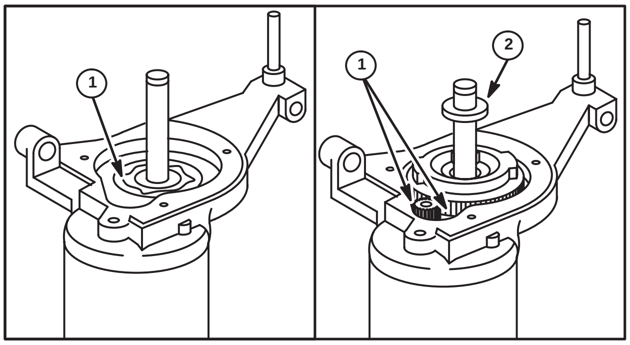


Fig. 39

7B

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

14. Tap end cap edge (1) lightly using a soft hammer to align the bearings, Fig. 40.
15. Replace nylon spur gear and retainer assembly, and tighten retainer screws securely. Do not lubricate helix except with dry silicone spray.
16. Install starter cover and torque screws to 25 in. lbs. (3 Nm).
17. Install starter motor on engine. Torque rear starter mounting screw (5/16”-18) to 140 in. lbs. (16 Nm). Torque front mounting screw (1/4”-20) to 90 in. lbs. (10 Nm).

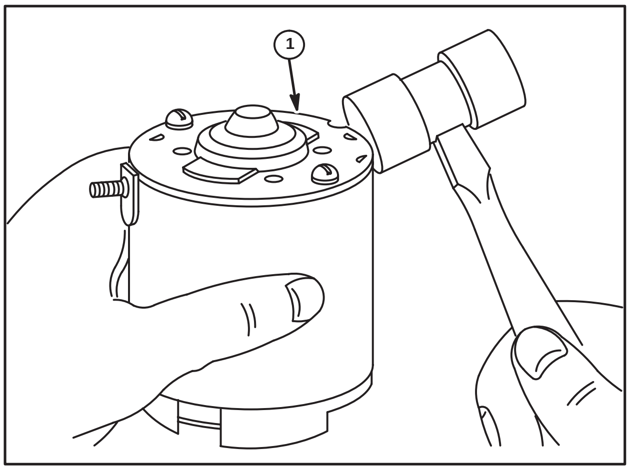


Fig. 40

12 Volt DC Gear Drive Starter Motor, Nylon Pinion Gear
Model Series 130000

Examine exploded view, Fig. 16, before disassembly. Note location of housing seam to drive-head end mounting bracket.

Disassemble Starter Motor Drive, Fig. 41

1. Place in “V” block (1) as shown with retainer resting in “V” (2).
2. Drive the roll pin out with a hammer and 1/8” (3.0 mm) diameter punch (3) to remove the retainer.

Inspect pinion gear for damaged teeth. Repair cause if pinion gear does not move freely on helix. The parts may be washed in a solvent such as Stanisol® or Varsol®. The gear, retainer, roll pin and clutch assembly are available as Briggs & Stratton service parts.

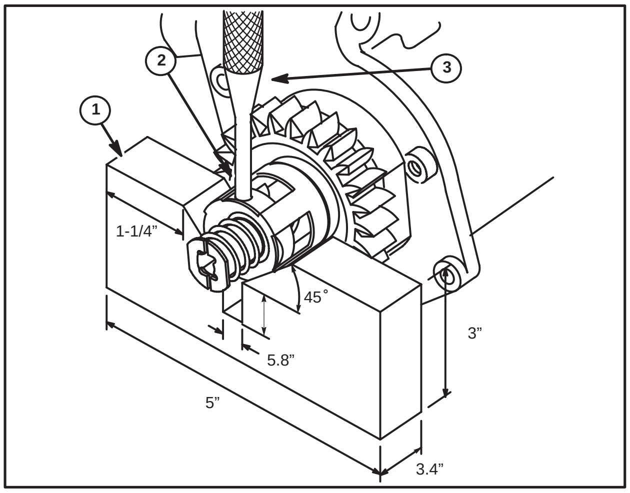


Fig. 41

Assemble Starter Motor Drive, Fig. 42

1. Reverse disassembly procedure for assembling. Assemble the pinion gear with beveled edge on the gear up as shown in Fig. 42.
2. Assemble cup and spring on gear if original assembly was so equipped.
3. Press or drive new roll pin through retainer slot and armature shaft hole with roll pin slot positioned as shown (2). The roll pin should be centered in shaft within 1/32” (.8 mm). ASSEMBLE WITH NEW ROLL PIN ONLY. Optional spring (3), retainer (4).

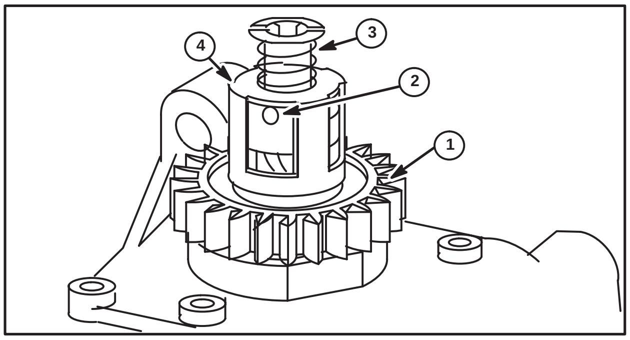


Fig. 42

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

Disassemble Starter Motor

1. Remove thru bolts. Note position of match marks and thru bolts. They must be reassembled in same position.
2. Remove drive-head end and inspect bushing for wear. Replace drive-head end mounting bracket if worn.
3. Press (“A”) the armature and commutator end cap against a work surface (1) while sliding housing upward (“B”) off the armature. This allows the armature to remain in the end cap (2) for inspection of brush/armature contact, Fig. 43.
4. Clean all residue from the armature, end cap, motor support, etc. Do Not soak bearings, housing or armature in solvent.
5. The commutator may be cleaned with a fine sandpaper such as flint or commutator paper. Do Not use emery cloth. Emery will embed in the commutator, causing rapid brush wear.
6. The commutator may be machined with a diamond cutting tool to no less than 1.230” (31.24 mm) – 12 volt, 1.320” (33.53 mm) – 120 volt, outside diameter.
7. Slots between commutator bars should be cleaned with blade (1) as shown in Fig. 44, or by using aerosol carburetor cleaner or compressed air, after sanding or machining.
8. If an armature or field coil is suspect, and proper equipment is available, test the suspect armature or field coil to determine if it is defective (opens or grounds).
9. If magnets or motor housing are suspect, a new part should be tried in the motor.
10. Check brushes for freedom of movement. If brushes stick in their retainers, repair before reassembly.
11. If brushes are worn to within 1/8” (3.0 mm) of wire at closest point, replace brushes (1), Fig. 45. New brush measurement shown (2).

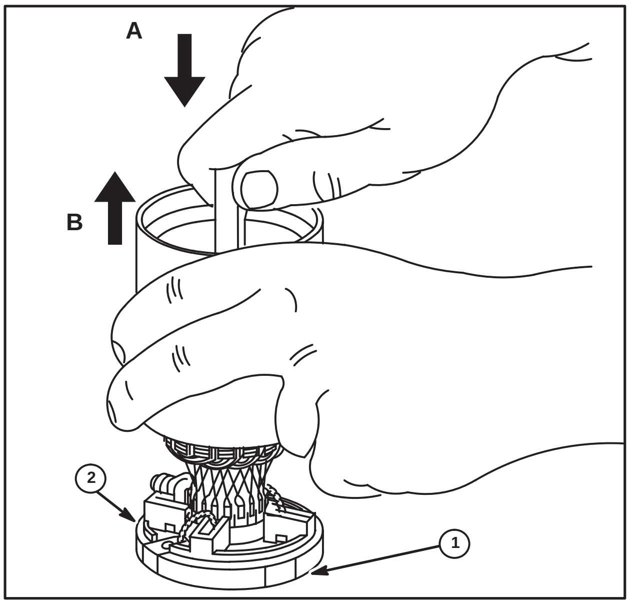


Fig. 43

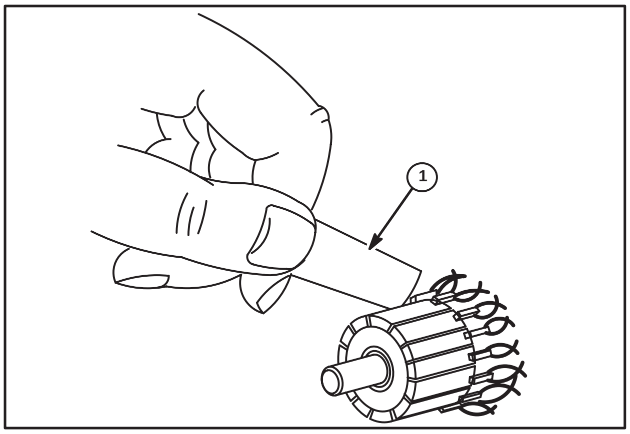


Fig. 44

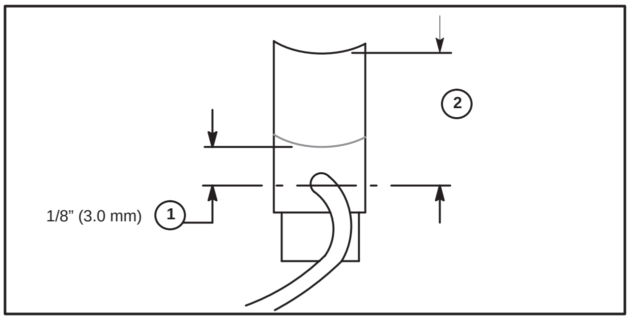


Fig. 45

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

Assemble Starter Motor

Lightly lubricate bearings with #20 oil and reassemble in the following manner.

1. Insert brush springs and brushes (1), Fig. 46, in holders as far as possible, and hold them in this position with brush retainers, Figs. 6, 46.
2. Slide motor housing over armature with the notch toward commutator end cap.
3. Match notch in housing with boss on brush end cap. Remove brush holders, if used, and rotate armature to be sure brushes are making full contact with commutator.

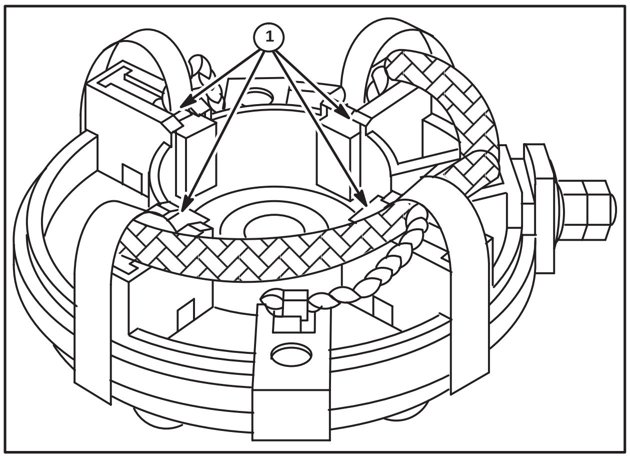


Fig. 46

4. Care should be used to prevent damage to magnets in motor housing during assembly.
5. Assemble spacers (1) and drive head end bracket, bearing shown – (2), aligning seam in housing with drive end mounting bracket.
6. Assemble thru bolts and torque to 35 in. lbs. (4 Nm).
7. Armature end play should be .006” to .038” (.15 to .97 mm) after assembly, Fig. 47.

Install starter on engine and torque mounting screws to 140 in. lbs. (16 Nm).

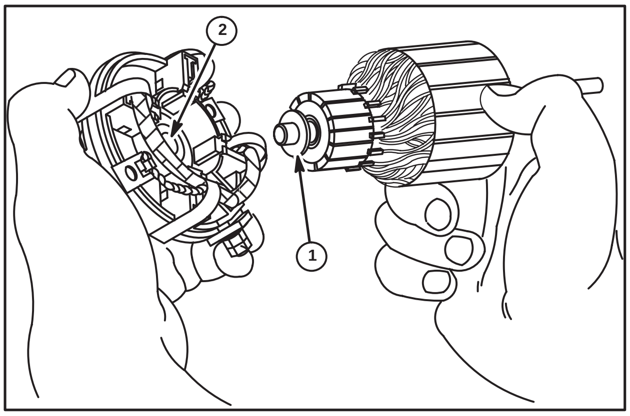


Fig. 47

7B

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

12 Volt DC & 120 Volt AC Gear Drive Starter Motor, Steel Drive Pinion, Exploded View Fig. 48

Model Series 130000

This system uses either a 12v DC or 120v AC starter motor. They are covered together in this section. Study Fig. 48 prior to starter motor disassembly.

Drive housing (1)
Spacer and retainer (2)
Lock nut (3)
Helix and drive gear assembly (4)
Pinion gear (5)
Spring washer (6)
Motor pinion (7)
End head (8)
Thrust washer (9)
Armature (10)
Thru bolts (11)
Housing (12)
12 volt terminal (13)
12 volt end cap (14)

Inset “A” shows 120 volt end cap assembly –
Ground post (15)
Rectifier assembly (16)
End cap (17)

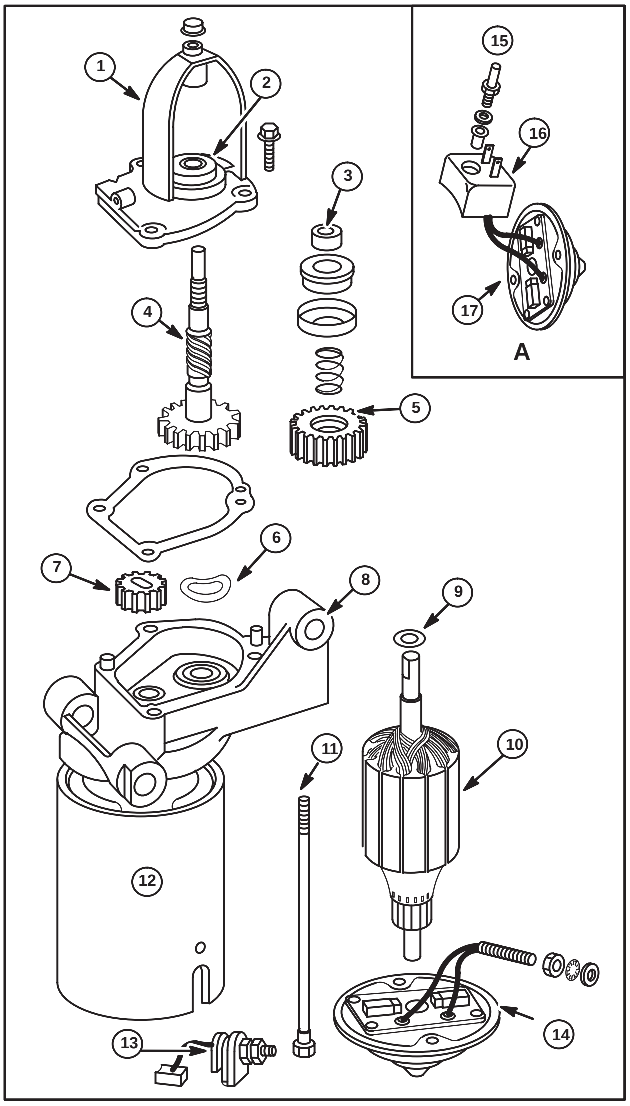


Fig. 48

Disassemble Starter Motor Drive

1. Remove drive housing (1) from end head (8), Fig. 48.
2. Clamp the drive gear (4) in a vise with brass jaws, to prevent damage to the gear teeth.
3. Remove the lock nut (3) and disassemble.

Assemble Starter Motor Drive

Reverse disassembly procedure for assembling. Be sure drive spacer and retainer (2) are correctly positioned in drive housing.

Do not lubricate drive assembly, except with a dry silicone spray.

Disassemble Starter Motor

NOTE: End head (1), end cap (2), and housing (4) must be placed in the same position as when removed. Assemble matching marks (3) or interference may result, Fig. 49.

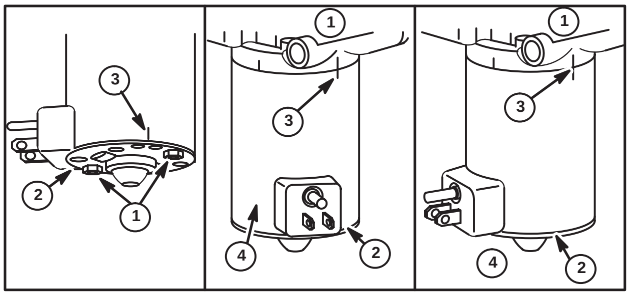


Fig. 49

1. Remove thru bolts (1), Fig. 50, then remove end head.

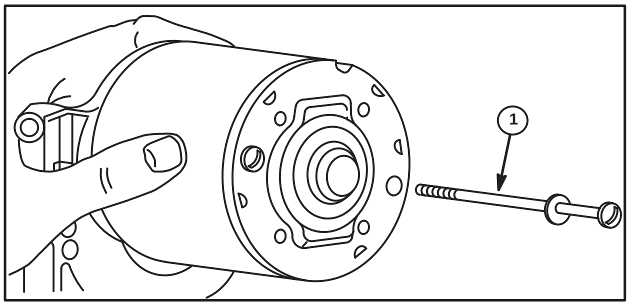


Fig. 50

2. Remove armature and end cap (2) by pushing up on armature shaft (A) as shown in Fig. 51.
3. Clean all residue from the armature, end cap, end head, etc.
4. Do not soak bearings, motor housing or armature in a solvent solution.
5. The armature commutator may be cleaned with a fine sand paper or commutator paper. Do not use emery cloth, as emery will embed in the commutator, causing rapid brush wear.
6. If it is suspected that the armature is defective, and proper equipment is available, test the suspect armature. If not, try a new armature in the motor.

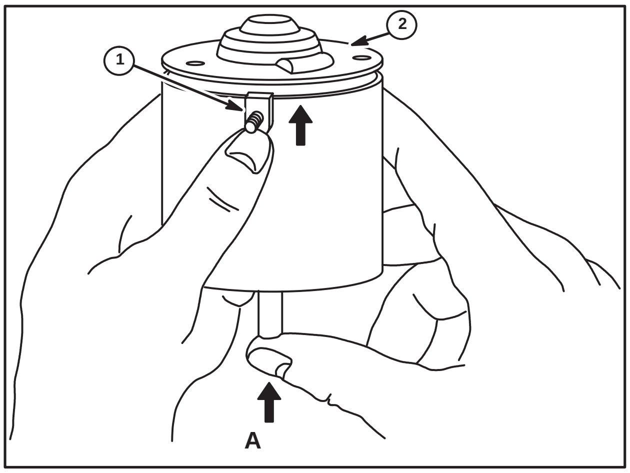


Fig. 51

7. Starter motor armatures have very low resistance, usually below detection on available multimeters. To check for shorted armatures, take starter to an electric motor repair facility.
8. The brushes should be checked for poor seating, weak springs, and contamination, Fig. 52 (Typ.).
9. If brushes are worn to less than 1/4” (6.0 mm), they should be replaced.
10. If the magnets appear to be weak, a new motor housing should be tried.

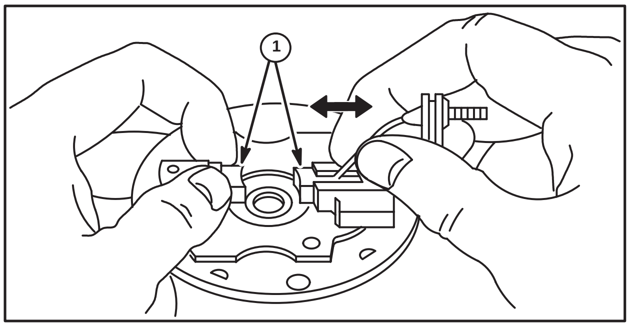


Fig. 52

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

Assemble Starter Motor

Lightly lubricate the bearings with #20 oil prior to reassembly.

1. Insert the brushes in their respective holders. Brush retainers, which can be made from scrap piece of rewind starter spring, Figs. 6 and 53, should be used during assembly.

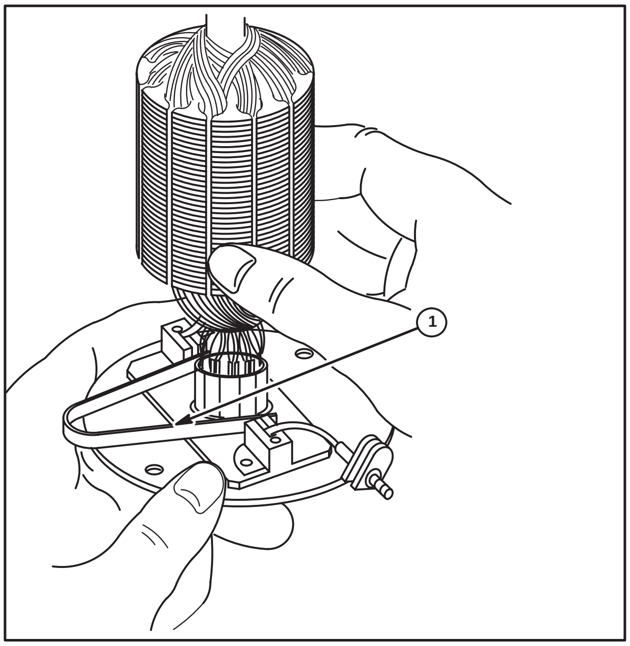


Fig. 53

2. Support armature shaft and slide it slowly into housing (1), Fig. 54 (Typ).
3. Insert rubber mounted terminal into housing.
4. Place thrust washer on motor PTO shaft.
5. Install end head and thru bolts.
6. Align end cap and end head match marks correctly, Fig. 49, and tighten screws.

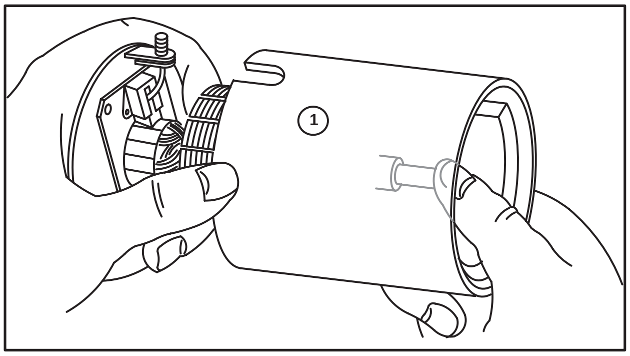


Fig. 54

7. Tap edge of end cap using a soft hammer to align motor bearings if required, Fig. 40 (Typ).
8. Check armature shaft for end play. Armature should rotate freely.
9. Test performance of starter motor, Page 18. If starter motor tests as specified, continue assembly.
10. Slip pinion gear on armature shaft.
11. Add a small amount of gear lubricant to gear teeth. Position gasket, spring washer and drive housing assembly, Fig. 48.
12. Fasten drive housing to end head securely with three screws.

7B

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

Briggs & Stratton Starter Motors

12 Volt DC; 120 Volt AC with Housings 3–1/16” (78.0 mm) to 4–9/16” (115.9 mm) long
Model Series 170000, 190000, 220000, 240000, 250000, 280000 and 320000

See Figs. 19 and 20, and Table No. 6, Specifications, for motor identification.

Study exploded view, Fig. 55 (Roll Pin Type), or Fig. 56, (Snap Ring Type) prior to starter motor disassembly.

Fig. 55
Pinion gear (1)
Helix and drive gear assembly (2)
End head (3)
Housing (4)
End cap (5)
Starter switch (120 volt only) (6)
Thru bolts (7)
Armature (8)
Insulating washer (120 volt only) (9)
Thrust washer (10)
Inset “A” – end cap, 12 volt, (11).

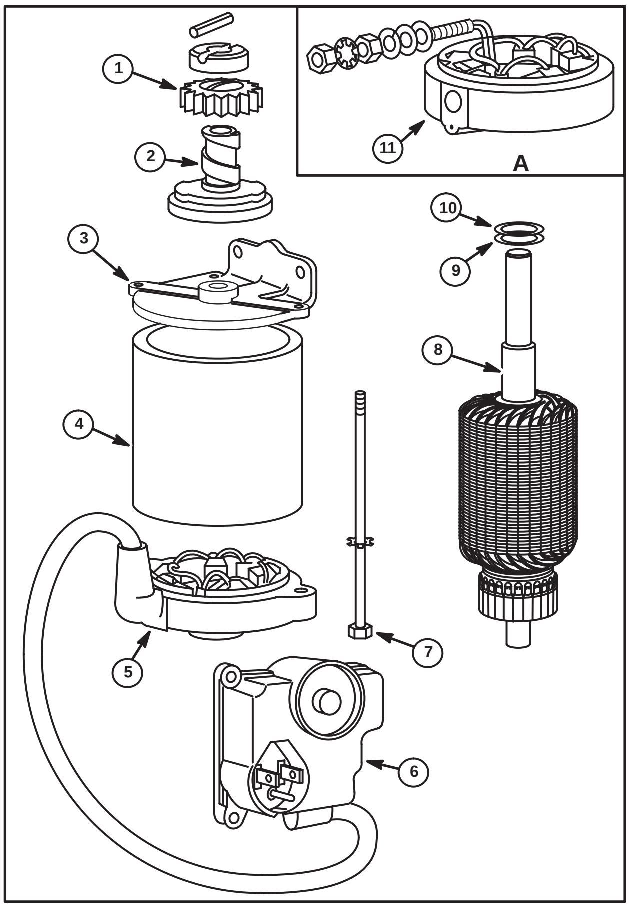


Fig. 55

Fig. 56
Snap ring (1)
Retainer (2)
Spring (3)
Pinion gear (4)
Spring washers (6)
Washer (7)
Drive end head (8)
Armature (9)
Housing (10)
Thru bolts (11)
End cap (13)

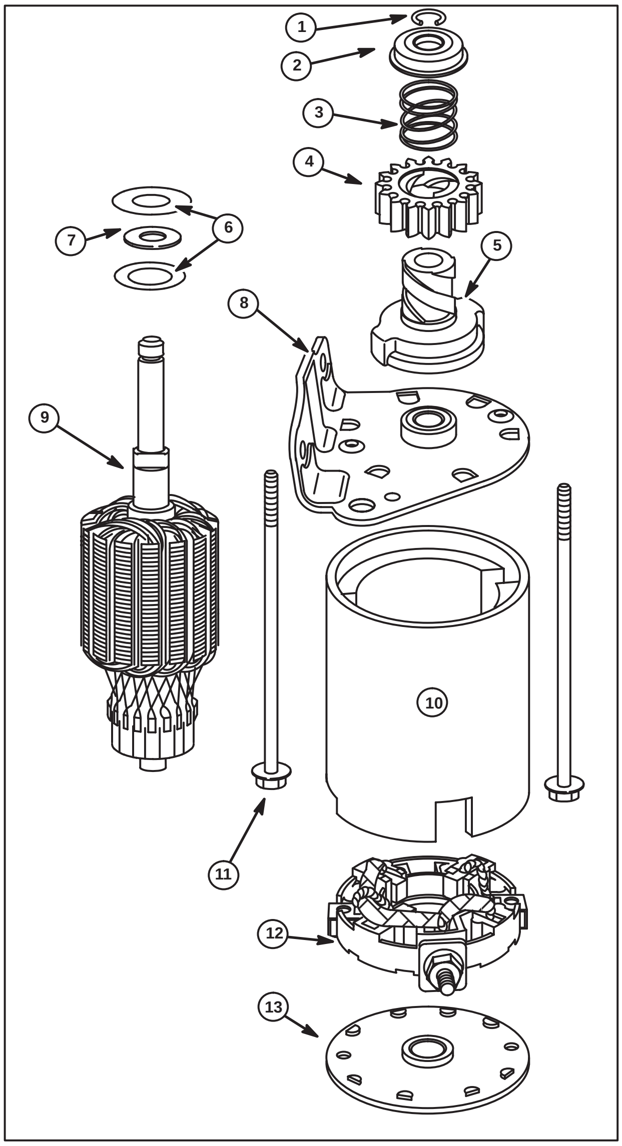


Fig. 56

7B

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

Starter Motor Drive, C-Ring Retainer Type Disassemble

1. Remove C-ring retainer using Tool# 19436, C-Ring Retainer Removal Tool, Fig. 57. Place counterbored side of tool over retainer and align drive pins with open end of C-ring. Place palm of hand over tool. Push down on tool to compress spring washer while turning screw clockwise. Continue turning screw until C-ring retainer pops off. Discard old C-ring.

WARNING

Flying objects can cause personal injury or property damage.

- To prevent eye injury always wear eye protection when removing c-ring retainer.

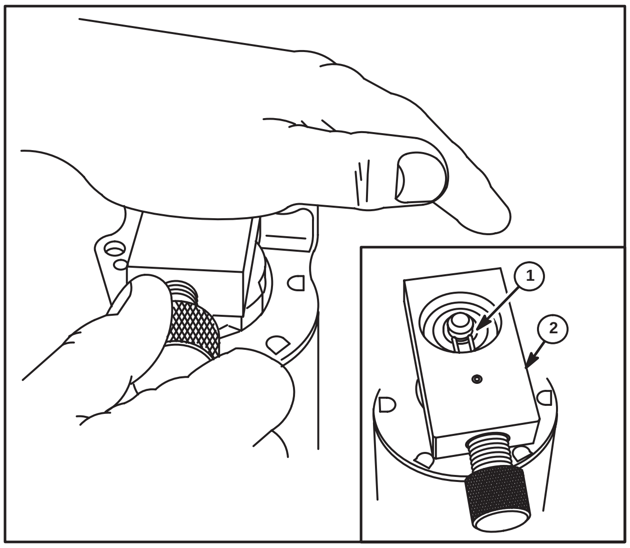


Fig. 57

2. Remove retainer (1), return spring (2), flat washer (3), spring washer (4), pinion gear (5), and starter clutch (6), Fig. 58.

The pinion gear should be inspected for damaged teeth. If a sticking condition exists between the pinion gear and the helix, correct before reassembly. The parts may be washed in a solvent such as Stanisol® or Varsol®. Do not lubricate helix except with dry silicone spray. The gear, return spring, wave washer, flat washer, retainer, retainer ring and clutch assembly are available as service parts.

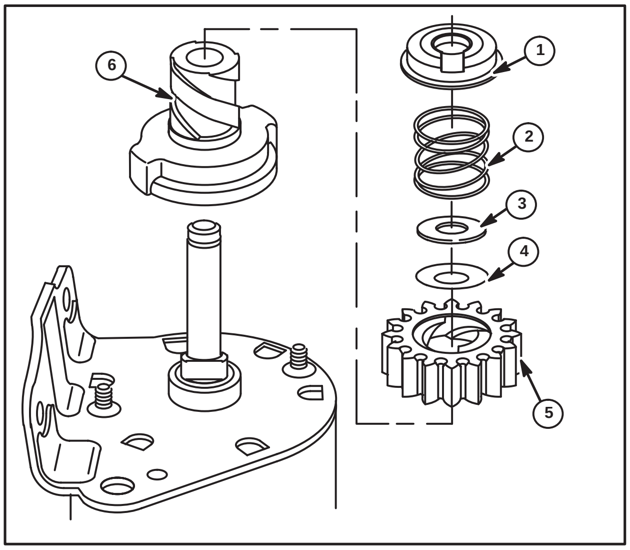


Fig. 58

Install Clutch

1. Place starter clutch on starter shaft, Fig. 59 A, and rotate clutch until it drops into place, Fig. 59 B.

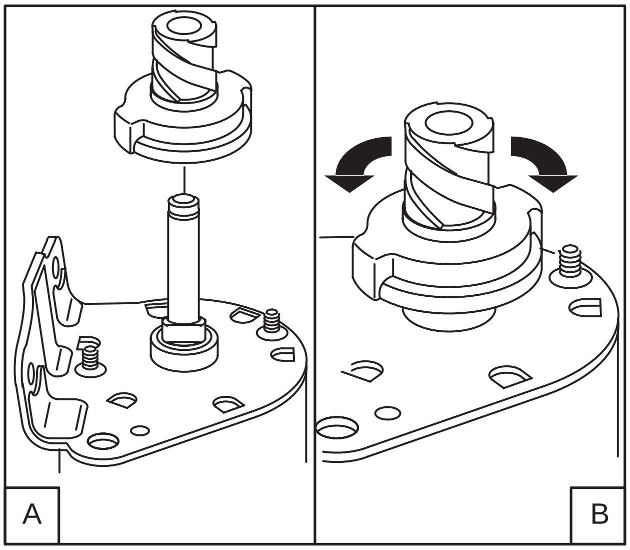


Fig. 59

7B

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

2. Install starter gear with beveled side of teeth up (1), Fig. 60. Then install return spring (2) making sure spring is in recess of starter gear (3).

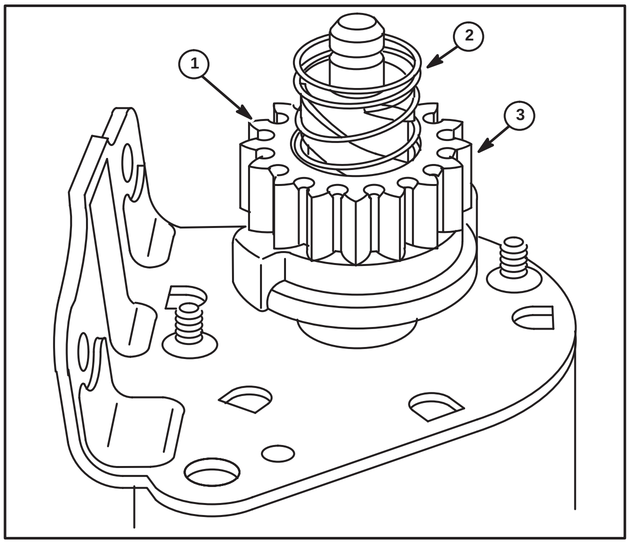


Fig. 60

3. Place spring washer (2) with concave side up, then place flat washer (1) on starter clutch spline, Fig. 61.

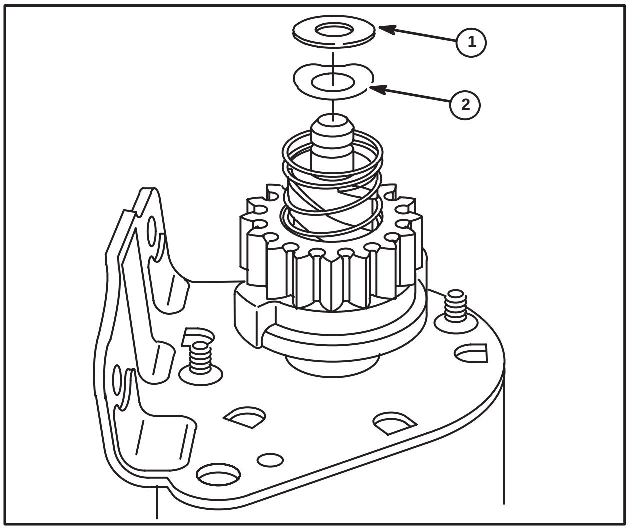


Fig. 61

4. Install NEW C-ring retainer into groove using Tool #19435, C-Ring Retainer Installer (2), Fig. 62. Place C-ring retainer over chamfered end of shaft. Align one of the slots (3) of C-ring retainer installer with open end of C-ring. Press or drive C-ring on until it snaps into groove in shaft.

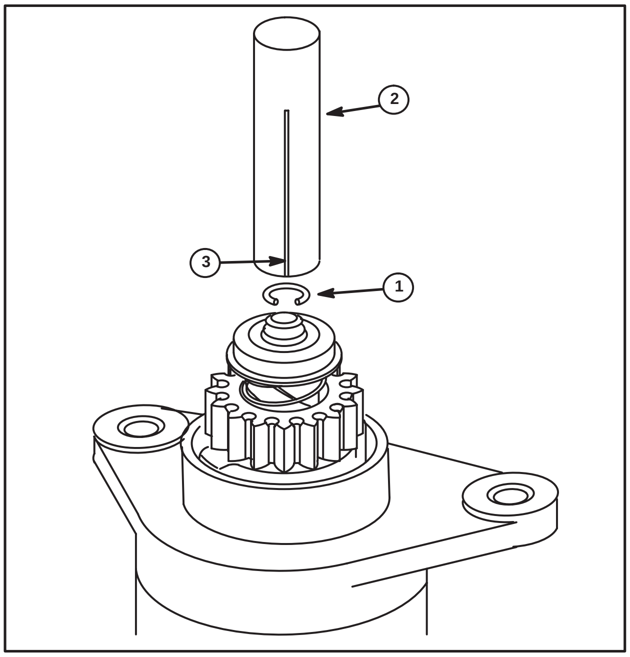


Fig. 62

7B

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

Starter Motor Drive, Roll Pin Retainer Style Disassemble

1. Place retainer (2) in “V” block (1) as shown in Fig. 63.
2. Drive the roll pin out with a hammer and 1/8” (3.0 mm) diameter punch (3) to remove the retainer.

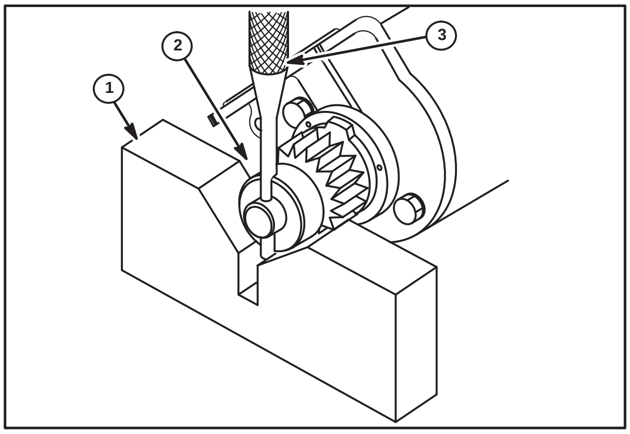


Fig. 63

NOTE: Some starter drive assemblies utilize a gear return spring. Two styles of returns have been used. Current style, Fig. 64 and early style, Fig. 65.

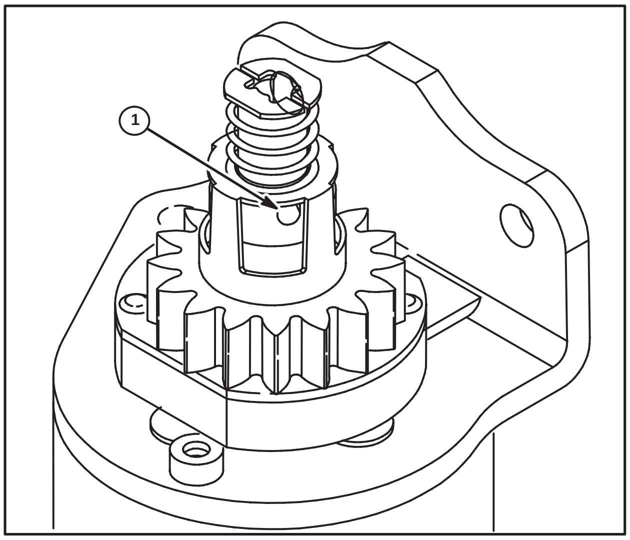


Fig. 64

The current style is removed after removing the roll pin (1). The early style is protected by a plastic cap over the drive assembly. Carefully remove the plastic cap from the cup using two screwdrivers, Fig. 65.

The pinion gear should be inspected for damaged teeth. If a sticking condition exists between the pinion gear and the helix, correct before reassembly. The parts may be washed in a solvent such as Stanisol® or Varsol®. Do not lubricate helix except with dry silicone spray.

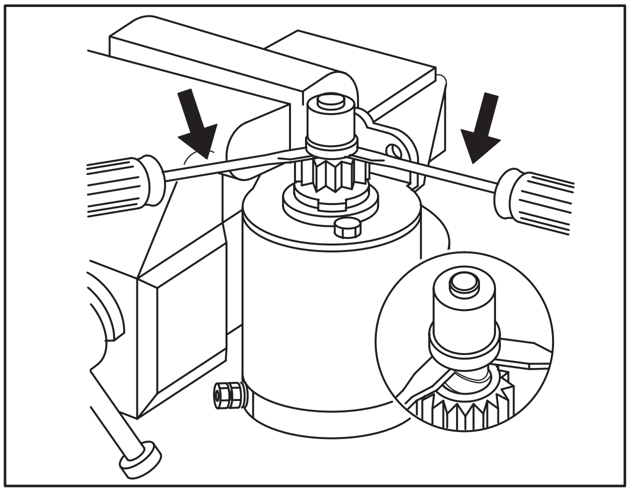


Fig. 65

7B

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

Assemble

1. Assemble pinion gear with beveled edge on the gear (1) up as shown in Fig. 66.
2. Assemble cup (2) and spring (3) on gear if original assembly was so equipped, and fit retainer (4) on shaft.
3. Drive new roll pin (5) through retainer slot and armature shaft hole. The roll pin should be centered in shaft within 1/32" (.8 mm). Assemble with new roll pin only.
4. If the original assembly is equipped with a spring cap assembly, assemble cap as follows:
5. To install plastic cap, fit a socket (2) over the plastic cap (3) and tap gently (1) as shown in Fig. 67.
6. Press cap in position. Cap should lock in position when properly assembled.

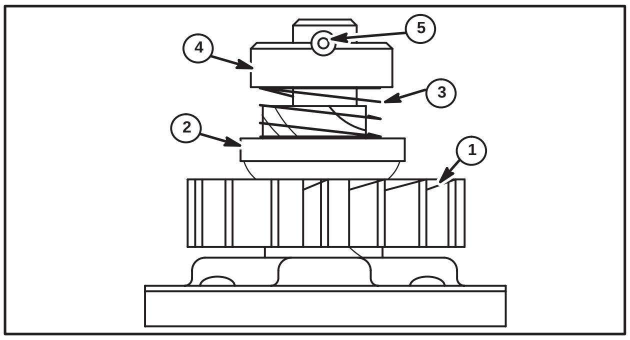


Fig. 66

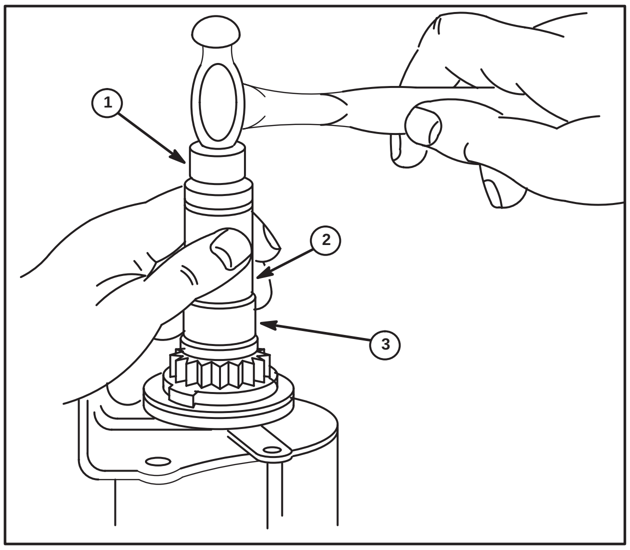


Fig. 67

Disassemble Starter Motor, C-Ring Retainer

1. Remove drive assembly as previously described.
2. Remove thru bolts, then drive head end.
3. Inspect bushing for wear. If worn, replace drive head end assembly.
4. Hold the armature "A" and bearing end cap (2) down against a work surface (1) while sliding housing up and off the armature (B). This allows the armature to remain in the bearing end cap and brush holder (3) for inspection of brush contact to armature, Fig. 68.

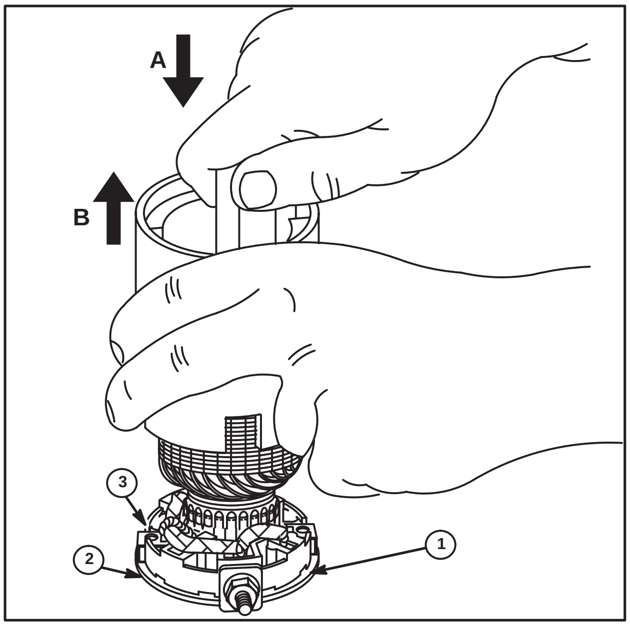


Fig. 68

7B

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

5. While holding brush holder and armature, remove bearing end cap (1) from armature, Fig. 69.
6. Remove brush holder from armature commutator.
7. Do Not soak bearings, housing or armature in solvent.
8. The armature commutator may be cleaned with a fine sand paper such as flint or commutator paper. Do Not use emery cloth, as emery will embed in the commutator causing rapid brush wear.
9. The commutator may also be machined with a diamond cutting tool to no less than 1.230” (31.24 mm) outside diameter.

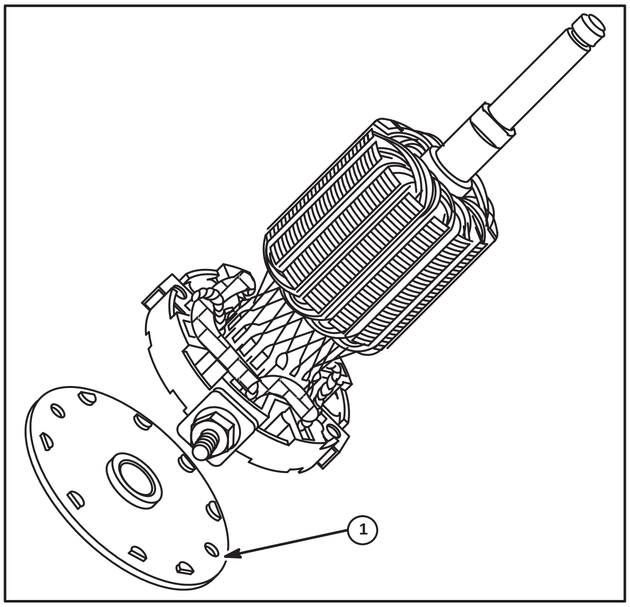


Fig. 69

10. Slots between commutator bars may be cleaned as shown in Fig. 44, or using an aerosol carburetor cleaner or compressed air after sanding or machining.
11. If it is suspected that the armature field coil, magnets or motor housing is defective, a new part should be tried in the motor. If proper testing equipment is available, check the suspected armature or field coil to determine if it is defective (opens or grounds).
12. The brushes should be checked for poor seating, weak brush springs, dirt, oil or corrosion.
13. If brushes are worn to within 1/8” (3.0 mm) of wire at closest point (B), replace brushes, Fig. 70. New, full brush size shown (A).
14. Brushes must move freely in their holders.

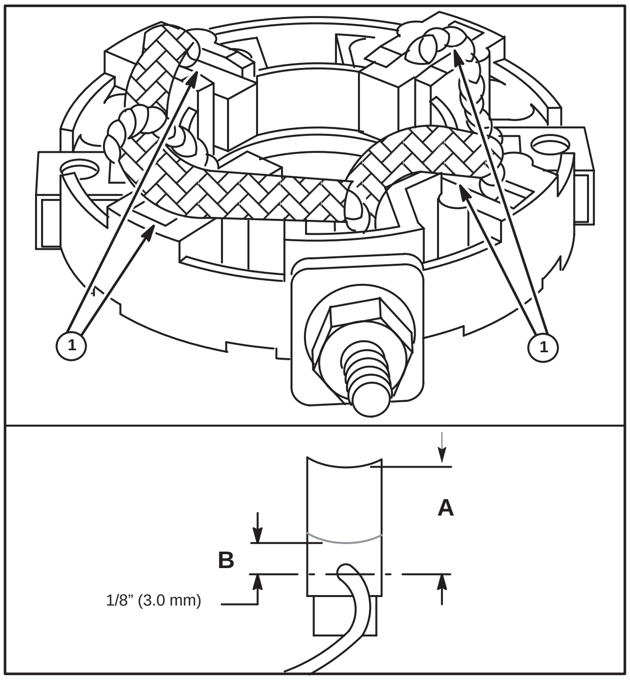


Fig. 70

7B

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

Assemble Starter Motor C-Ring Retainer Type

Lightly lubricate the bearings with #20 oil prior to reassembly.

1. Place brushes in their slots and hold brushes with brush retainers, Figs. 6, 71.
2. Place armature commutator in brush holder and remove brush retainers.
3. Align and install bearing end plate on armature commutator journal.

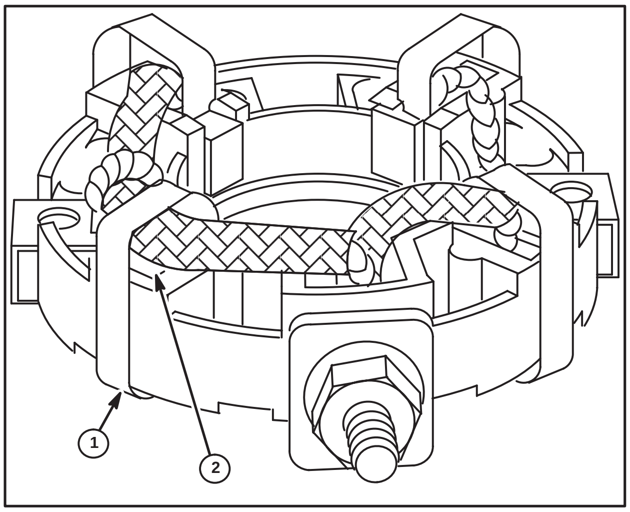


Fig. 71

4. Slide motor housing over armature with the notch toward brush holder, Fig. 72.

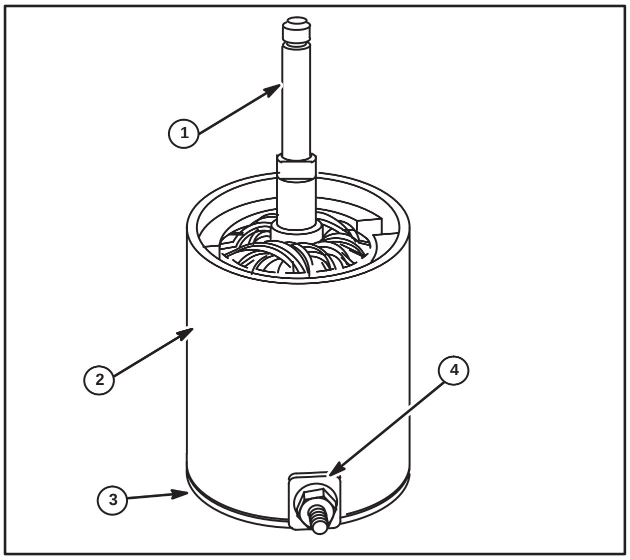


Fig. 72

5. Place spring washer (1) on armature shaft with concave side up, Fig. 73. Then place flat washer (2) on shaft.

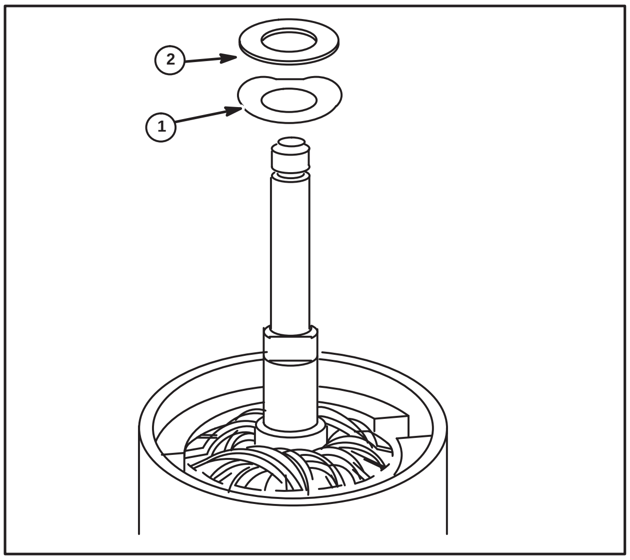


Fig. 73

7B

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

6. Place drive end cap on starter housing making sure that mark on cap (1) lines up with housing seam (2), Fig. 74.
7. Install through bolts in starter.
8. Use starter clutch to rotate armature and check for binding. Correct if necessary.
9. Install starter drive as previously described.

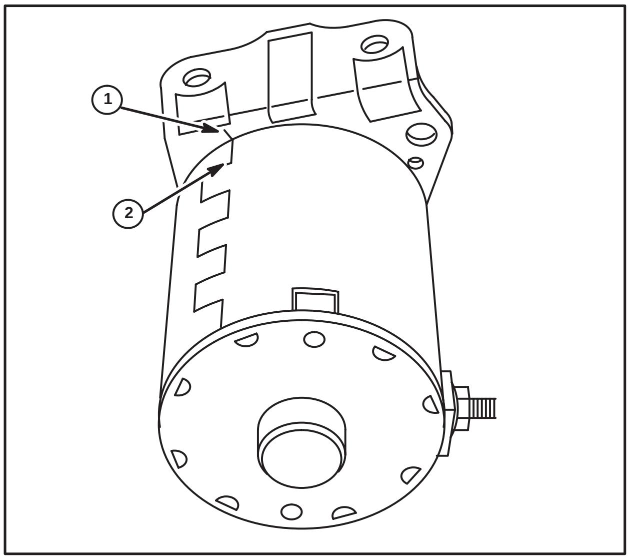


Fig. 74

10. Install starter on engine and start mounting screws(1). While holding starter against locating lugs on cylinder (2), Fig. 75, torque mounting screws to 140 in. lbs. (16 Nm).
    Wire clip (3)
11. Reinstall starter guard, if used.

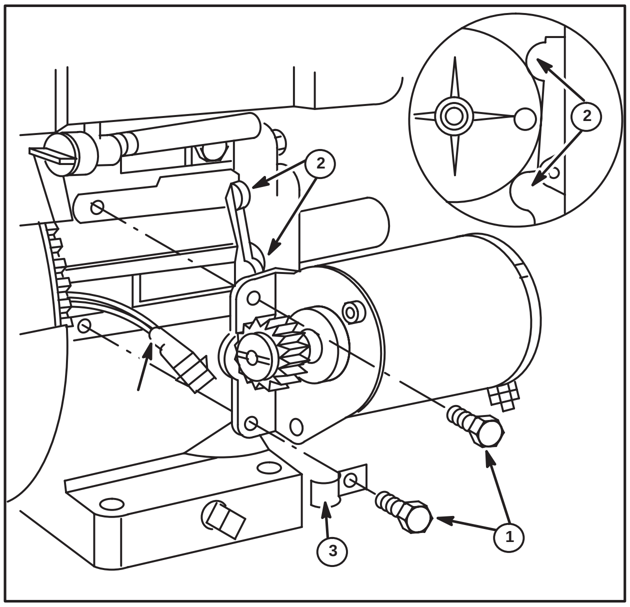


Fig. 75

7B

Disassemble Starter Motor, Roll Pin Retainer Type

1. Mark drive end cap at seam on housing. Remove thru bolts (3), noting position of bolts and match marks (1) for reassembly. Hold housing and cap together (4), Fig. 76.
2. The drive head end (5) may now be removed. Inspect bushing for wear. If worn, replace drive head end assembly.

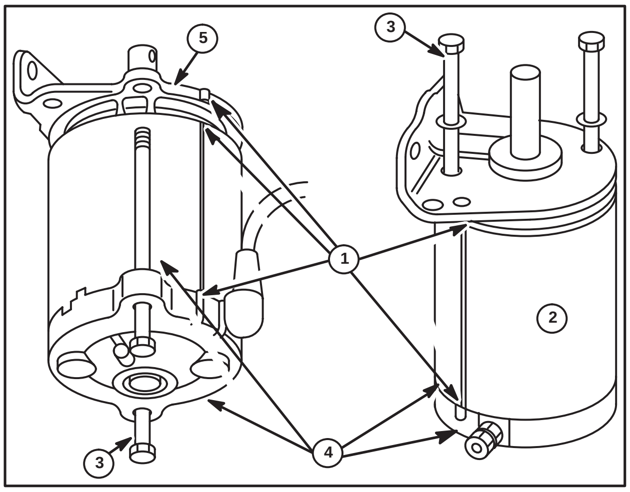


Fig. 76

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

3. Hold down the armature “A” and commutator end cap against a work surface (1) while sliding housing up “B” off the armature. This allows the armature to remain in the end cap for inspection of brush to armature contact, Fig. 77 (Typ).

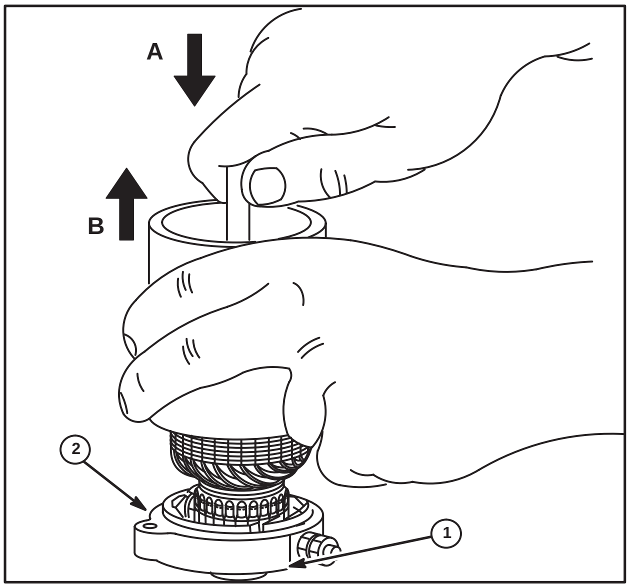


Fig. 77

Remove Armature from Brush End Cap

1. Clean all residue from the armature, end cap, motor support, etc. Do Not soak bearings, housing or armature in solvent.
2. The commutator may be cleaned with a fine sand paper such as flint or commutator paper. Do Not use emery cloth, as emery will become embedded in the commutator, causing rapid brush wear.
3. The commutator may be machined with a diamond cutting tool to no less than 1.230” (31.24 mm) – 12 volt, 1.320” (33.53 mm) – 120 volt, outside diameter.
4. Slots between commutator bars may be cleaned as shown in Fig. 44, or using an aerosol spray carburetor cleaner or compressed air after sanding or machining.
5. If it is suspected that the armature field coil, magnets or motor housing is defective, a new part should be tried in the motor. If proper testing equipment is available, check the suspected armature or field coil to determine if it is defective (opens or grounds).
6. The brushes should be checked for poor seating, weak brush springs, dirt, oil or corrosion.
7. If brushes are worn to within 1/8” (3.0 mm) of wire at closest point, replace brushes, Fig. 70.
8. Brushes must move freely in their holders.

Assemble Starter Motor

Lightly lubricate the bearings with #20 oil prior to reassembly.

1. Assemble wiring in commutator end cap for 120 volt AC motor as shown in Fig. 78: white (1), black (2), green (3).
2. Insert brushes and springs in their respective holders, except 4–1/2” (111.0 mm) and 4–9/16” (115.9 mm) housing starters.

Use brush retainers during assembly.

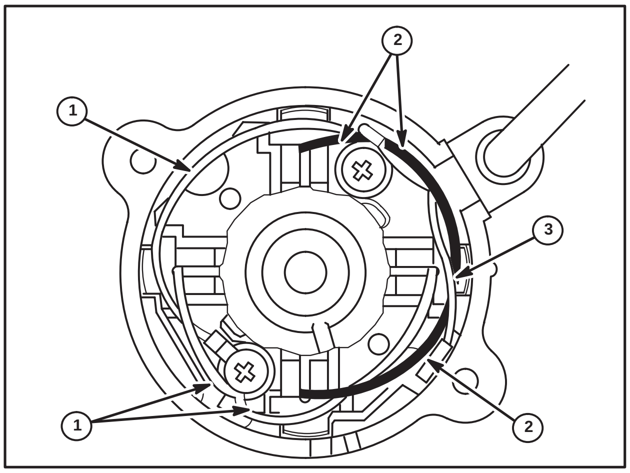


Fig. 78

7B

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

Assemble Housing All Except 4–1/2” (111.0 mm), 4–9/16” (115.9 mm) Housings

1. Slide motor housing over armature with the notch toward commutator end cap.
2. Match alignment marks, Fig. 76.
3. Use care to prevent damage to magnets in motor housing during assembly.
4. Assemble spacers and drive head end bracket, again aligning match marks.
5. Assemble thru bolts and washers.
6. Torque thru bolts, 45 to 55 in. lbs. (5 to 6 Nm) for 1/4-20 thru bolts and 40 to 45 in. lbs. (4 to 5 Nm) for 10-24 thru bolts.
7. Armature end play is .006” (.18 mm) to .038” (1.22 mm) after assembly.

Install Brushes, 4–1/2” (111.0 mm) and 4–9/16” (115.9 mm) Housings

With a small blade screwdriver, bend brush spring out and insert brush in brush holder, Fig. 79.

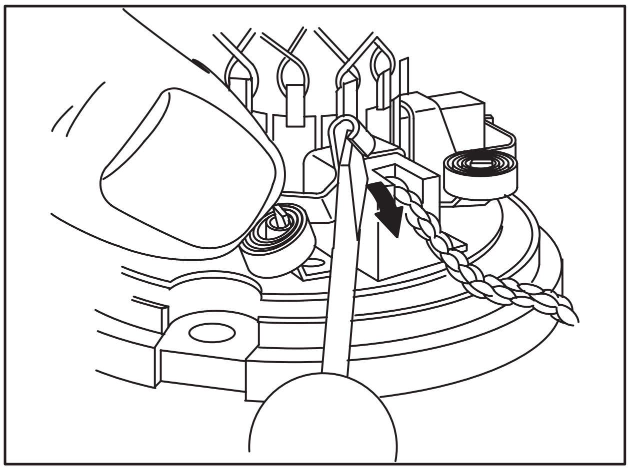


Fig. 79

Assemble Housing to Brush End Cap 4–1/2” (111.0 mm), 4–9/16” (115.0 mm) Housings

This design of starter housing has a large notch (1) which indexes over the insulated terminal, Fig. 80.

1. While pushing down on armature and brush end cap, slide starter housing down until large notch indexes with insulated terminal boss. DO NOT damage magnets in starter housing.
2. Assemble thru bolts and washers.
3. Torque thru bolts, 45 to 55 in. lbs. (5 to 6 Nm) for 1/4-20 thru bolts and 40 to 45 in. lbs. (4 to 5 Nm) for 10-24 thru bolts.

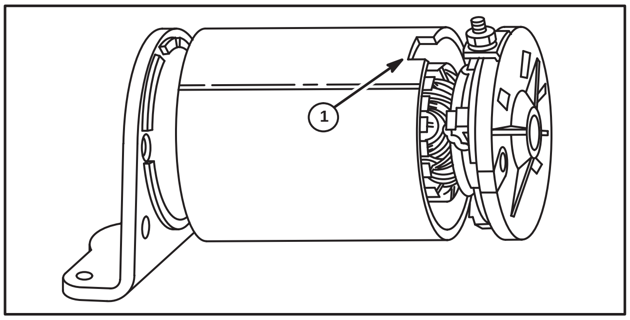


Fig. 80

Before and after repairing the 120 volt AC starter motor, a Hi-Pot test must be made to prevent injury. If the proper test equipment is not available, take the starter motor to a qualified electric motor repair shop for testing.

After assembly of the starter motor drive and Hi-Pot test is passed, the starter motor is now ready for installation to the engine.

American Bosch – Mitsubishi Gear Drive Starter Motors

120 Volt AC, 12 Volt DC Model Series 170000, 190000

See exploded views, Fig. 81, before disassembly.

Thru bolts (1)
Drive assembly (2)
Drive end cap (3)
Housing (4)
Armature assembly (5)
Brushes (6)
End cap commutator (7)
Pinion gear (8)
Helix (9)
Armature shaft (10)
Drive cap (11)
Thrust washer (12)
End cap (13)
Rectifier assembly (14)

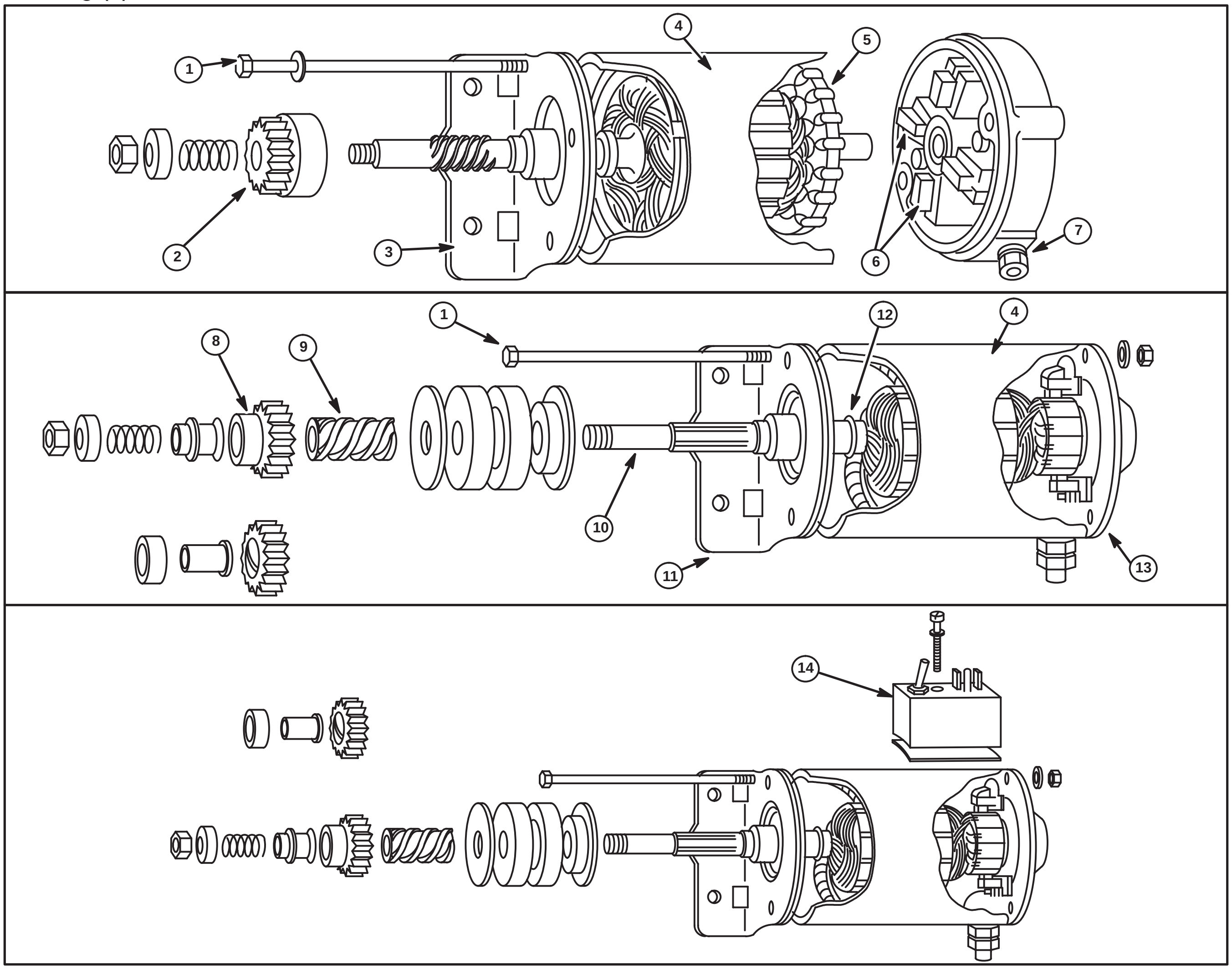


Fig. 81

Disassemble Starter Motor Drive Exploded Views – Fig. 81

WARNING

Unintentional sparking can result in fire or electric shock.

- After servicing, the 120 volt starter motor should be Hi-Pot tested by an electric motor repair shop before reinstalling on engine to determine if a shock hazard exists.

1. Clamp the pinion gear (8) in a vise having brass jaws to prevent damage to the gear teeth.
2. Remove the lock nut and the starter drive (2) and disassemble.

The pinion gear should be inspected for damaged teeth. If a sticking condition exists between the pinion gear and the helix (9), the parts may be washed in a solvent such as Stanisol® or Varsol®. Do not lubricate helix, except with dry silicone spray. If the sticking condition persists, the complete drive assembly must be replaced. Individual parts of the drive assembly are not available.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

Assemble Starter Motor Drive, Fig. 82

1. Reverse disassembly procedure for assembling. When assembling helix to shaft, the spline (1) must face threaded end of shaft, Fig. 82.
2. Torque lock nut to 170 in. lbs. (19 Nm) This torque has an effect on pinion travel, so proper torque should be maintained.

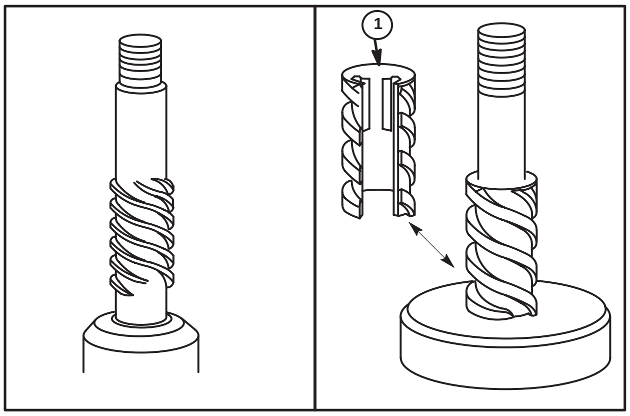


Fig. 82

Disassemble Starter Motor
Fig. 83A – Typical
Fig. 83B – American Bosch 12 Bolt Starting Motor

1. Remove the lockwasher, nuts and thru bolts (1), Fig. 83. Note location of thru bolts and match marks (2). They must be reassembled in the same position to prevent interference.
2. Remove the armature, drive cap and gear drive as an assembly.
3. To remove the commutator end cap (4), lift the brush springs and slide brushes out of the brush holders.
4. Clean all residue from the armature, commutator end cap (3), drive end cap, etc.
5. Do not soak bearings, housing or armature in solvent.
6. The armature commutator may be cleaned with a fine sand paper such as flint or commutator paper and aerosol carburetor cleaner or compressed air. Do not use emery cloth, as emery will embed in the commutator causing rapid brush wear.
7. If it is suspected that the armature, field coil or motor housing is defective, new parts should be tried in the motor.
8. If proper testing equipment is available, check the suspected armature or field coil to determine if it is defective.
9. The brushes should be checked for proper seating, weak brush springs, dirt, oil or corrosion.
10. The brushes must move freely in their holders.

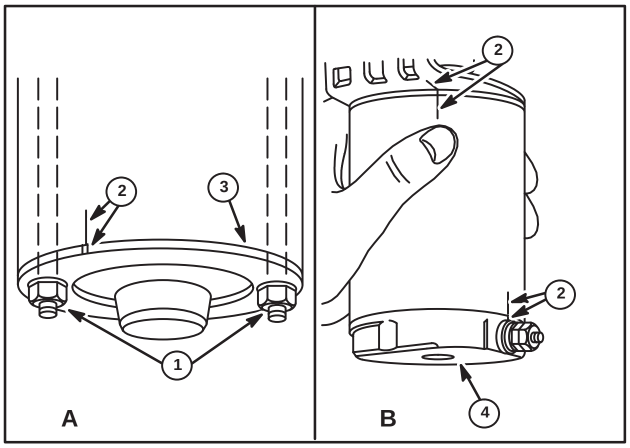


Fig. 83

7B

Assemble Starter Motor

Lightly lubricate bearings with #20 oil prior to reassembly.

1. Insert the brushes (2) in their respective holders, and use brush retainers to hold them during reassembly, Fig. 84.

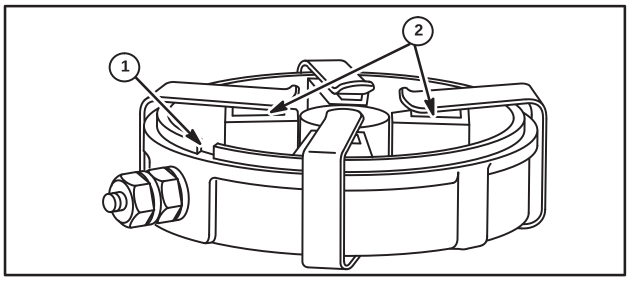


Fig. 84

2. Slide the armature into the motor housing, being sure to match the drive end cap keyway (1) to the stamped key in motor housing, Fig. 84.
3. Assemble end cap, again matching the keyway to key in housing. Use care to prevent damage to ceramic magnets, where used.
4. Assemble thru bolts, lockwashers and nuts.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

SPECIFICATION TABLES

TABLE NO. 1
System 3® System 4®, 6 & 12 Volt Specifications System

Voltage	Minimum Motor RPM	Maximum Amps
6	800	18 (Disregard surge current)
12	1400	9 (Disregard surge current)

TABLE NO. 2
12 Volt DC Starter Specifications Nylon Pinion

Minimum RPM	Maximum Amps
5250	14 (Disregard surge current)

TABLE NO. 3
12 Volt Specifications Steel Pinion

Minimum Motor RPM	Maximum Amps
5600	6 (Disregard surge current)

TABLE NO. 4
120 VOLT SPECIFICATIONS120 Volt Specifications

Minimum Motor RPM	Maximum Amps
8300	1-1/2 (Disregard surge current)

TABLE NO. 5
Briggs & Stratton Starter Motor Identification

Housing Length “L”	Motor Voltage
3–1/16” (78.0 mm)	12
3–1/2” (89.0 mm)	120
3–21/32” (93.0 mm)	12
3–3/4” (95.0 mm)	12
3–13/16” (97.0 mm)	12
4–1/2” (111.0 mm)	12
4–9/16” (115.9 mm)	12

TABLE NO. 6
12 Volt DC Starter Specifications

Motor Housing Length	Minimum RPM	Maximum Amps
3–1/16” (78.0 mm)	6500	18 (Disregard surge current)
3–21/32” (93.0 mm)	6500	18 (Disregard surge current)
3–3/4” (95.0 mm)	6900	19 (Disregard surge current)
3–13/16” (97.0 mm)	6900	19 (Disregard surge current)
4–1/2” (111.0 mm)	6500	20 (Disregard surge current)
4–9/16” (115.9 mm)	6500	35 (Disregard surge current)

TABLE NO. 7
120 Volt AC Starter Specifications

Motor Housing Length	Minimum RPM	Maximum Amps
3-1/2” (89.0 mm)	6500	2.7 (Disregard surge current)

TABLE NO. 8
Digital Multimeter

Red Test Lead (+) Positive	Black Test Lead (–) Negative	“Beep” (Continuity)
A	B	NO
B	A	YES
B	C	NO
C	B	YES
C	D	YES
D	C	NO
D	A	YES
A	D	NO

7B

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

TABLE NO. 9
12 Volt Starter Motor Performance Chart

Starter Motor Identification	Voltage Required	Minimum Motor RPM	Maximum Amps
American Bosch SME-12A-8	6V ± 0.1	5000	25 (Disregard surge current)
American Bosch SMH-12A-11	12V ± 0.3	4800	16 (Disregard surge current)
American Bosch 01965-23-MO-30-SM	12V ± 0.3	5500	16 (Disregard surge current)
Mitsubishi MMO-4FL MMO-5ML MOO1TO2271	6V ± 0.1	6700	16 (Disregard surge current)

TABLE NO. 10
120 Volt Starter Motor Performance Chart

Starter Motor Identification	Voltage Required	Minimum Motor RPM	Maximum Amps
American Bosch SME-110-C3 SME-110-C6 SME-110-C8	120	7400	3-1/2 (Disregard surge current)
American Bosch 06026-28-M030SM	120	7400	3 (Disregard surge current)
Mitsubishi J282188	120	7800	3-1/2 (Disregard surge current)

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 41 OF THIS SECTION.

SECTION 7C
Alternators

Section Contents

7C

Section Contents, Cont'd.

Briggs & Stratton Alternator Systems

Single Cylinder Engine Models

The alternator systems used on Briggs & Stratton single cylinder engines can be identified by the color of the output wire and connector. Table No. 1, lists the various alternator system, engine model applications. Test procedures are listed by page number, reference illustrations by Fig. number.

TABLE NO. 1

Basic Model Series	90000 110000	120000	130000	170000	190000	220000	240000	250000	280000	320000
System 3® System 4®	Fig. 1 p. 4									
1/2 Amp		Fig. 3 p. 4								
1.2 Amp (Current)			Fig. 4 p. 5							
1-1/2 Amp (Early)			Fig. 5 p. 5							
DC Only				Fig. 6 p. 5	Fig. 6 p. 5	Fig. 6 p. 5	Fig. 6 p. 5	Fig. 6 p. 5	Fig. 6 p. 5	Fig. 6 p. 5
AC Only					Fig. 7 p. 6	Fig. 7 p. 6	Fig. 7 p. 6	Fig. 7 p. 6	Fig. 7 p. 6	Fig. 7 p. 6
Dual Circuit				Fig. 8 p. 5	Fig. 8 p. 5	Fig. 8 p. 5	Fig. 8 p. 5	Fig. 8 p. 5	Fig. 8 p. 5	Fig. 8 p. 5
Tri-Circuit					Fig. 9 p. 6	Fig. 9 p. 6	Fig. 9 p. 6	Fig. 9 p. 6	Fig. 9 p. 6	Fig. 9 p. 6
Quad Circuit								Fig. 10 p. 7	Fig. 10 p. 7	
5 & 9 Amp Regulated					Fig. 11 p. 7			Fig. 11 p. 7	Fig. 11 p. 7	Fig. 11 p. 7
10 & 16 Amp Regulated					Fig. 12 p. 7	Fig. 12 p. 7	Fig. 12 p. 7	Fig. 12 p. 7	Fig. 12 p. 7	Fig. 12 p. 7

NOTE: All alternators are rated at 3600 RPM, except Model Series 90000, 110000, 120000 which are rated at 2800 RPM. Output is reduced as engine speed is lowered.

7C

IDENTIFICATION

Figs. 1 through 12 illustrate the different types of alternator systems discussed in this section.

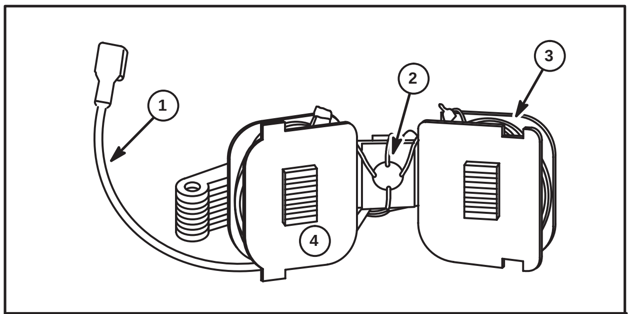
SYSTEM DESCRIPTIONS

System 3® and 4® Alternator

The DC alternator operates as an integral part of the engine, separate from the starting and ignition systems. It provides DC charging current to a 6 or 12 volt battery.

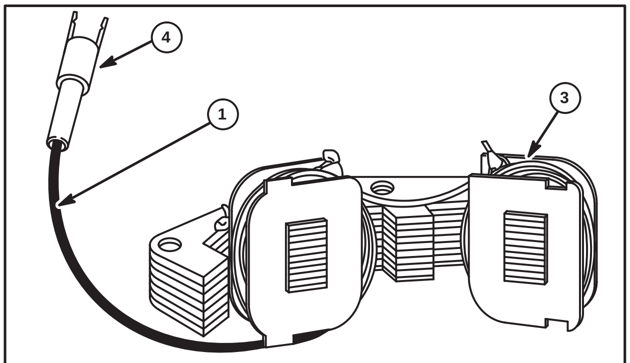
Two styles of stator have been used. The early style was used before Date Code 84052300 on 6 volt systems, Fig. 1.

The current style has been used since Date Code 84052200 on both 6 and 12 volt systems, Fig. 2.



- .5 Amps DC+ charging for battery
- One BLACK lead (1) from stator (3)
- Full wave rectifier (2)

Fig. 1



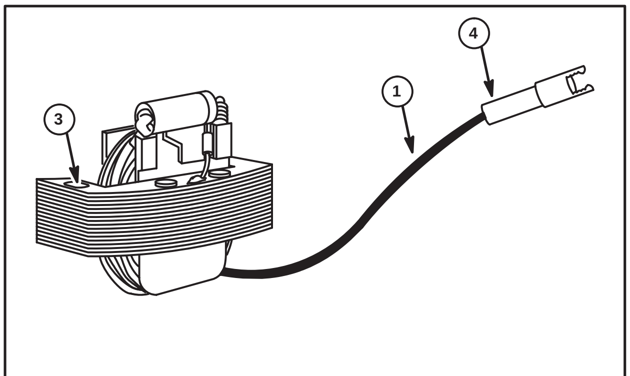
- .5 Amps DC+ charging for battery
- One BLACK lead (1) from stator (3)
- WHITE connector output lead (4)

Fig. 2

7C

1/2 AMP ALTERNATOR Used on MODEL SERIES 121700 – 124700 (Fig. 3)

The 1/2 amp DC alternator is designed to operate as an integral part of the engine and is separate from the starting and ignition system. It is intended to provide DC charging current for a 12 volt battery.

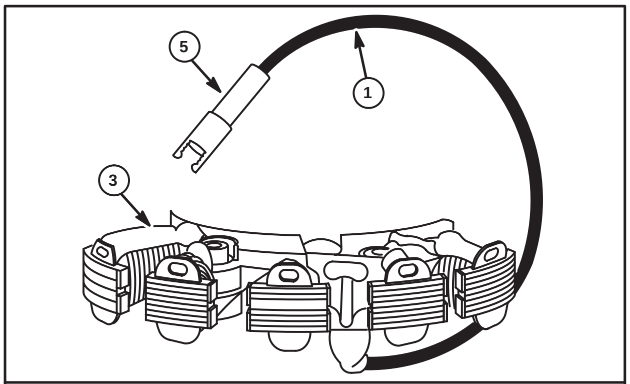


- .5 amps DC+ for charging battery
- One BLACK lead (1) from stator (3)
- WHITE connector output lead (4)

Fig. 3

1.2 AMP ALTERNATOR
Used on Model Series 130000
After Date Code 91032400 (Fig. 4)

The 1.2 amp DC alternator provides current for charging a 12 volt battery. A 12 ampere hour battery is suggested for warm temperature operation and a 24 ampere hour for cold service.



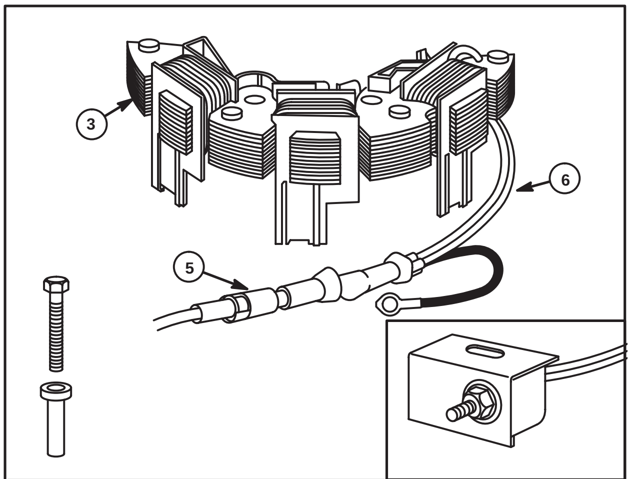
- 1.2 amps DC+ for charging battery
- One BLACK lead (1) from stator (3)
- RED connector output lead (5)

Fig. 4

1-1/2 AMP ALTERNATOR
Used on Model Series 130000
Before Date Code 91032500 (Fig. 5)

The integral 1-1/2 amp alternator, with solid state rectifier, is designed for use with a compact battery. A 12 ampere hour battery is suggested for warm temperature operation and a 24 ampere hour for cold service.

The alternator is rated at 3600 RPM. Output is reduced at lower engine RPM.

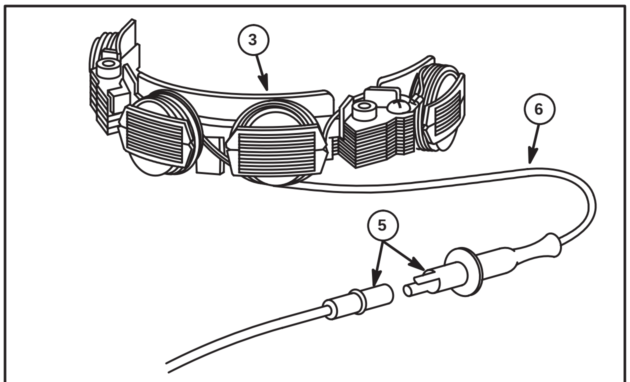


- 1-1/2 amps DC+ charging for battery
- Two RED leads (6) from stator (3)
- RED connector output lead (5)

Fig. 5

DC Only Alternator (Fig. 6)

The DC alternator provides DC current for charging a 12 volt battery. The current from the alternator is unregulated and is rated at 3 amps at an engine speed of 3600 RPM.

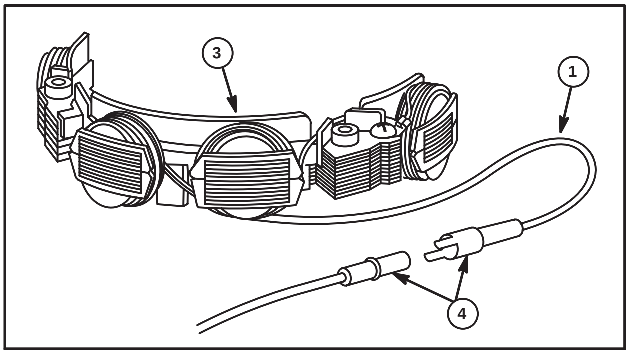


- 3 amps DC+ for charging battery
- One RED lead (6) from stator (3)
- Diode encased at connector
- RED connector output lead (5)

Fig. 6

AC Only Alternator (Fig. 7)

The AC alternator provides current for headlights only. Current for the lights is available only while the engine is running. Output depends upon engine speed. 12 volt lights with a total rating of 60 to 100 watts may be used. With lights rated at 70 watts, the voltage rises from 8 volts at 2400 RPM to 14 volts at 3600 RPM, so headlight brightness changes with engine speed.



- 14 volts AC for lighting circuit
- One BLACK lead (1) from stator (3)
- WHITE connector output lead (4)

Fig. 7

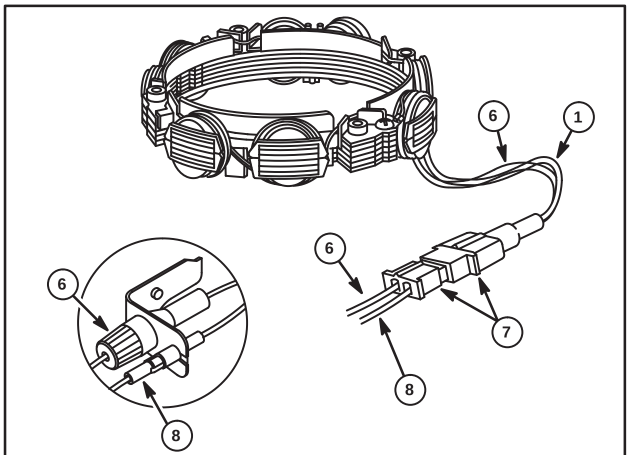
Dual Circuit Alternator (Fig. 8)

The dual circuit alternator uses a single polarized plug with two pins. One pin is for charging the battery and the second is for lights. Earlier dual circuit alternators used a separate connector for each of the circuits.

The dual circuit alternator provides DC current for battery charging and an independent AC circuit for headlights. The battery is not used for lights, so lights are available even if battery is disconnected or removed.

Current for lights is available only while engine is running. Output depends upon engine speed, so headlight brightness changes with engine speed. 12 volt lights with a total rating of 60 to 100 watts may be used. With lights rated at 70 watts, the voltage rises from 8 volts at 2400 RPM to 12 volts at 3600 RPM.

The current from the DC side of the alternator is unregulated and is rated at 3 amps. The output rises from 2 amps at 2400 RPM to 3 amps at 3600 RPM.



- 3 amps DC+ for charging battery, RED lead (6)
- 14 volts AC for lighting circuit, BLACK lead (1) up to connector, WHITE lead (8) after connector
- Diode encased at connector
- WHITE connector (7) with two pin terminals

Fig. 8

Tri-Circuit Alternator (Fig. 9)

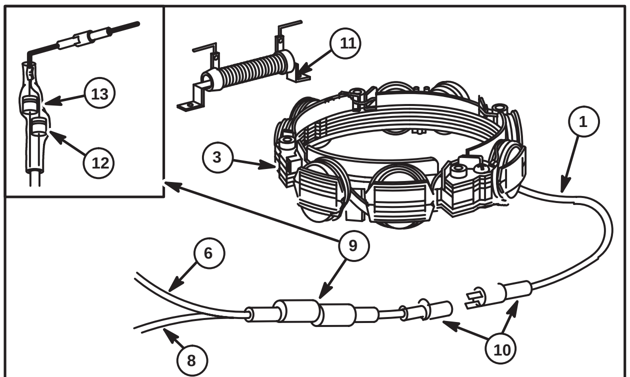
The tri-circuit alternator provides alternating current through a single output lead and connector to a wiring harness containing two diodes.

One diode rectifies the AC current to 5 Amps – (negative) DC for lights. The second diode rectifies AC current to 5 Amps + (positive) DC for battery charging and external loads, such as an electric clutch.

NOTE: Some OEMs supply diodes as an integral part of the equipment wiring harness.

A 1 OHM 20 Watt resistor may be placed in series with the (+) DC charging lead, limiting the charging current to approximately 3 amps when the clutch is not engaged. When the clutch is engaged the resistor is bypassed allowing full output to the battery and clutch.

NOTE: The 1 OHM 20 Watt resistor is supplied by the equipment manufacturer, when required.



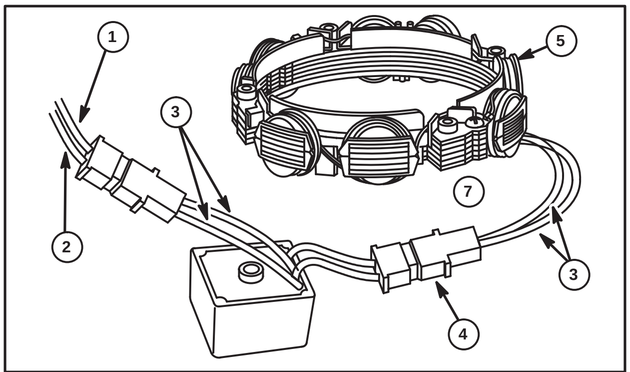
- 28 volts AC from stator (3) to diodes (9)
- One BLACK lead (1) from stator
- GREEN connector (10)
- WHITE lead (8) for lights
- RED lead (6) connector to battery and clutch
- 1 OHM 20 Watt Resistor (11)
- Charging (12) and Light (13) diodes

Fig. 9

Quad Circuit Alternator (Fig. 10)

The quad circuit alternator system provides AC current through two output leads to the regulator-rectifier. The regulator-rectifier converts AC current to DC and provides unregulated current (5 amps DC–) for lighting and regulated current (5 amps DC+) for charging the battery. The charging rate will vary with engine RPM and temperature.

NOTE: The quad circuit and 10-16 amp regulated system use the same stator.



- 5 amps DC+ regulated for charging battery
- 5 amps DC– unregulated for lights (White lead)
- Two BLACK leads (3) from stator (5) into yellow connector (4)
- WHITE lead to lights (1)
- RED lead to battery (2)

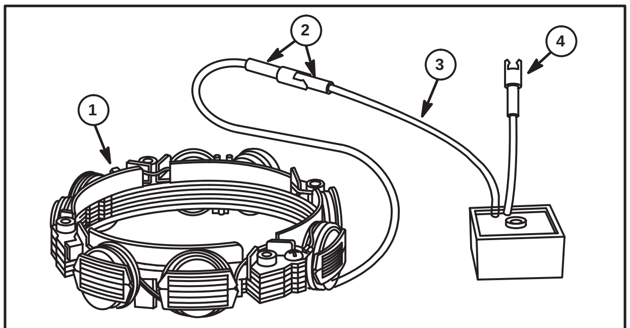
Fig. 10

5 & 9 AMP Regulated Alternator (Fig. 11)

The 5 & 9 amp regulated alternator systems provide AC current through a single lead to the regulator-rectifier. The regulator-rectifier converts the AC current to DC, and regulates current to the battery. The charging rate will vary with engine RPM, battery state of charge, and temperature.

Alternator output (5 or 9 amp) is determined by the flywheel alternator magnet size. The stator and regulator-rectifier are the same for the 5 and 9 amp system.

The 5 & 9 amp regulated system and the Tri-Circuit system use the same stator.



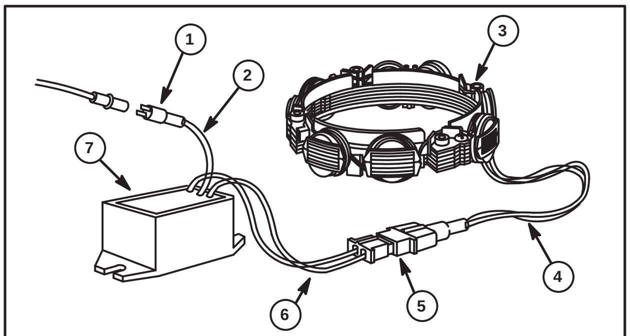
- 5 or 9 amps DC+ regulated for charging battery
- One BLACK lead from stator (1)
- GREEN connector (2) from stator
- YELLOW lead (3) to regulator-rectifier
- One RED lead (4) from regulator-rectifier with RED connector

Fig. 11

10 & 16 Amp Regulated Alternator (Fig. 12)

The 10 & 16 amp regulated alternator system provides AC current through two output leads to the regulator-rectifier. The regulator-rectifier converts the AC current to DC, and regulates the current to the battery. The charging rate will vary with engine RPM, battery state of charge, and temperature.

Alternator output (10 or 16 amp) is determined by flywheel alternator magnet size. The stator and regulator-rectifier are the same for the 10 and 16 amp system.



- 10 or 16 amps DC+ regulated for charging battery
- Two BLACK leads (4) from stator (3)
- YELLOW connector (5) with two pin terminals
- Two YELLOW leads (6) to regulator-rectifier
- One RED lead (2) from regulator-rectifier to RED connector output lead (1)
- 10 and 16 amp systems use the same stator, color coding and regulator-rectifier (7)
- Alternator output is determined by flywheel alternator magnet size

Fig. 12

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TROUBLESHOOTING

1. Battery Not Charging
   a. Engine RPM too low
   b. Defective battery
   c. Loose or corroded battery ground leads
   d. Open, shorted or grounded wires between output connector and battery
   e. Defective diode (open or shorted)
   f. Defective or improperly grounded regulator-rectifier
   g. Diode installed incorrectly (reversed)
   h. Excessive current draw from accessories
   i. Low magnetic flux or damaged alternator magnets
2. Battery In State Of Overcharge
   a. Severe battery vibration (missing or broken tie down straps)
   b. Battery rate of charge not matched to alternator output
   c. Damaged battery (shorted battery cells)
   d. Defective regulator
   e. One ohm resistor shorted or grounded (Tri-Circuit only)
   f. Battery too small (Amp/Hour Rating)
3. Headlights Not Working
   a. Inline fuse “blown” (if equipped)
   b. Defective headlights
   c. Loose or corroded wires
   d. Open, shorted, or grounded wires between output connector and headlights
   e. Defective diode (Tri-Circuit, open or shorted, white output lead side)
   f. Low magnetic flux or damaged alternator magnets
4. Electric Clutch Not Working (Tri-Circuit)
   a. Engine RPM too low
   b. Inline fuse “blown” (if so equipped)
   c. Loose or corroded wires
   d. Open, shorted or grounded wires between output connector and electric clutch
   e. Defective diode (open or shorted, red output lead side) NOTE: Battery will also not charge.
   f. Defective electric clutch switch
   g. Open, shorted, or grounded clutch circuit
   h. Low magnetic flux or damaged alternator magnets

Equipment To Test Alternators

Digital Multimeter

The Digital Multimeter (DMM), Briggs & Stratton Tool #19464, may be used to read volts, ohms or amperes, and test diodes, Fig. 13.

NOTE: The DMM is equipped with two fuses to prevent damage to the meter in the event that the input limits are exceeded. If the meter displays a reading of 0.00 when testing DC output (A ⎓), check fuses in meter. Refer to FLUKE Operators Manual for procedure for checking fuses. Replacement fuses are available as service part #19449.

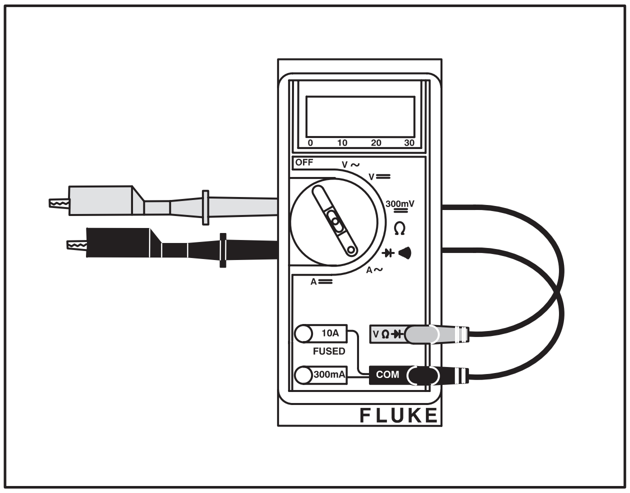

Fig. 13

DC Shunt

The DMM will withstand DC input of 10 to 20 Amps for up to **30** seconds. When checking DC output on 16 Amp regulated system, use the DC shunt, Tool #19359, Fig. 14, to avoid blowing fuse in meter.

Tachometer

Digital tachometer, Briggs & Stratton Tool #19389, Fig. 15.

IMPORTANT NOTE: Check battery polarity. Negative (–) side of battery should be grounded to engine or frame; positive (+) side of battery to starter motor and alternator charge lead. If reversed, rectifier and/or battery will be damaged.

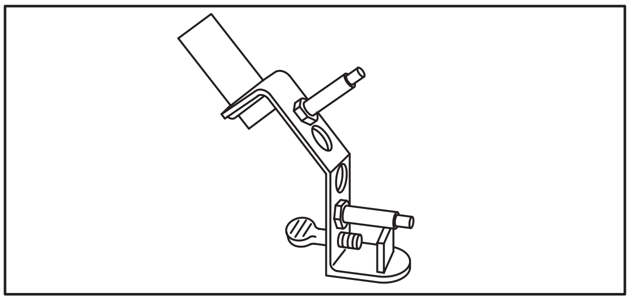

Fig. 14

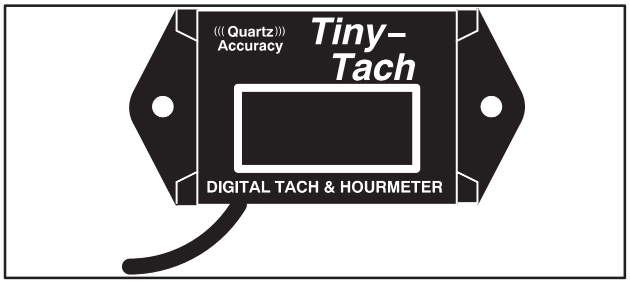

Fig. 15

Testing Alternator Output

Test Procedure Sequence:

1. Test alternator output.
2. Test diode(s) or regulator-rectifier (if equipped).

NOTE: All alternator output specifications are rated at a specific RPM. Before testing alternator output (volts, amps), first use an accurate tachometer and temporarily adjust engine speed to RPM specified in test instructions.

System 3®, 4® and Dual Circuit Alternators

Alternator Output Test Procedures

Test DC Amp Output

1. Insert RED test lead (3) into 10 A receptacle in meter.
2. Insert BLACK test lead (2) into COM receptacle in meter.
3. Rotate selector to A⎓ (DC amps) position.
4. Attach RED test clip to stator output lead (4), Fig. 16 (Typical).
   See Fig. 17 for Dual Circuit alternator. The RED wire (5) is DC output. The bump on the connector indicates the DC output terminal (6)
5. Attach BLACK test clip (2) to the positive (+) battery terminal or charging harness lead (1).

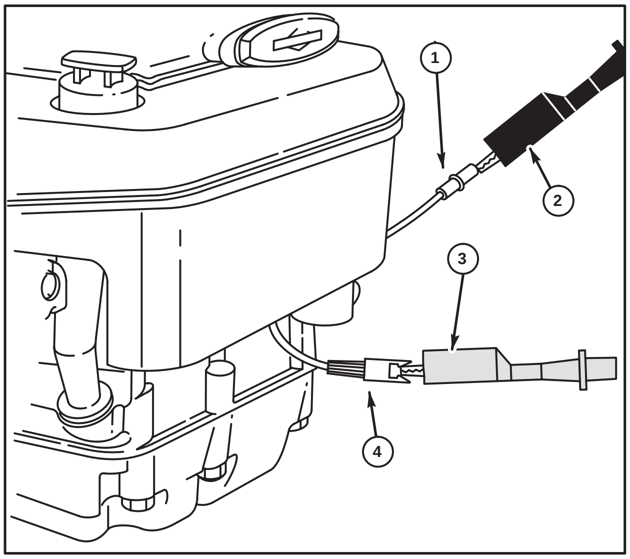

Fig. 16

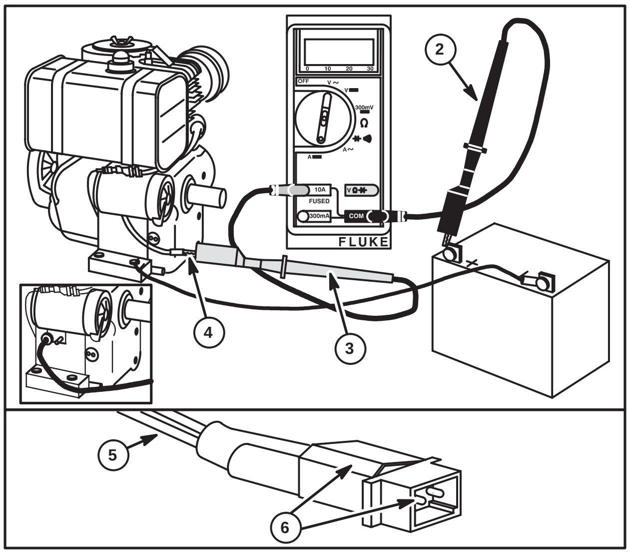

Fig. 17

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6. With engine running at specified RPM, output should be as listed in Table No. 2, Specifications.
7. If low or no output, check stator air gap, when applicable. See Table No. 2, Specifications.
8. If stator air gap is within specification and there is low or no output, replace stator.

Test AC Voltage Output

Procedures are common to all systems with exceptions noted below.

Temporarily disconnect stator wire harness from regulator-rectifier. (5 & 9 amp Regulated Alternator)

1. Insert RED test lead (3) into V Ω ▶| receptacle in meter.
2. Insert BLACK test (1) lead into COM receptacle in meter.
3. Rotate selector to V∼ (AC volts) position.
4. Attach RED test lead clip to AC output terminal (2), Fig. 18, Typical.
   See Fig. 19 for Dual Circuit alternator.

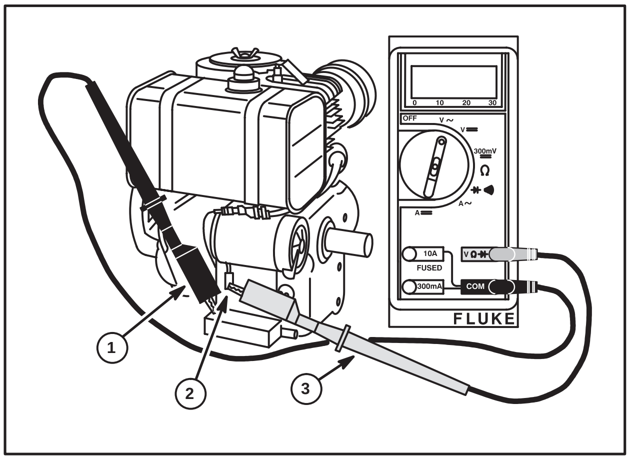

Fig. 18

5. The BLACK wire (1) is AC output. Connect the RED lead (2) to the output lead or AC output terminal (4).
   Ground the BLACK lead (4) to the engine.
   The bump on the connector indicates the AC output terminal (6)
   a. (Quad Circuit and 10 & 16 amp Regulated Alternators) Insert RED (2) and BLACK (3) test lead probes into output terminals in yellow connector (6), as shown in Fig. 20. (Meter test clip leads may be attached to either terminal.)

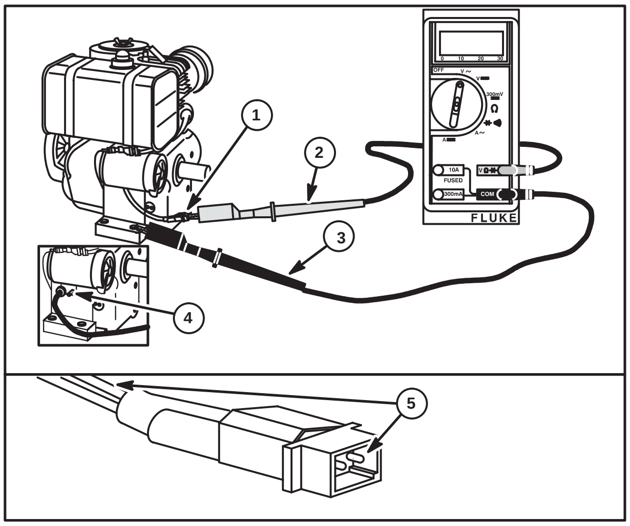

Fig. 19

6. Attach BLACK test lead clip to engine ground.
7. With engine running at 3600 RPM, AC output should be as listed in Table No. 3, Specifications.
8. If no or low output is found, check for bare wires or any other obvious defects. If "shorted" leads are not visible, replace the stator.
9. If alternator output is good, test diodes located in wiring harness. (Tri Circuit Alternator)

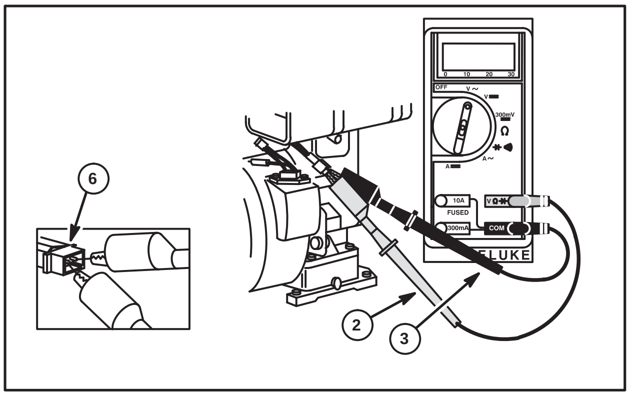

Fig. 20

Stator Air Gap Adjustment (Typical)

See Table No. 2, Specifications, if applicable.

1. Rotate flywheel until magnets are away from stator.
2. Loosen both stator mounting nuts and move stator away from flywheel and tighten one nut.
3. Place a .006” (.17 mm) or .010” (.25 mm) thick gauge (7), depending on application, between stator and flywheel.
4. Turn flywheel until magnets are under stator. Loosen nut and let stator be pulled against flywheel magnet.
5. Torque mounting nuts to 25 in. lbs. (3 Nm).
6. Turn flywheel to remove gauge, Fig. 21.

Replace Defective Stator

1-1/2 Amp Alternator
Used on Model Series 130000
Before Date Code 91032500

1. Remove the blower housing, rotating screen, rewind clutch and flywheel (1).

   Note: Location of stator wires: under one coil spool and between starter and starter drive housing as shown in Fig. 22.

2. Remove ground wire (5) or rectifier assembly (3, early style) from starter drive housing.
3. Remove the two stator mounting screws (2) and bushings.
4. Install new stator assembly (4) with stator mounting screws and bushings. Be sure leads (7) are properly positioned as shown in Fig. 23.
5. While tightening mounting screws (2), push stator toward crankshaft to take up clearance in bushings (6).
6. Torque mounting screws to 20 in. lbs. (2 Nm).
7. Before re-assembly, locate stator wires against cylinder in order to clear ring gear and flywheel.
8. Attach ground wire or rectifier assembly (early style) to drive housing.
9. Replace flywheel and torque rewind clutch as noted on specification chart.
10. Reassemble rotating screen and blower housing.

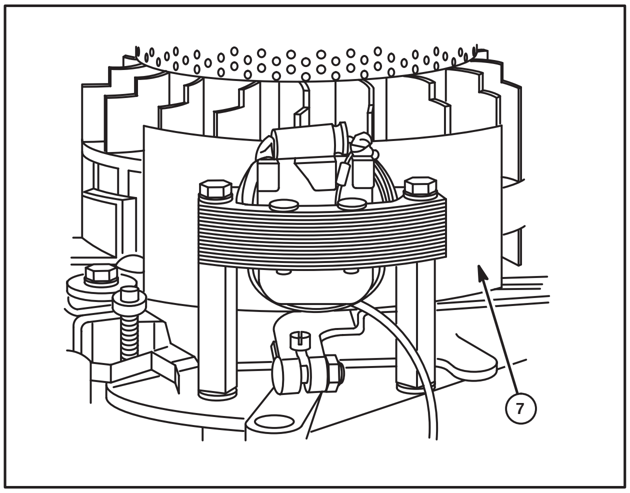

Fig. 21

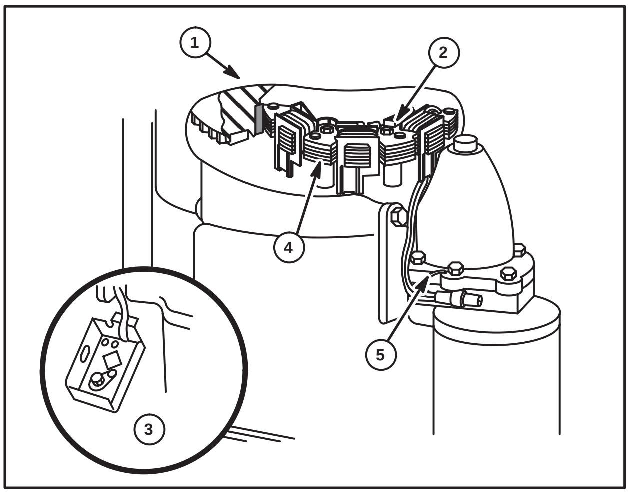

Fig. 22

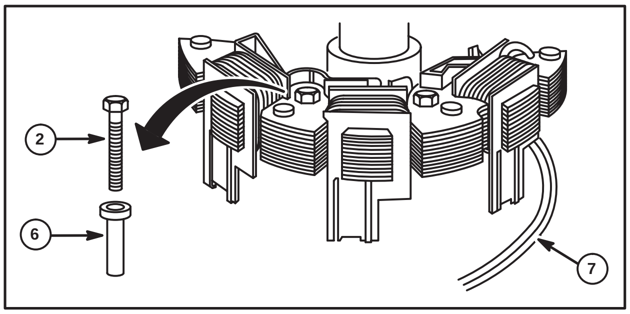

Fig. 23

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Rectifier (Diode) Test

Note: In the Diode Test position, the DMM will display the forward voltage drop across the diode(s) in the rectifier. If the voltage drop is less than 0.7 volts, the meter will “Beep” once as well as display the voltage drop. A continuous tone indicates continuity (shorted diode). An incomplete circuit (open diode) will be displayed as “OL.”

1-1/2 Amp Alternator Used on Model Series 130000 Before Date Code 91032500

1. Insert RED test lead (1) into V Ω ▶| receptacle in meter.
2. Insert BLACK test lead (2) into COM receptacle in meter.
3. Rotate selector to ▶| •))) (Diode Test) position.
4. Attach BLACK test lead clip to output terminal. Leave BLACK test lead attached through Step 6, below.
5. Pierce one output wire with a pin and touch RED test lead probe to pin as shown in Fig. 24, Typical.
   a. Meter should “Beep.”
   b. If meter makes a continuous tone or displays “OL” rectifier is defective. Replace.
6. Repeat test with other output wire.
   a. Meter should “Beep.”
   b. If meter makes a continuous tone or displays “OL” rectifier is defective. Replace.
7. Attach RED test lead clip to a clean unpainted area on engine (good ground). Leave RED test lead clip attached for remainder of test.
8. Pierce one stator output wire with a pin and touch BLACK test lead probe to pin.
   a. Meter should “Beep.”
   b. If meter makes a continuous tone or displays “OL” rectifier is defective. Replace.
9. Repeat test with other stator output wire.
   a. Meter should “Beep.”
   b. If meter makes a continuous tone or displays “OL” rectifier is defective. Replace.
10. If rectifier tests OK, replace stator and re-test DC output.

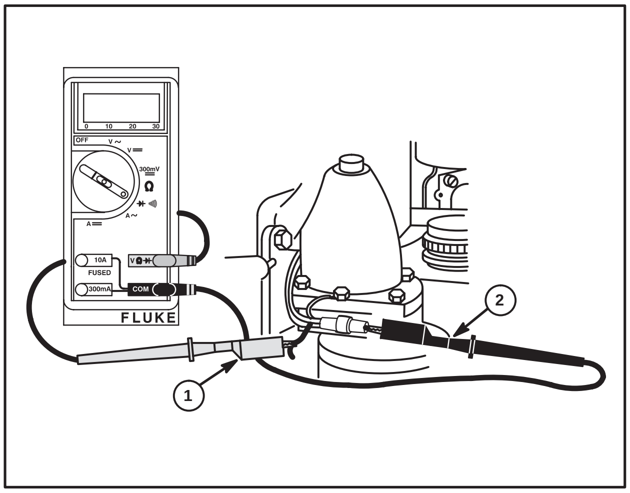

Fig. 24

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DC Only Alternator Test

Test procedures for both systems are identical.

1. Insert RED test lead (1) into V Ω ⏵| receptacle in meter.
2. Insert BLACK test lead (2) into COM receptacle in meter.
3. Rotate selector to ⏵|))))) (Diode Test) position.
4. Attach RED test lead clip to point “A” and Black test lead clip to point “B,” Fig. 25 (DC Only), Fig. 26 (Dual Circuit). (It may be necessary to pierce the red (3) wire with a pin as shown.)
   a. If meter “Beeps” once, diode is OK.
   b. If meter makes a continuous tone, diode is defective (shorted).
   c. If meter displays “OL,” proceed to step 5.
5. Reverse test leads.
   a. If meter “Beeps” once, diode is installed backwards.
   b. If meter still displays “OL,” diode is defective (open).
6. If diode tests OK, replace the stator.

NOTE: Service replacement diode harnesses are available. Use Rosin Core solder when installing new harness. Use shrink tubing or tape for all connections. DO NOT USE CRIMP CONNECTORS.

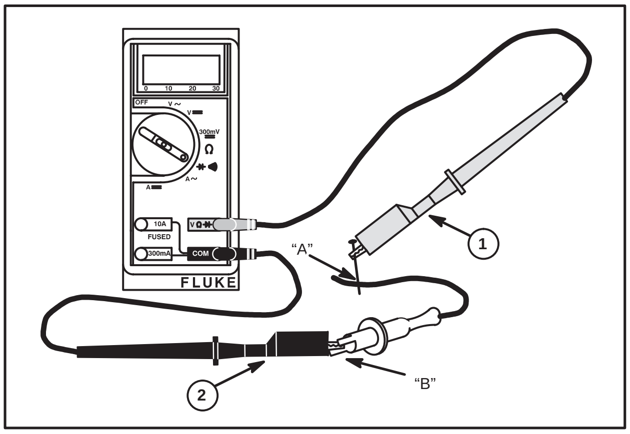

Fig. 25

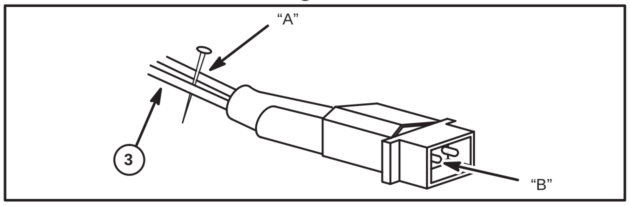

Fig. 26

Tri-Circuit Alternator Test

NOTE: One diode is for the charging circuit and the other diode is for the lighting circuit.

Charging Circuit (Red Wire B+)
Lighting Circuit (White Wire B–)

Procedures are identical except for steps 4 and 5 (see text).

1. Insert RED test lead into V Ω ⏵| receptacle in meter.
2. Insert BLACK test lead into COM receptacle in meter.
3. Rotate selector to ⏵|))))) (Diode Test) position.
4. **Charging Circuit (Red Wire B+)** Attach BLACK test lead (2) clip to point “A,” Fig. 27. (It may be necessary to pierce red wire (3) with a pin as shown.) Insert RED test lead (1) probe into harness connector.

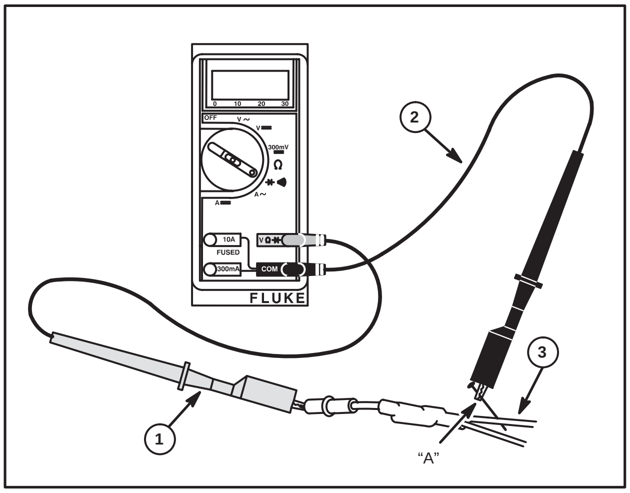

Fig. 27

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5. **Lighting Circuit (White Wire B–)** Attach RED test lead (1) clip to point "A," Fig. 28. (It may be necessary to pierce white wire (4) with a pin as shown.) Insert BLACK test lead (2) probe into harness connector.
   a. If meter "Beeps" once, diode is OK.
   b. If meter makes a continuous tone, diode is defective (shorted). Replace.
   c. If meter displays "OL," proceed to step 6.
6. Reverse test leads.
   a. If meter "Beeps" once, diode is installed backwards.
   b. If meter still displays "OL," diode is defective (open). Replace.

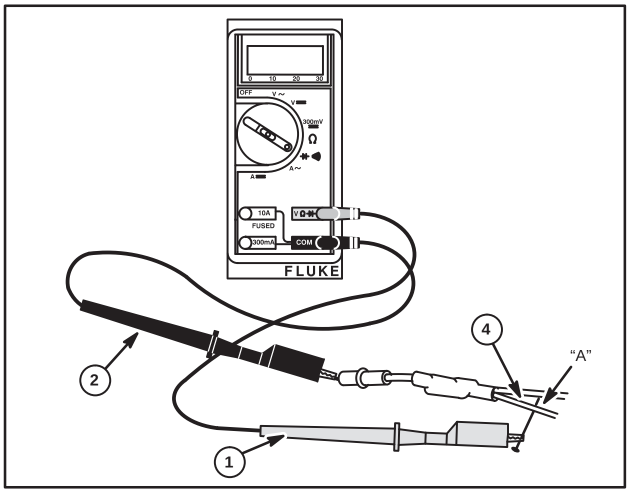

Fig. 28

Quad Circuit Alternator

Test Charging Circuit (DC+)

NOTE: Regulator-rectifier will not function unless it is grounded to engine. Make sure the regulator-rectifier is securely mounted to engine.

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When testing regulator-rectifier for amperage output a 12 volt battery with a minimum charge of 5 volts is required. There will be no charging output if battery voltage is below 5 volts.

NOTE: Connect test leads securely before starting engine. If a test lead vibrates loose while engine is running, regulator-rectifier may be damaged.

1. Insert RED test lead into 10 A receptacle in meter.
2. Inset BLACK test lead into COM receptacle in meter.
3. Rotate selector to A ═ (DC amps) position.
4. Attach RED test lead (1) clip to charging output pin (3, red wire), Fig. 29.
5. Attach BLACK test lead (2) clip to positive (+) battery terminal.
6. With engine running at 3600 RPM output should be 3 to 5 amps. Amperage will vary with battery voltage. A fully charged battery will show less amperage.
7. If no output or low output is found, replace regulator-rectifier.

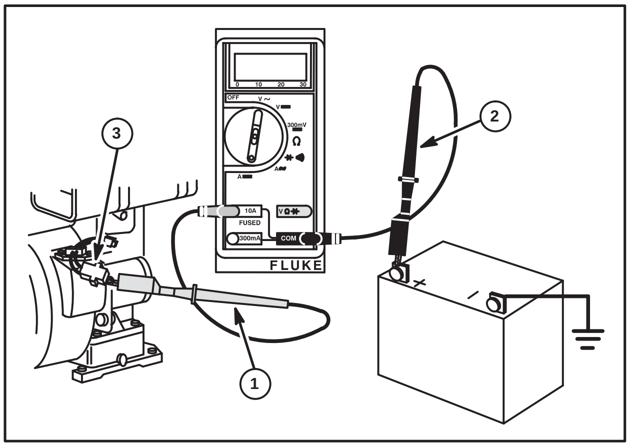

Fig. 29

Test Lighting Circuit (DC–)

The black wire from the regulator-rectifier provides 5 amps (-) DC and is used only for lighting. If the headlights do not operate, first check bulbs, wiring and/or light switch. To test lighting circuit requires a 1 OHM 20 Watt resistor (4, available from an electrical supply house) and a test harness (5, made from 393362) shown in Fig. 30.

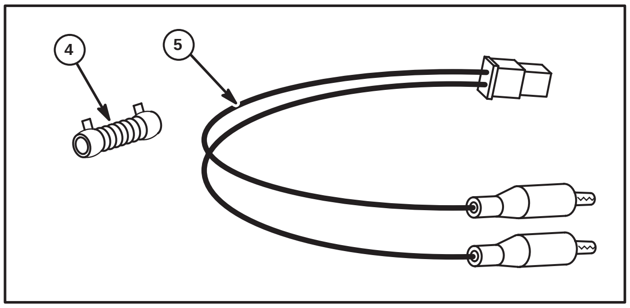

Fig. 30

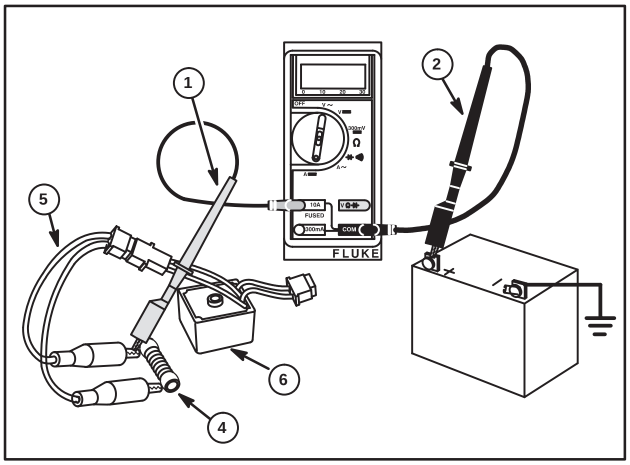

Fig. 31

1. Insert RED test lead (1) into 10 A receptacle in meter.
2. Inset BLACK test lead (2) into COM receptacle in meter.
3. Rotate selector to A ⎓ (DC amps) position.
4. Connect test harness (5) to output connector and attach alligator clips to 1 ohm 20 watt resistor (4) as shown in Fig. 31.
5. Attach RED test lead clip to resistor, and BLACK test lead clip to positive (+) battery terminal.
6. With engine running at 3600 RPM output on the meter should be approximately 8 amps.
7. If no output or low output is found, replace the regulator-rectifier (6).

CAUTION

The resistor will become hot during this test procedure, conduct test quickly.

Severe thermal burns can occur on contact.

5 & 9 AMP Regulated Alternator

Testing Regulator-Rectifier

NOTE: Regulator-rectifier will not function unless it is grounded to engine. Make sure the regulator-rectifier is securely mounted to engine.

When testing regulator-rectifier for amperage output, a 12 volt battery with a minimum charge of 5 volts is required. There will be no charging output if battery voltage is below 5 volts.

NOTE: Connect test leads securely before starting engine. If a test lead vibrates loose while engine is running, the regulator-rectifier may be damaged.

1. Insert RED test lead (1) into 10 A receptacle in meter.
2. Insert BLACK test lead (2) into COM receptacle in meter.
3. Rotate selector to A ⎓ (DC amps) position.

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4. Attach RED test lead clip to DC output terminal on the red output connector on the regulator-rectifier (3), Fig. 32.
5. Attach BLACK test lead clip to positive (+) battery terminal.
6. With the engine running at 3600 RPM. The output should be:

*** 3-5 Amps – 5 Amp System**

*** 3-9 Amps – 9 Amp System**

* Depending upon battery voltage. A fully charged battery will show less amperage.

7. If no output or low output is found, replace the regulator-rectifier.

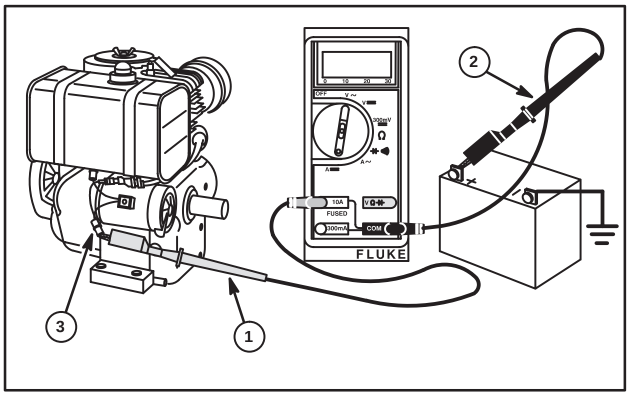

Fig. 32

10 & 16 Amp Regulated Alternator

Test Regulator-Rectifier

NOTE: The DMM will withstand DC input of 10 to 20 Amps for up to **30** seconds. When checking DC output of 16 Amp regulated system, use DC Shunt, Tool #19359, to avoid blowing fuse in meter. <u>See special instructions for installation procedure on 16 Amp system.</u>

NOTE: Regulator-rectifier will not function unless it is grounded to engine. Make sure the regulator-rectifier is securely mounted to engine.

When testing regulator-rectifier for amperage output, a 12 volt battery with a minimum charge of 5 volts is required. There will be no charging output if battery voltage is below 5 volts.

NOTE: Connect test leads securely before starting engine. If a test lead vibrates loose while engine is running, the regulator-rectifier may be damaged.

Testing Regulator-Rectifier 10 Amp System

1. Insert RED test lead (1) into 10 A receptacle in meter.
2. Insert BLACK test lead (2) into COM receptacle in meter.
3. Rotate selector to A ⎓ (DC amps) position.
4. Attach RED test lead clip to DC output terminal on regulator-rectifier (3), Fig. 33.
5. Attach BLACK test lead clip to positive (+) battery terminal.
6. With the engine running at 3600 RPM. The output should be:

*** 3-10 Amps – 10 Amp System**

* Depending upon battery voltage. A fully charged battery will show less amperage.

7. If no output or low output is found, replace the regulator-rectifier.

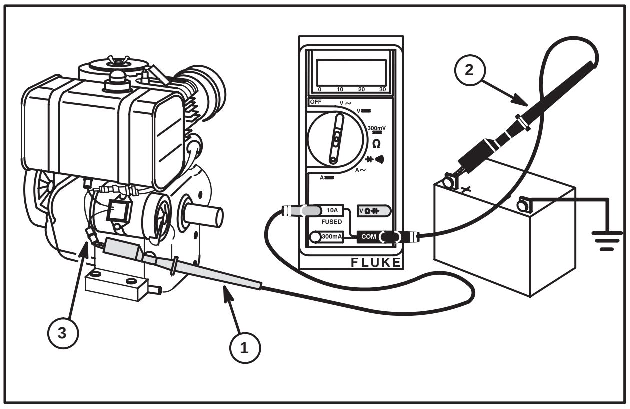

Fig. 33

16 Amp System

To avoid blowing fuse in meter when testing DC output of 16 Amp system the DC Shunt, Tool #19359 (3) is required.

The DC Shunt **must** be installed on the **–** (**negative**) terminal of the battery, Fig. 34. All connections must be clean and secure.

1. Install shunt on negative battery terminal.
2. Insert RED test lead (1) into **V** Ω ⊣+ receptacle in meter and connect to RED post terminal on shunt, Fig. 34.
3. Insert BLACK test lead (2) into COM receptacle in meter and connect to BLACK post terminal on shunt.
4. Rotate selector to **300mV** ⎓ position.
5. Attach RED test lead clip to DC output terminal on regulator-rectifier, Fig. 34.
6. With the engine running at 3600 RPM. The output should be:

*** 3-16 Amps – 16 Amp System**

* Depending upon battery voltage. A fully charged battery will show less amperage.

7. If no output or low output is found, replace the regulator-rectifier.

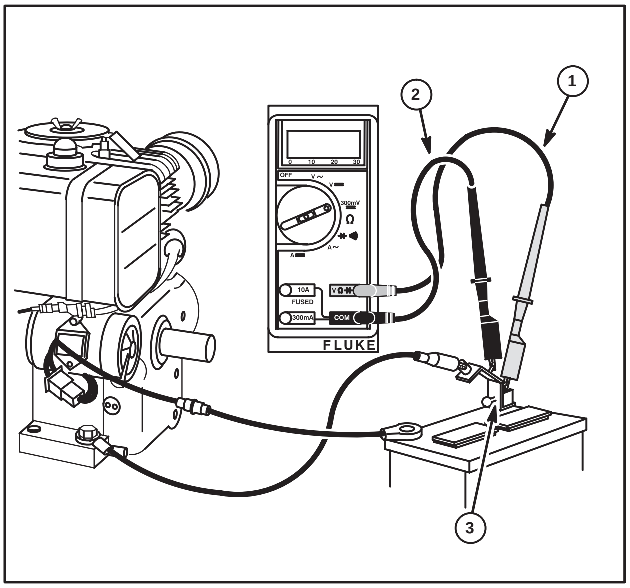

Fig. 34

Replacing Rectifier

1-1/2 Amp Alternator Used on Model Series 130000 Before Date Code 91032500

NOTE: Early style rectifier box is replaced by rectifier harness shown in Fig. 35.

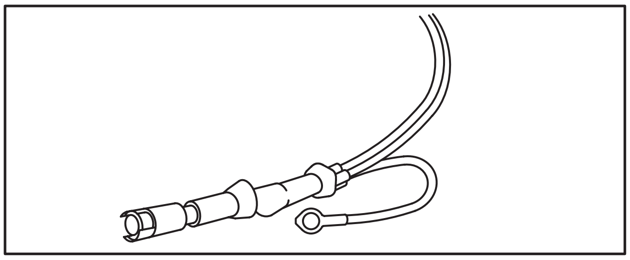
Fig. 35

1. Cut stator wires close to rectifier so that stator wires remain as long as possible.
2. Discard old rectifier.
3. Strip insulation back 3/8” (9.5 mm) from stator wires.

NOTE: Replacement rectifier has two exposed wires which are already stripped of insulation.

4. Twist and solder each stator wire to a rectifier wire.
5. Insulate each connection with electrical friction tape or shrink tubing. Keep connected areas as compact as possible.
6. Attach ground wire to drive housing using original rectifier mounting screw, Fig. 22.

7C

Suggested Wiring Diagrams

Components for typical starting systems are listed below:

1. 12 Volt Battery
2. Starter Motor
3. Solenoid
4. Ignition Switch
5. Upper Stator
6. Lower Stator
7. Anti-Afterfire Solenoid
8. Ammeter
9. Diode
10. Oil Gard® Float
11. Oil Gard® Module
12. Ignition Armature
13. Spark Plug
14. Alternator
15. Regulator Rectifier
16. Wire – Black/White Tracer
17. Wire – Yellow/Green Tracer
18. Wire – Red/White Tracer
19. Wire – Black
20. Wire – Yellow
21. Wire – Red
22. Wire – Green
23. WIre – Yellow
24. Wire – Red/Black Tracer
25. Wire – AC Output
26. Wire – DC Output
27. Headlights
28. Headlight Switch
29. Charge Indicator Light
30. Wire – Blue
31. Electric Clutch
32. Clutch Switch
33. Resistor

The following wiring diagrams are recommended ways of wiring either five or six terminal ignition switches supplied by Briggs & Stratton.

Fig. 36 – Typical Dual Circuit Alternator Wiring Diagram
5 Terminal Switch

Fig. 37 – Typical Dual Circuit Alternator Wiring Diagram
6 Terminal Switch

Fig. 38 – Typical 5/9 amp Regulated Alternator Wiring Diagram
6 Terminal Switch

Fig. 39 – Typical 16 amp Regulated Alternator Wiring Diagram
5 Terminal Switch

Fig. 40 – Typical 16 amp Regulated Alternator Wiring Diagram
6 Terminal Switch

Fig. 41 – Typical 16 amp Regulated Alternator Wiring Diagram
With Charge Indicator Light and 6 Terminal Switch

Fig. 42 – Typical Tri-Circuit Alternator Wiring Diagram
6 Terminal Switch

Fig. 43 – Typical Tri-Circuit Alternator Wiring Diagram
With Resistor and 5 Terminal Switch

Fig. 44 – Typical Tri-Circuit Alternator Wiring Diagram
With Resistor and 6 Terminal Switch

SPECIFICATIONS

The following wiring diagrams are recommended ways of wiring either five (5) or six (6) terminal ignition switches supplied by Briggs & Stratton.

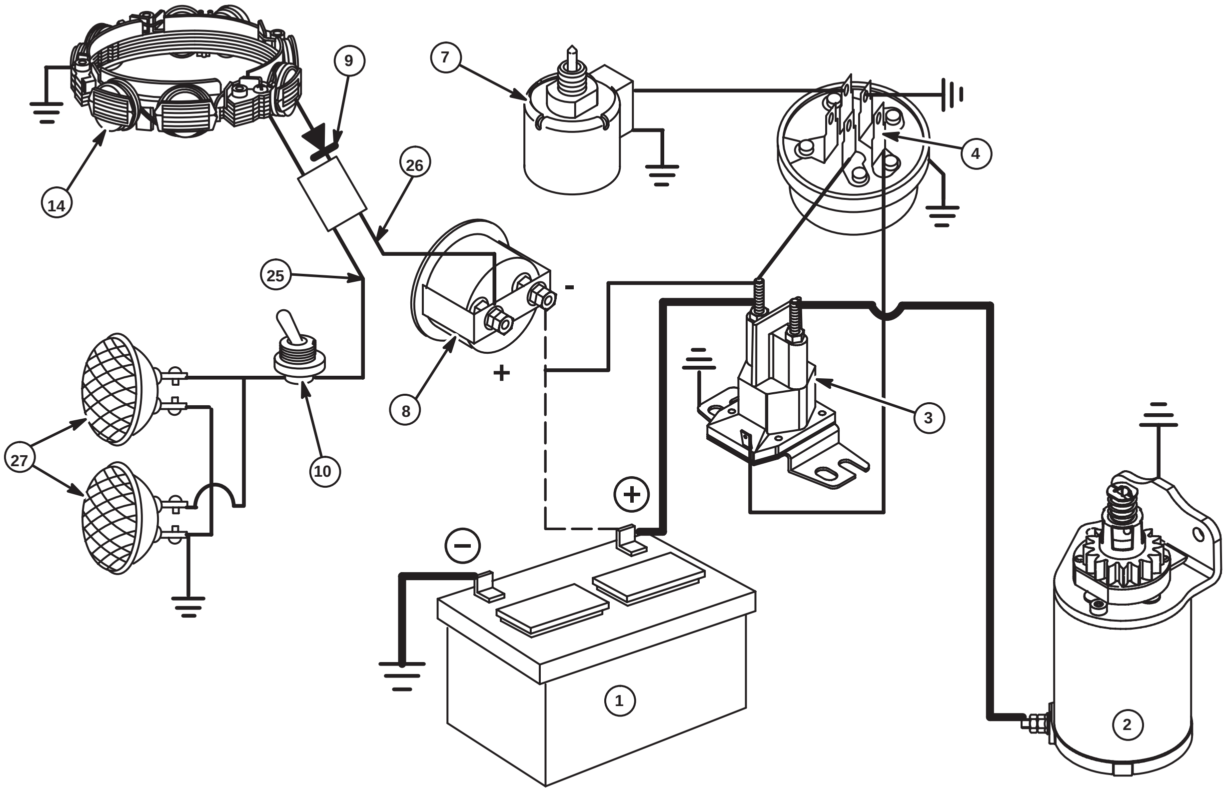

Fig. 36

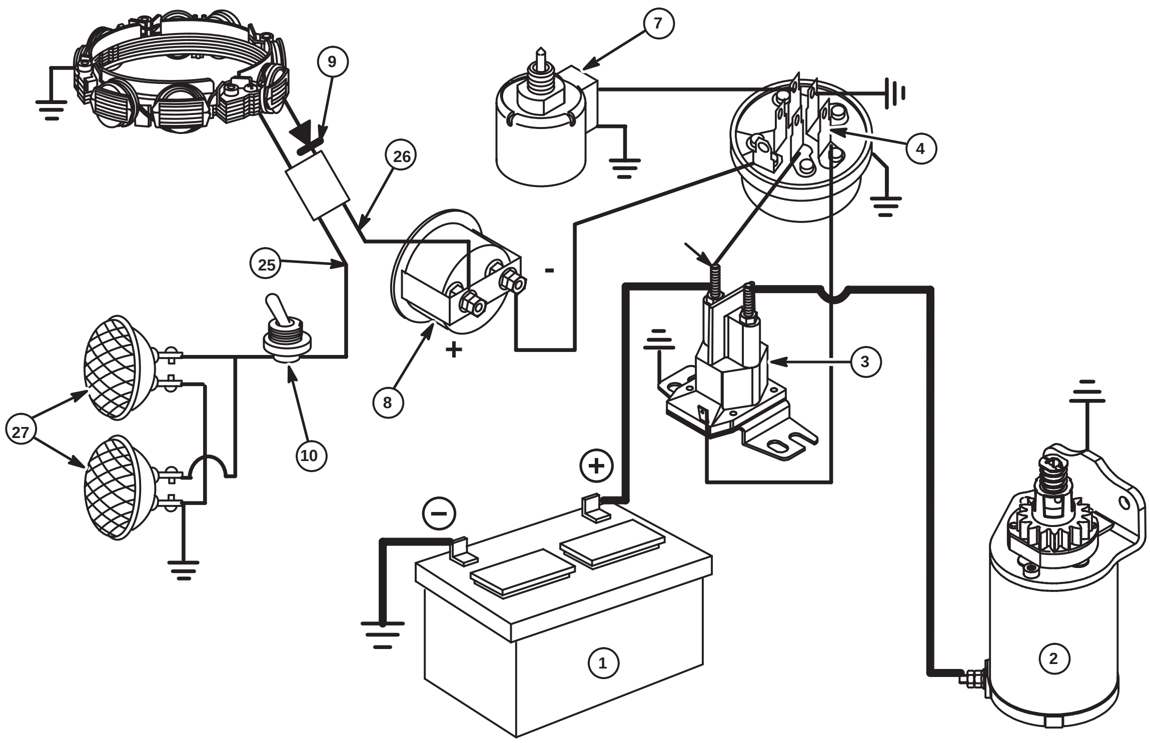

Fig. 37

7C

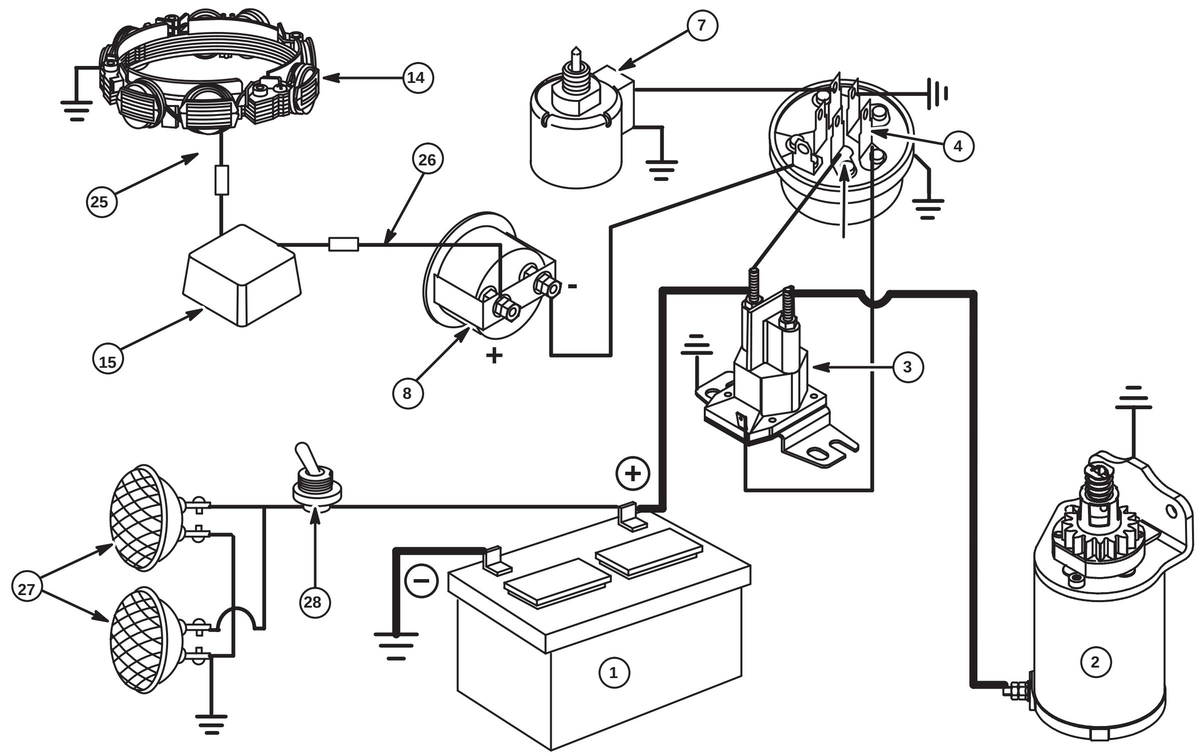

Fig. 38

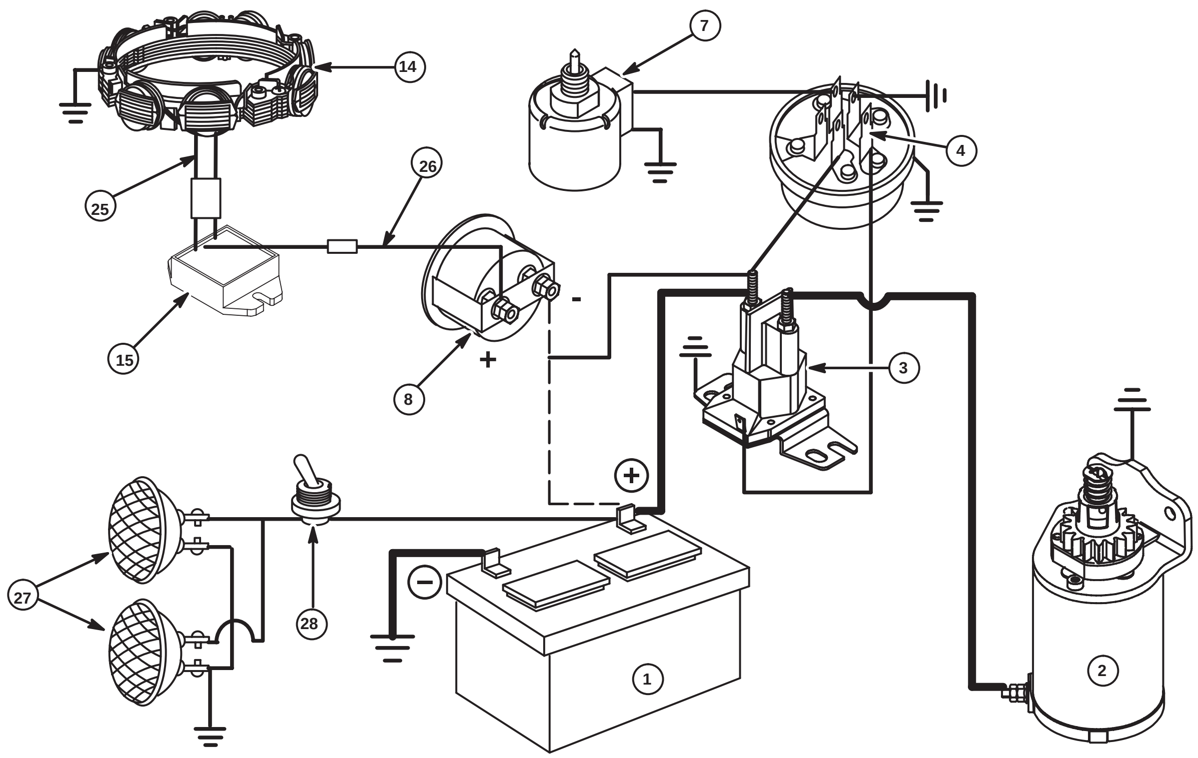

Fig. 39

7C

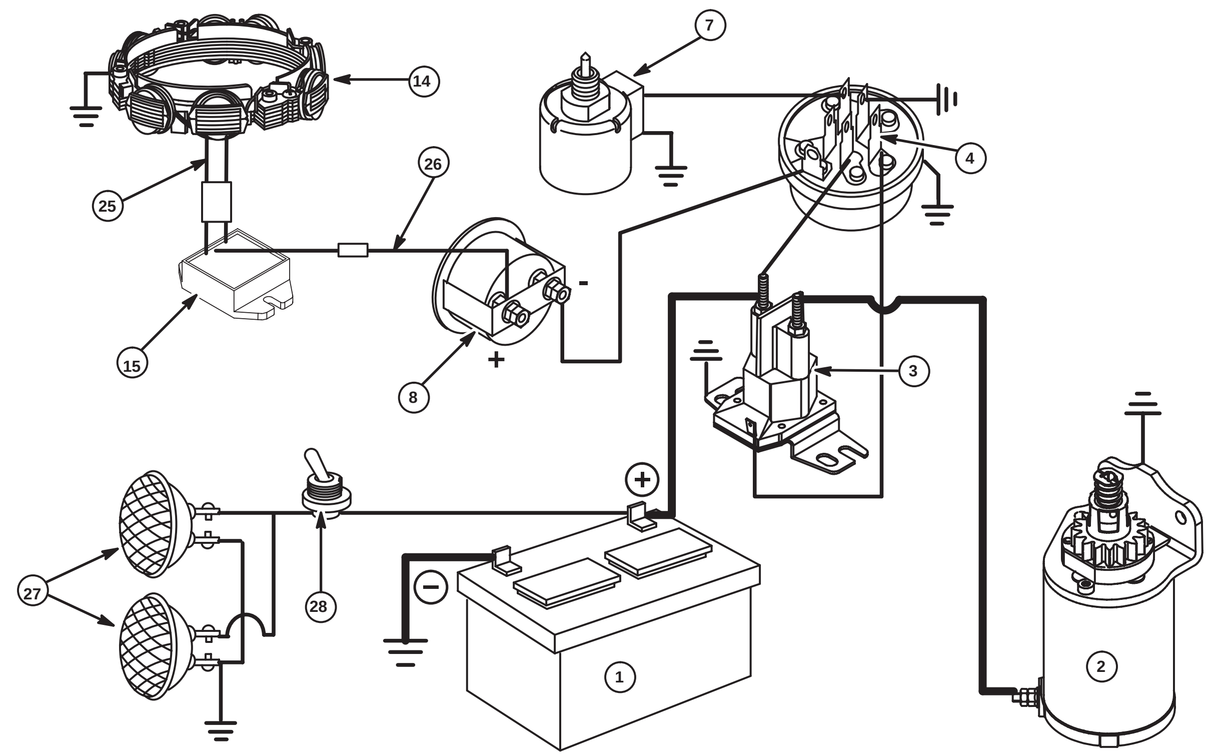

Fig. 40

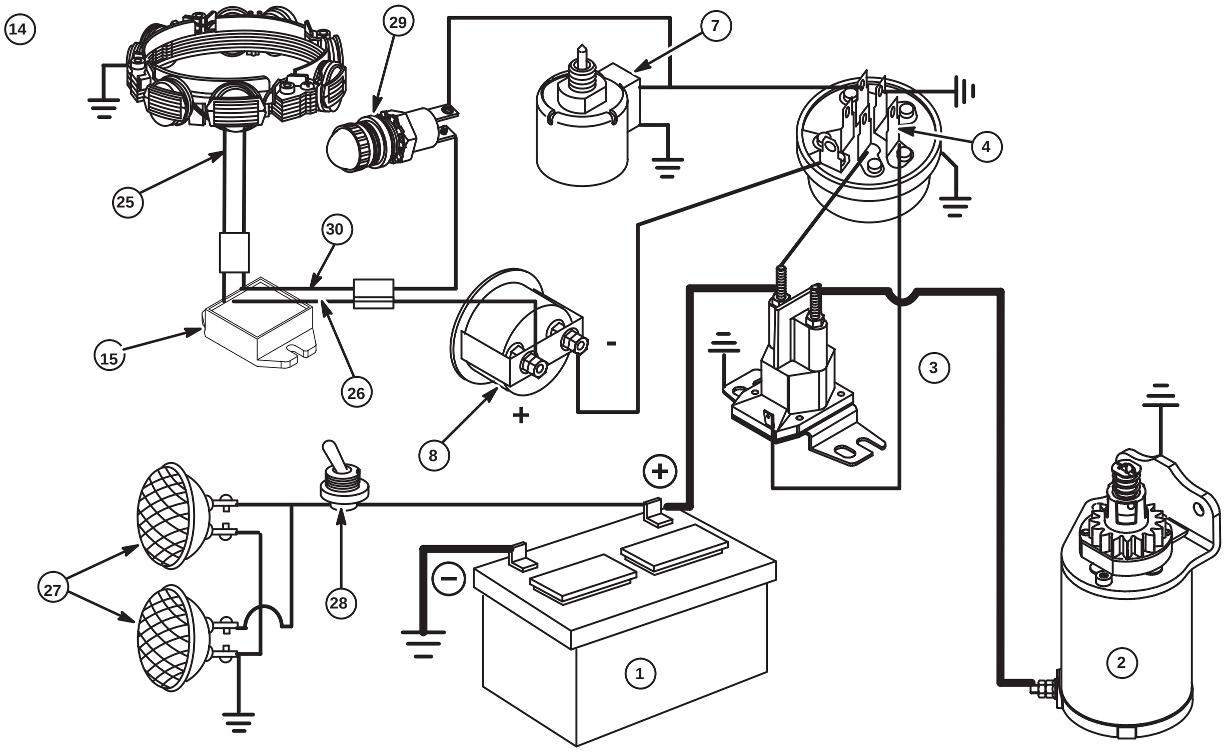

Fig. 41

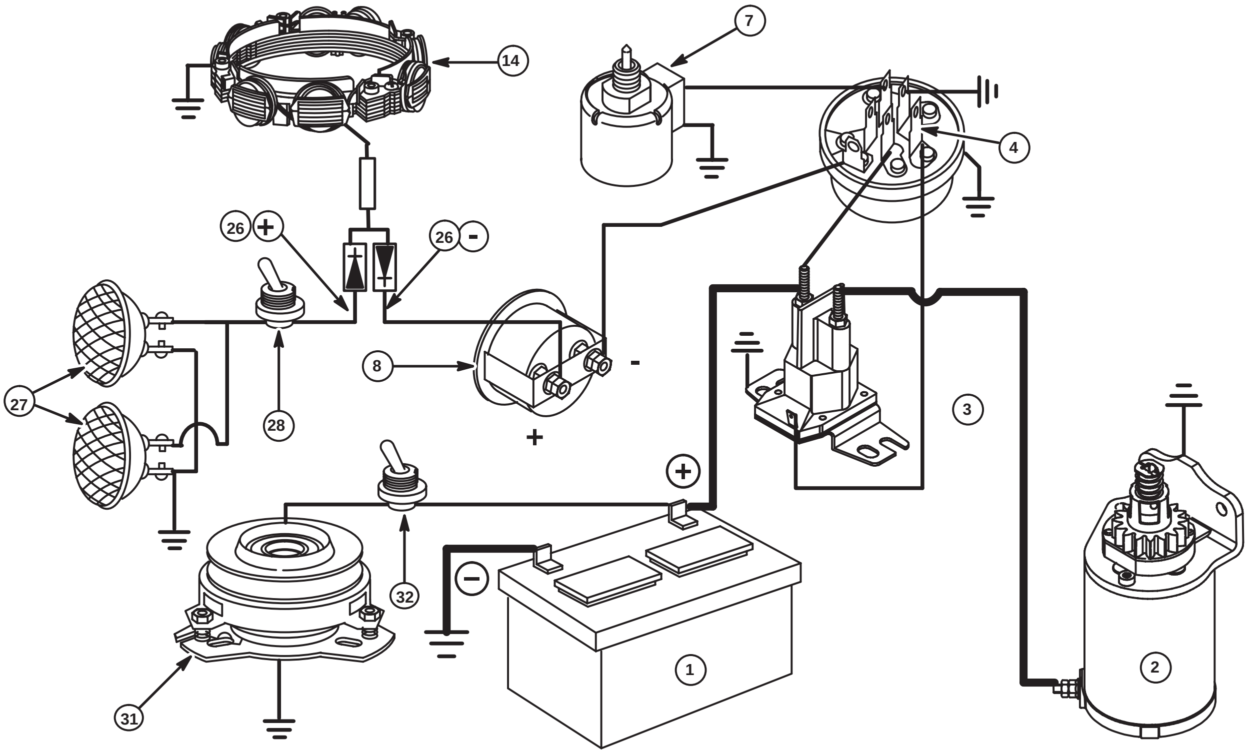

Fig. 42

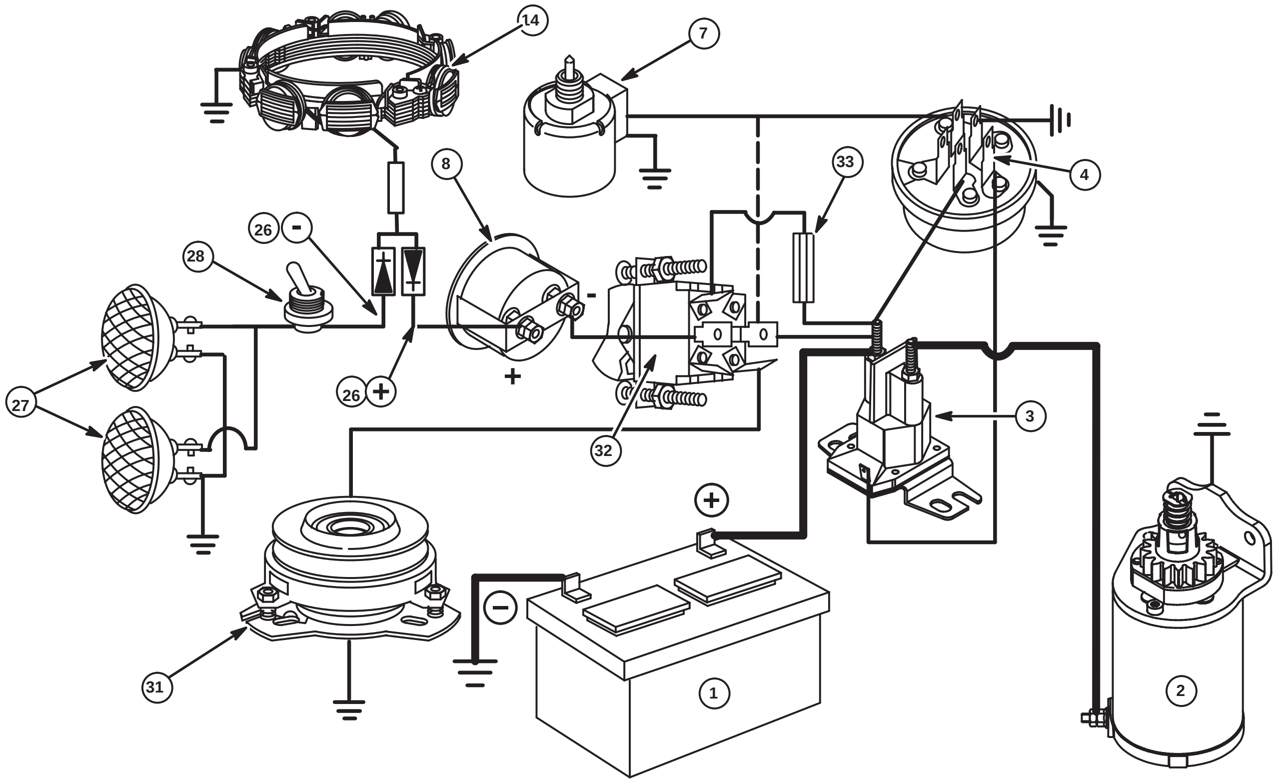

Fig. 43

7C

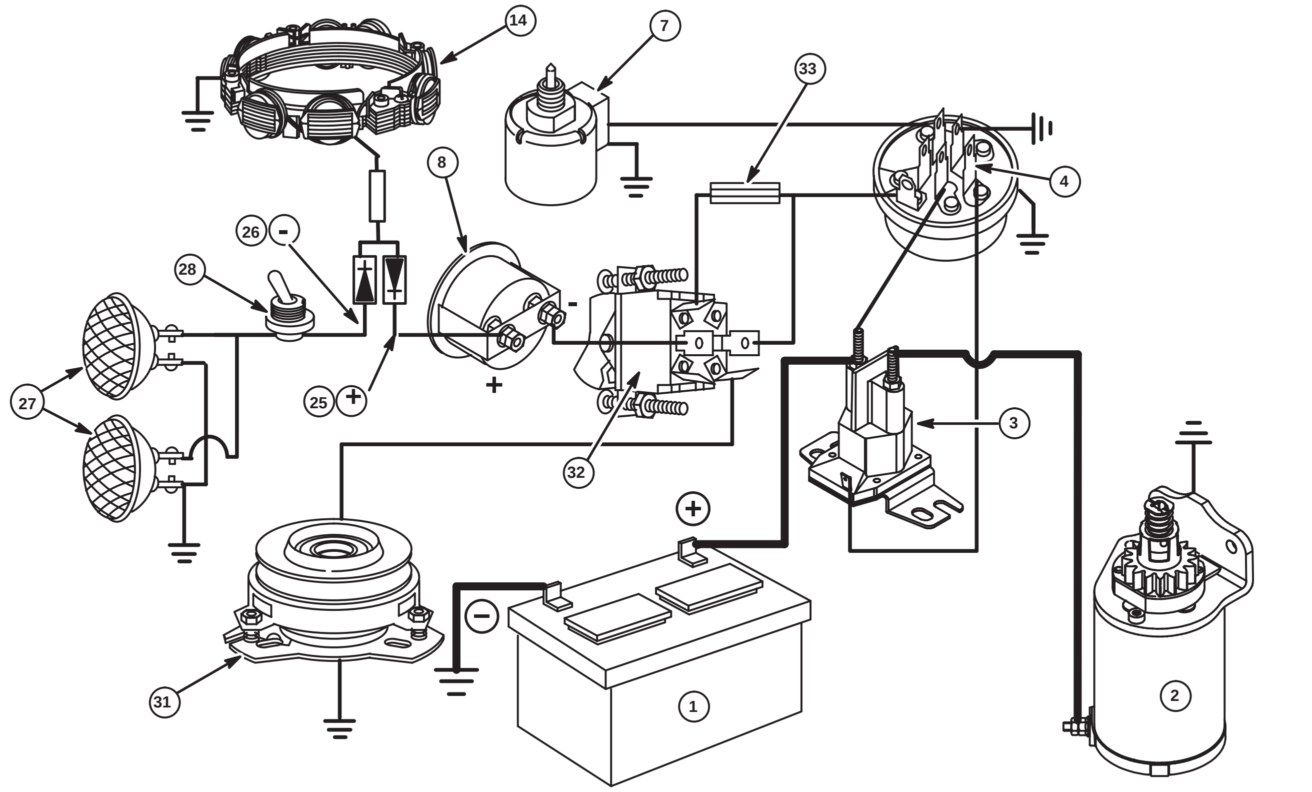

Fig. 44

TABLE NO. 2
Alternator DC Output and Stator Air Gap (Where Applicable)
System 3® and 4® Alternator
Output: No less than .5 amp DC @2800 RPM. Stator Air Gap: .010” (.25 mm), (current style only).
1/2 Amp Alternator **Model Series 121700 – 124700**
Output: No less than .5 amp DC @2800 RPM. Stator Air Gap: .006” – .008” (.15 – .20 mm), (current style only)
1.2 Amp Alternator **Model Series 130000 – After Date Code 91032400**
Output: No less than 1 amp DC @3600 RPM. Output will vary with battery voltage. At maximum battery voltage, output will be approximately 1 amp.
1-1/2 Amp Alternator **Model Series 130000 – Before Date Code 91032500**
Output: No less than 1.2 amps DC @3600 RPM.
DC Only Alternator and Dual Circuit Alternator
Output: Between 2 to 4 amps DC @3600 RPM. Output will vary with battery voltage. At maximum battery voltage, output should be approximately 2 amps.

TABLE NO. 3
Alternator AC Output
AC Only Alternator and Dual Circuit Alternator
Output: No less than 14 volts AC @3600 RPM.
Tri-Circuit Alternator
Output: No less than 28 volts AC @3600 RPM.
Quad Circuit Alternator
Output: No less than 20 volts AC @3600 RPM.
5 & 9 Amp Regulated Alternator
Output: No less than 28 Volts AC – 5 Amp System @3600 RPM **40 Volts AC – 9 Amp System**
10 & 16 Amp Regulated Alternator
Output: No less than 20 Volts – 10 Amp System @3600 RPM **30 Volts – 16 Amp System**

7C

NOTE: If alternator output test indicates a 16 Amp system, see special instructions for testing regulator-rectifier.

SECTION 8
Lubrication

Section Contents

8

Oil capacities are listed in the OIL CAPACITY CHART, Specifications, Page 8 of this section.

NOTE: Always refill to full mark on dipstick.

GEAR REDUCTION UNITS

Change Oil, Aluminum Engines (6 to 1 Gear Reduction Models)

Model Series 60000, 80000, 100200, 130000

Every one hundred (100) hours of operation:

1. Remove oil level plug (3) and oil fill plug (1), Fig. 1.
2. Loosen four screws holding gear case cover to drain oil.
3. Retighten cover screws to 85 in. lbs. (10 Nm) torque.
4. Refill gear case with same oil as used in engine crankcase. Refer to Section 1 for recommended oil service specifications and viscosity.
5. Pour oil into filler hole until oil runs out of oil level check hole.
6. Replace both plugs making sure oil fill plug with vent hole (2) is installed in top hole, Fig. 1.

Model Series 170000, 190000, 220000

Every one hundred (100) hours of operation:

1. Remove drain plug (4) in bottom of gear case cover and drain oil, Fig. 2.
2. Replace plug.
3. To refill, remove oil check plug (3) and oil fill plug (1) and pour oil into filler hole until it runs out level check hole. Refer to Section 1 for recommended oil service specifications and viscosity.
4. Replace both plugs, making sure oil fill plug with vent hole (2) is installed in top hole, Fig. 2.

Change Oil, Cast Iron Engines (6 to 1 Gear Reduction Models)

Model Series 230000, 240000

The reduction gears are lubricated by engine crank-case oil. Remove drain plug (4) from gear case cover to drain oil remaining in gear case when changing engine oil, Fig. 3.

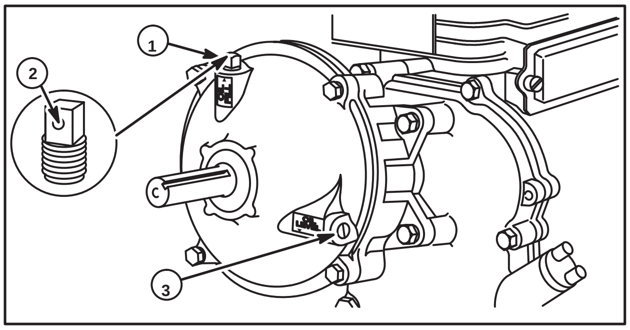

Fig. 1

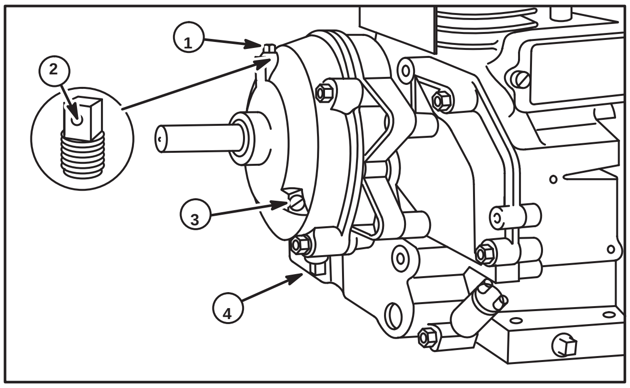

Fig. 2

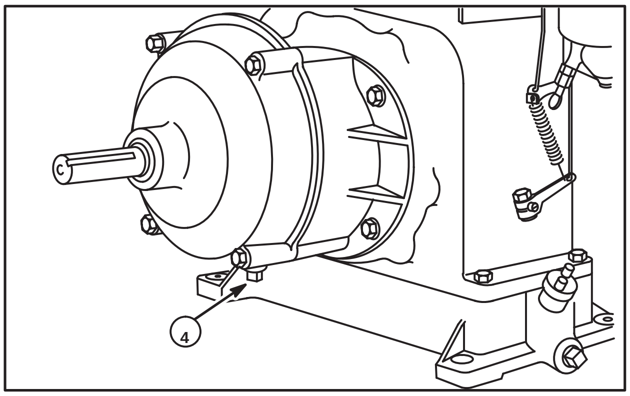

Fig. 3

8

EXTENDED OIL FILL TUBE AND DIPSTICK

1. When installing the extended oil fill tube (1) and dipstick assembly, the tube must be installed so the “O” ring seal (2) is firmly compressed.
2. Push the tube downward toward the sump, then tighten blower housing screw, securing the tube and bracket.
3. When the cap and dipstick assembly is fully seated, it seals the upper end of the tube, Fig. 4.

A faulty seal at either end of the dipstick tube can result in a loss of crankcase vacuum, and smoke discharge through the muffler.

<u>**DO NOT**</u> overfill the sump or crankcase with oil. Fill only to mark indicated on dipstick. Excessive oil will cause a smoking condition, as the engine attempts to discharge the surplus oil.

BREATHER

The breather’s function is to maintain crankcase vacuum. It has a one way fiber disc valve, limiting the direction of air flow caused by the piston moving back and forth. It allows air to flow out of the crankcase, but blocks the return flow, 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 (if so equipped) and gaskets.

Checking Breathers

If the fiber disc valve (2) is stuck or binding, the breather cannot function properly and must be replaced. Be sure the vent holes (1) are open. A .045” (1.14 mm) wire (3) should not enter the space between the fiber disc valve and body. (A wire spark plug gap gauge may be used.) Check as shown in Fig. 5.

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. Use caution when checking gap.

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

Most breathers are vented through the air cleaner, to prevent dirt from entering the crankcase. Inspect venting elbows or tube for damage and effective sealing. Various breather assemblies (4) are illustrated in Fig. 6.

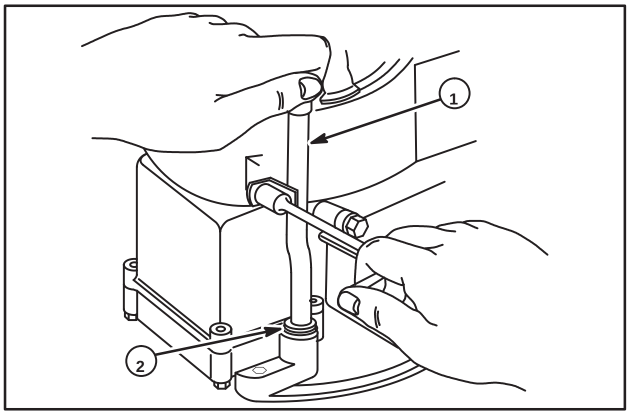

Fig. 4

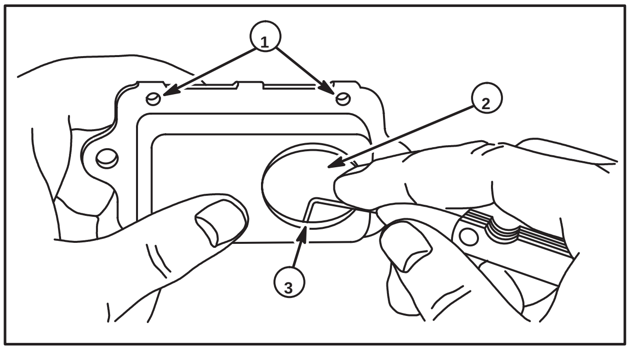

Fig. 5

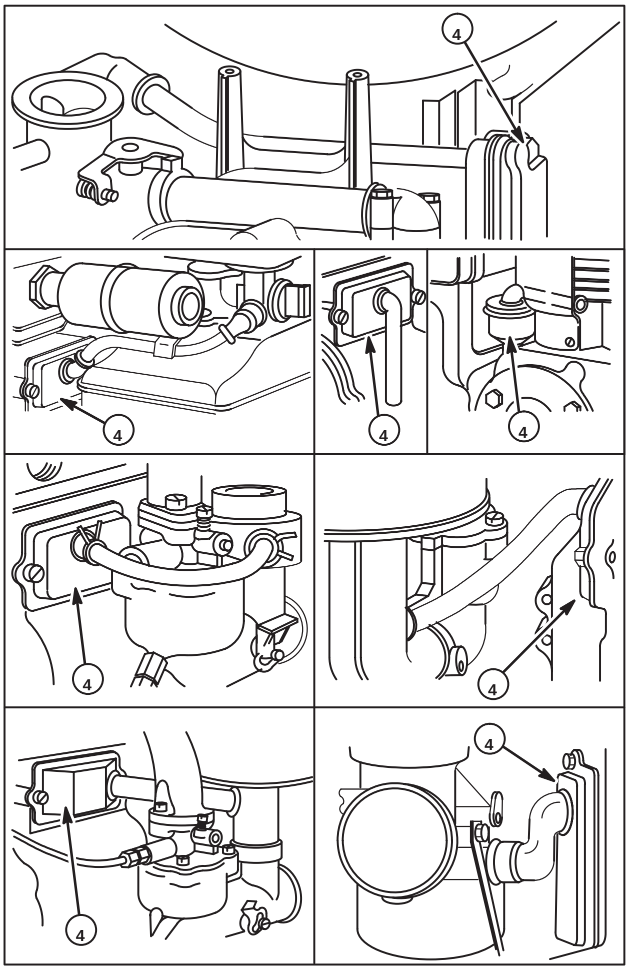

Fig. 6

LUBRICATION SYSTEMS

Splash Lubrication

Aluminum Alloy and Cast Iron Engines

In this system the dipper, attached to the connecting rod, dips into the engine oil during rotation, splashing oil on all moving parts. There is no oil pump. Install connecting rod and dipper by engine model series as shown in Section 9.

Typical styles of dipper (5) are shown in Figures 7 – 11

Fig. 7, Aluminum Model Series 60000

Fig. 8, Aluminum Model Series 80000, 9K400, 111000, 112000, 120000, 190000, 19K400, 220000, 250000

Fig. 9, Aluminum Model Series 100200, 130000, 135400, 13K400, 170000

Fig. 10, Early Cast Iron Model Series 230000, dipper is part of connecting rod cap.

Fig. 11, Cast Iron Model Series 230000, 240000, 300000, 320000, 32K400

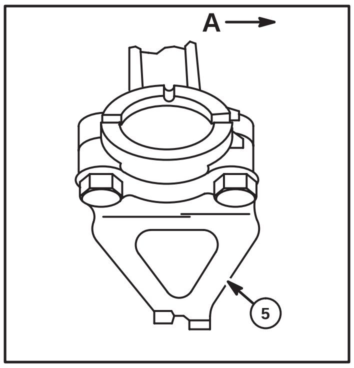

Fig. 7

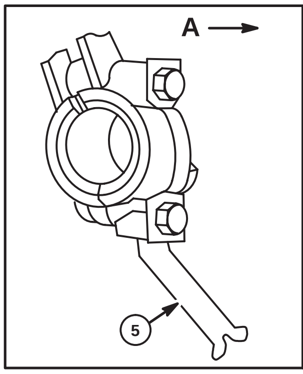

Fig. 8

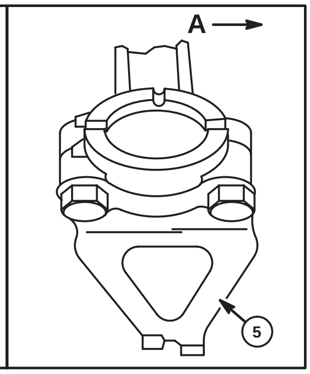

Fig. 9

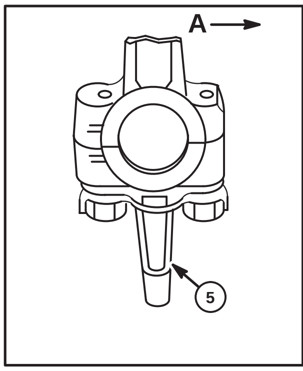

Fig. 10

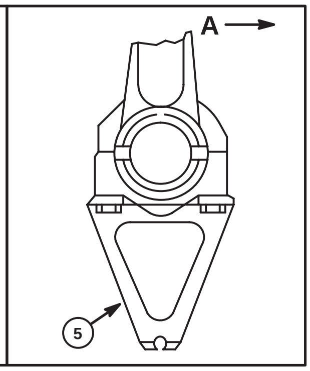

Fig. 11

8

Slinger Lubrication, Oil Slinger Aluminum Alloy Engines

The oil slinger (2) is driven by the cam gear (1) and splashes oil on all moving engine parts.

Early style slingers, Fig. 12. Illus. 1, 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 .490" (12.4 mm) or less. Replace steel bushing if worn.

Current style oil slingers, Fig. 12. Illus. 2 and Fig. 13 (vertical crankshaft engines) have a stamped steel bracket. Unit is a one piece assembly. Spring washer is used only on Model Series 100900, 130900. Inspect gear teeth, both styles and replace if worn.

NOTE: On Model Series 130700, 130900, 131700, 132900 equipped with right angle drive P.T.O. DO NOT USE SPRING WASHER on oil slinger bracket.

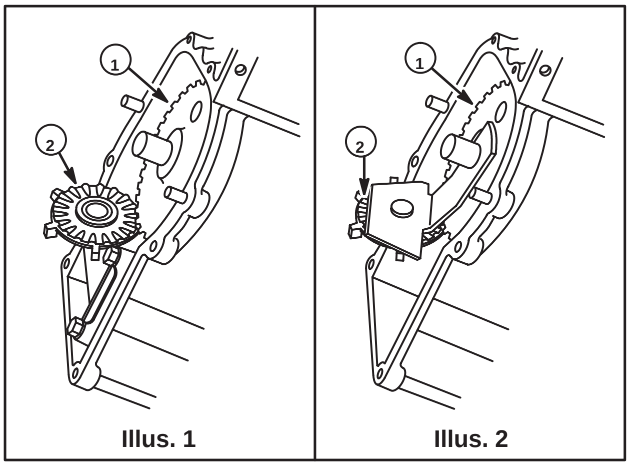

Fig. 12

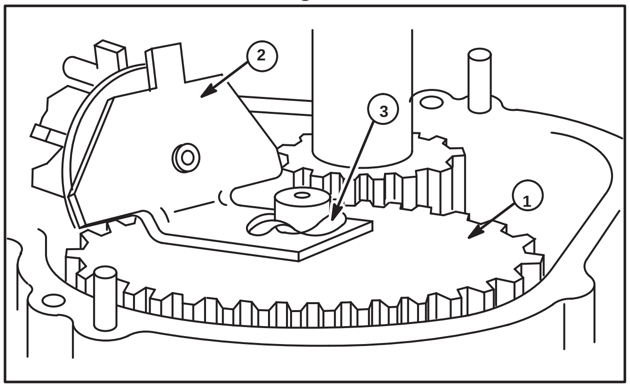

Fig. 13

OIL GARD®

Some models of Briggs & Stratton engines are equipped with Oil Gard®, a low oil shut-off system designed to prevent engine damage before the engine becomes damaged by running with insufficient oil.

Two types of Oil Gard® have been used; float operated type, Fig. 14 and spark gap type, Fig. 15.

Principles of Operation, Float Type

This Oil Gard® system uses a float to operate a magnetic switch, depending on oil level in engine crankcase. When oil level is at correct level, the float rises, opening the magnetic switch (1), Illustration 1. When oil level drops below a minimum level, the float drops, causing the magnetic switch to close (2), Illustration 2.

When this happens,

1. The ignition primary current will cause the warning light (3, when equipped) to flash.
2. The engine will stop.

The engine cannot be restarted until the oil level is restored to correct level opening switch contacts, Fig. 14.

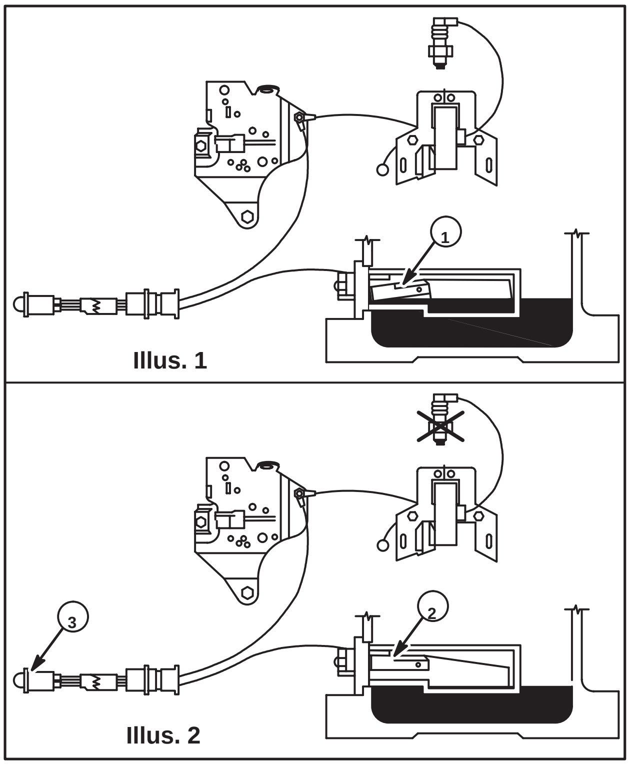

Fig. 14

8

Principles of Operation, Spark Gap Type

This Oil Gard® system uses an oil level sensor with a spark gap connected to a high tension lead from the ignition armature (1). When oil is the correct level, the spark gap (2) is filled with oil and a spark will not jump the gap.

When oil level drops to the point where the spark gap is exposed to air in the crankcase, the resistance of the gap is lower than the spark plug (3) gap and spark will fire across the Oil Gard® sensor instead of the spark plug, stopping the engine. The engine cannot be restarted until the oil level is returned to normal, Fig. 15.

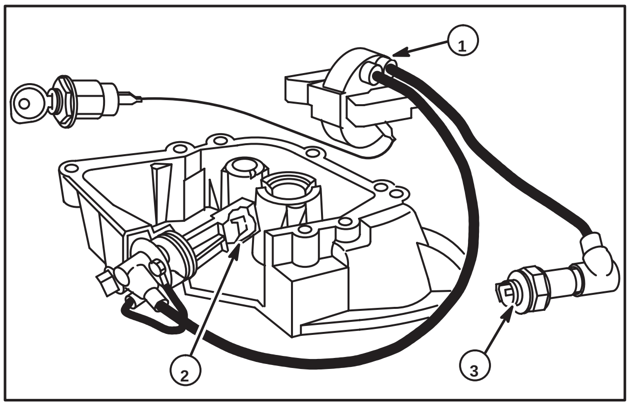

Fig. 15

TROUBLESHOOTING OIL GARD® SYSTEMS

Troubleshooting an Oil Gard® system need not be complicated or time-consuming. A basic understanding of how the Oil Gard® switch and its components function is all that is needed in order to locate the problem or the cause of failure with this low-oil warning system. If a problem occurs, review the principle of operation, Figs. 16 and 17.

USE THE CHARTS AND ILLUSTRATIONS TO ASSIST IN TROUBLESHOOTING PROBLEMS WHICH COULD OCCUR WITH THE LOW-OIL WARNING SYSTEM . . .OIL GARD®. The chart lists the failures that are most likely to occur first, with references given by letter designation on the illustration.

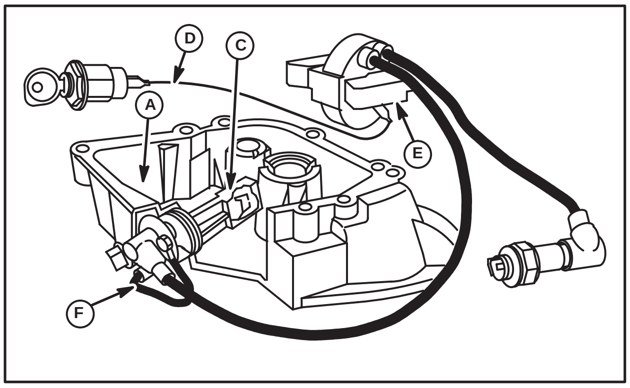

Fig. 16

8

The table below lists possible problems with the probable cause and cure. Refer to Fig. 16.

PROBLEM	LETTER	CAUSE	CURE
No Spark	A B C	Low Oil in Crankcase Excessive Angle of Operation Defective Oil Gard® Sensor	Refill With Oil Reduce Angle of Operation Replace Sensor
No Spark – Correct Amount of Oil in Crankcase	D E	Stop Wire Grounded Defective Magnetron® Armature	Repair or Replace Wire Replace Armature
Spark Present – Low on Oil	F C	Defective Ground Wire Defective Oil Gard® Sensor	Repair or Replace Wire Replace Sensor
Intermittent Spark	D C	Stop Wire Grounded Defective Oil Gard® Sensor	Repair or Replace Wire Replace Sensor

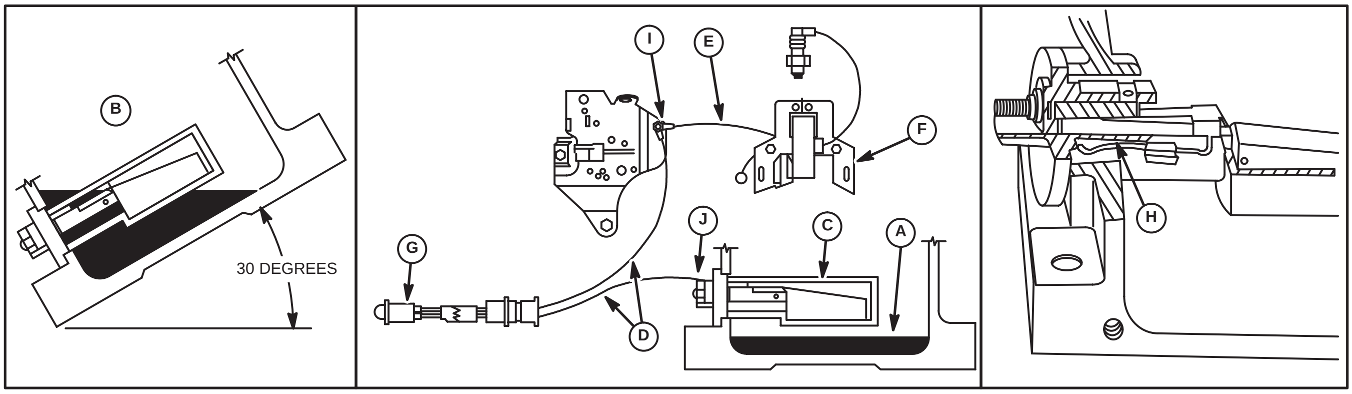

Fig. 17

The table below lists possible problems with the probable cause and cure. Refer to Fig. 17.

PROBLEM	LETTER	CAUSE	CURE
No Spark – Light Flashes, (when equipped)	A	Low Oil in Crankcase	Refill With Oil
	B	Excessive Angle of Operation	Reduce Angle of Operation
	C	Defective Oil Gard® Switch	Replace Switch
No Spark – Light (when equipped) Does Not Flash – Correct Amount of Oil in Crankcase	D	Wiring Harness Grounded	Repair or Replace Wiring Harness
	E	Stop Wire Grounded	Repair or Replace Wire
	F	Defective Magnetron® Armature	Replace Armature
Spark Present – Light (when equipped) Does Not Flash – Low on Oil	G	Defective Light or Harness	Replace Light
	H	Oil Gard® Switch Wire Not Making Ground	Adjust Wire
	C	Defective Oil Gard® Switch	Replace
Intermittent Spark	D or E	Grounded Stop Wire or Harness	Repair or Replace Wire or Harness
	C	Defective Oil Gard® Switch	Replace Switch
	H	Oil Gard® Switch Wire Not Making Ground	Adjust Switch Wire
No Spark – Light (when equipped) Does Not Flash – Low on Oil	I or J	Wiring Harness Connections Reversed	Reverse Connections

8

OIL CAPACITY CHART

Basic Model Series	Capacity Ounces (Liters)
Vertical Crankshaft Aluminum Cylinders	
60000, 80000, 90000, 10A900, 10B900, 10C900, 100700, 110000, 120000	21 (.6)
100900, 130000	28 (.8)
170000, 190000	36 (1.1)
220000, 250000, 280000	48 (1.4)
Horizontal Crankshaft Aluminum Cylinders	
60000, 80000, 90000, 100200, 130000	21 (.6)
170000, 190000	44 (1.3)
220000, 250000	40 (1.2)
Horizontal Crankshaft Cast Iron Cylinders	
230000, 240000, 300000, 320000	64 (1.9)

SECTION 9
Pistons – Rings – Rods

Section Contents

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 8 OF THIS SECTION.

Remove Piston and Connecting Rod

1. Bend down rod bolt lock (1), when used, Fig. 1. Connecting rods without rod bolt locks use one or two thin washers, or washer-head bolts. On connecting rods with dippers held by both connecting rod bolts, no washers or rod bolt locks are used.
2. Remove connecting rod cap (2).
3. Remove any carbon or ridge at top of cylinder bore to prevent ring breakage on cast iron sleeves or cast iron cylinders. The ridge does not have to be removed on aluminum cylinder bores.
4. Push piston and rod out through top of cylinder.

NOTE: All pistons have oil drain slots or drilled holes in the oil control ring groove except for Model Series 120000 pistons, which use drain slots in the ring lands.

NOTE: Pistons used in CAST IRON SLEEVE BORE aluminum alloy engines **CANNOT BE USED** in Kool Bore™ (aluminum bore) engines. Pistons used in Kool Bore™ (aluminum bore) engines are chrome plated. These chrome plated pistons **CANNOT BE USED** in SLEEVE BORE engines.

5. Use “Illustrated Parts Lists” to determine which pistons to use based on Model, Type and Code.

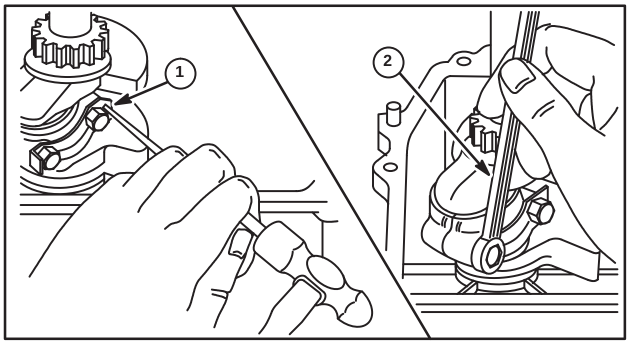

Fig. 1

Remove Connecting Rod

All Model Series Except Current Model Series 170000, 190000, 220000, 250000, 280000

Some pistons use a piston pin with one end flat and the other end recessed. All other pistons use a hollow piston pin. Some pistons use two piston pin locks while other pistons use one piston pin lock and a piston pin stop in the piston.

1. Remove a piston pin lock (1) with needle nose pliers (2). One end of the pin (3) is recessed (4) to facilitate removal of the lock, Fig. 2.
2. Push piston pin out from other side.

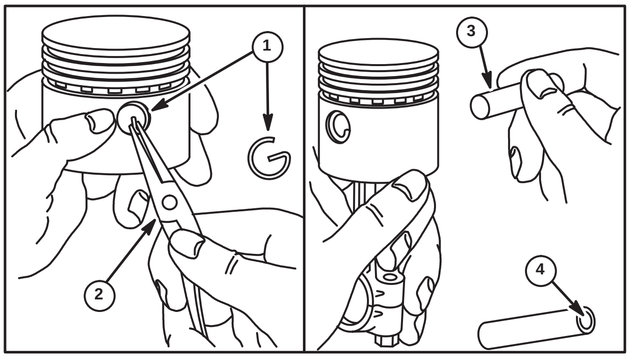

Fig. 2

Current Model Series 170000, 190000, 220000, 250000, 280000

1. Rotate piston pin retainer (5) until one end is exposed in notch in piston pin bore (6), Fig. 3.
2. Grasp end of piston pin retainer with needle nose pliers, pull in and up to remove retainer.
3. Push piston pin out from other side.

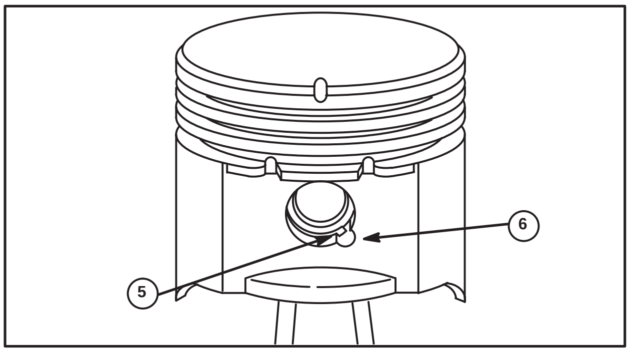

Fig. 3

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 8 OF THIS SECTION.

Remove Piston Rings

Remove piston rings using Piston Ring Expander Tool, #19340, Fig. 4.

NOTE: Some oil control rings consist of two thin steel rails and a spring expander. These steel rails cannot be removed with Piston Ring Expander, Tool #19340. Grasp one end of the steel rail and wind the rail from the oil ring groove into the next ring groove. Repeat as necessary to remove from piston.

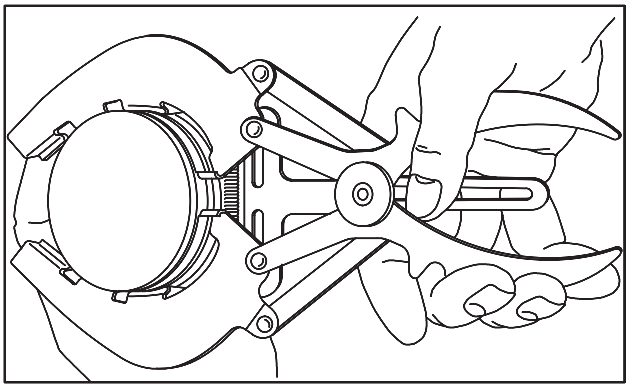

Fig. 4

Check Piston

If cylinder is to be resized, a new oversized piston assembly will be used.

If cylinder will not be resized, inspect piston for signs of wear or scoring. If condition is acceptable, check ring land wear.

Check Piston Ring Land Wear

1. Clean carbon from top ring groove.
2. Place a NEW ring in the groove and measure the space between the ring and the ring land (1). If a .007” (.18 mm) thick feeler gauge, Model Series 60000 through 130000, or .009” (.23 mm) thick feeler gauge, Model Series 170000 through 320000, can be inserted, the piston is worn and should be replaced, Fig. 5.

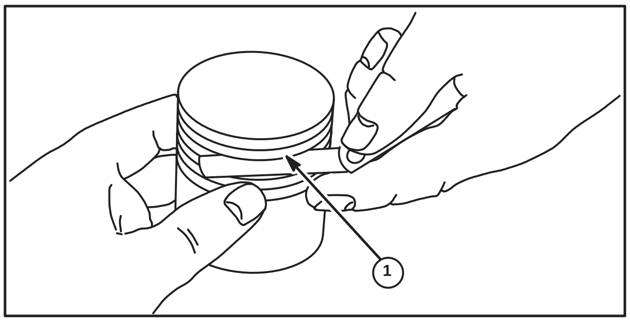

Fig. 5

Check Piston Ring End Gaps

1. Clean all carbon from the ends of the old piston rings (2) and from the cylinder bore.
2. Insert rings one at a time 1” (25.4 mm) down into the cylinder.
3. Check gap with feeler gauge (3), Fig. 6. If ring gap (4) is greater than shown in Table No. 1, Page 8, the ring should be rejected.

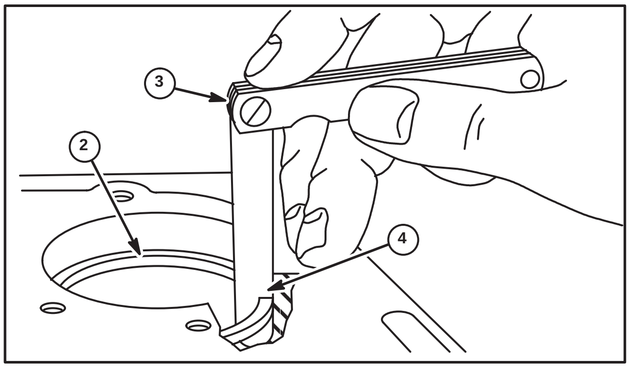

Fig. 6

Connecting Rod and Piston Pin

Rejection sizes of crankpin bearing hole and piston pin bearing hole are shown in Table No. 2, Page 8. If the piston pin is worn .0005” (.01 mm) out of round or below the rejection sizes listed in Table No. 3, Page 8, it should be replaced. Piston pins .005” (.13 mm) oversize are available in case the connecting rod and piston are worn at the piston pin bearing. If the crankpin bearing in the rod is scored or worn, the rod must be replaced. Do not attempt to “file” or “fit” the rod.

Assemble Piston, Pin and Connecting Rod

Piston pins are slip-fit in the piston and connecting rod. Some pistons use a piston pin with one end flat and the other end drilled. All other pistons use a hollow piston pin. Some pistons use two piston pin locks while other pistons use one piston pin lock and a piston pin stop in the piston.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 8 OF THIS SECTION.

Piston Without Notch on Head

1. Install one pin lock in piston pin bore groove. (If bore is grooved for two locks.)
2. Place rod inside piston and slide piston pin into piston from side opposite lock or piston pin stop then through piston and rod until pin seats on lock or stop. Install (remaining) pin lock.

Piston With Notch on Head

The notch on the piston faces the magneto side of the engine.

1. On pistons except Model Series 300000, 320000, install one pin lock in bore groove opposite notch (1). Place rod in piston with offset rod cap to left side of piston, Fig. 7. Push piston pin from notch side of piston through piston and rod until pin seats on lock. Install second piston pin lock, (when used).
2. Model Series 300000, 320000 have a notch (1) and letter “F” on the piston. Install pin lock (2) in pin bore groove opposite the notch and letter “F.” Place rod in piston with assembly marks (3) on same side as notch and letter “F”. Install pin through piston and rod until pin seats on lock. Install second lock, Fig. 8.

NOTE: The top ring (4) and center ring (6) are the same. Both rings use marks (5) to identify the top of the rings.

Install Piston Rings

Install the oil control ring first, then the center compression ring. Install the top compression ring last, as shown in Fig. 9 and Fig. 10. Use Piston Ring Expander, Tool #19340. Install expander under oil control ring, when equipped. Typical piston ring cross section for aluminum bore engines, Fig. 9.

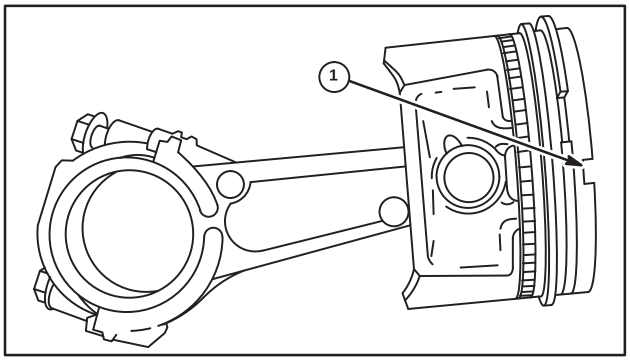

Fig. 7

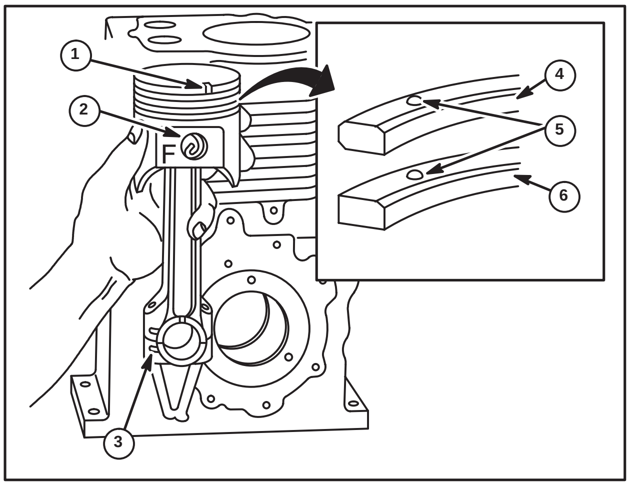

Fig. 8

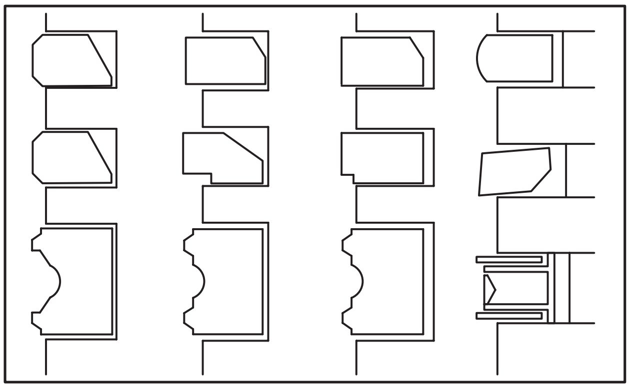

Fig. 9

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 8 OF THIS SECTION.

Typical piston ring cross section for cast iron sleeve and cast iron bore engines, Fig. 10.

NOTE: Some compression rings have an identifying dot on the top of the ring. Always install ring(s) with dot facing top of piston.

NOTE: On oil rings that use two thin steel rails and spring expander, install expander first. Twist one steel rail at a time down from one ring groove to the next and onto the expander.

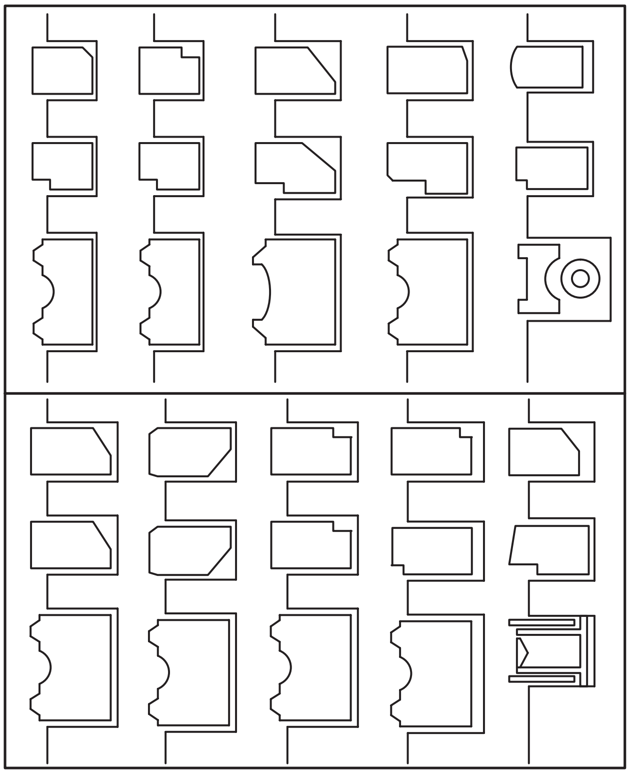

Fig. 10

Install Piston and Rod Assembly in Cylinder

NOTE: See section 11 for additional information regarding rings, cylinder honing and/or resizing prior to reassembly.

Fit Ring Compressor to Piston Assembly

1. Oil piston rings and piston skirt.

   NOTE: On aluminum bore engines, use ring compressor with the projections (2) at the top (1), as shown, Fig. 11, Illust. 2.
   On cast iron sleeve and cast iron cylinder engines, use ring compressor with the projections (2) at the bottom (3), as shown, Fig. 11, Illust. 1.

2. Insert the piston assembly (5) into the piston ring compressor (4), Fig. 12. Use Ring Compressor, Tool #19070 (Model Series 60000 through 130000), or Ring Compressor Tool #19230 (Model Series 170000 and up).

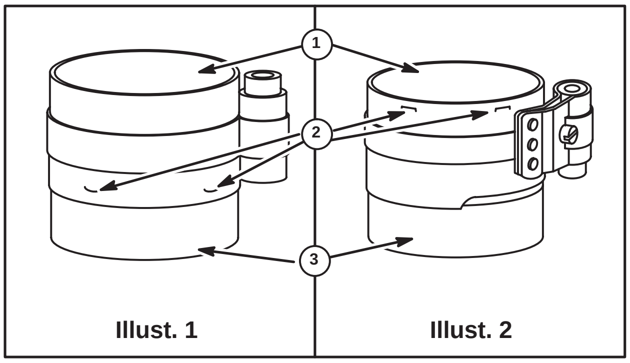

Fig. 11

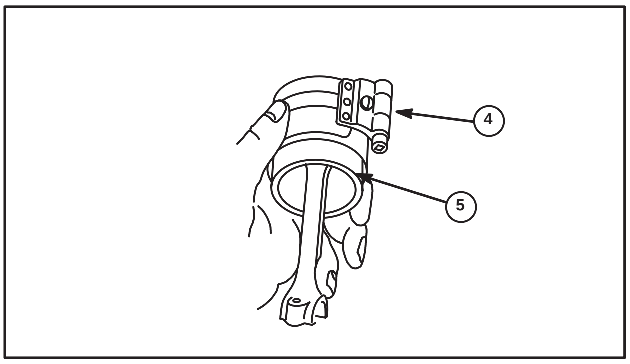

Fig. 12

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 8 OF THIS SECTION.

3. Place piston assembly (5) and compressor upside down on bench and push piston down until head of piston is even with edge of compressor (6), Fig. 13.
4. Tighten compressor with wrench (7) until piston cannot be turned in compressor.
5. Then loosen compressor until piston can be turned with slight resistance.

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

Install Piston Assembly (Without Notch On Head)

1. Place connecting rod and piston assembly with compressed rings into cylinder bore (8), Fig. 13.
2. Position rod so correct side is facing cam gear (A). Turn crankshaft until crankpin is at top dead center.

(With Notch On Head)

1. Place rod and piston assembly with compressed rings into cylinder bore with notch on piston facing magneto side of engine.
2. Turn crankshaft until crankpin is at top dead center.

(Remaining Steps For Both Types)

3. Push piston down by hand until rod rests on crankpin.
4. Oil crankpin and install rod cap with match marks (9) or flats (12) aligned, Fig. 14.
5. Place shop rag over piston and ring compressor to protect hands.
6. Assemble connecting rod bolt, rod bolt lock (10, when used), and dipper (11, when used).

Typical styles of locks and dippers are shown in Figures 14 – 18.

Fig. 14, Aluminum Model Series 60000

Fig. 15, Aluminum Model Series 80000, 111000, 112000, 120000, 190000, 220000, 250000

Fig. 16, Aluminum Model Series 100200, 130000, 170000

Fig. 17, Early Cast Iron Model Series 230000

Fig. 18, Cast Iron Model Series 230000, 240000, 300000, 320000

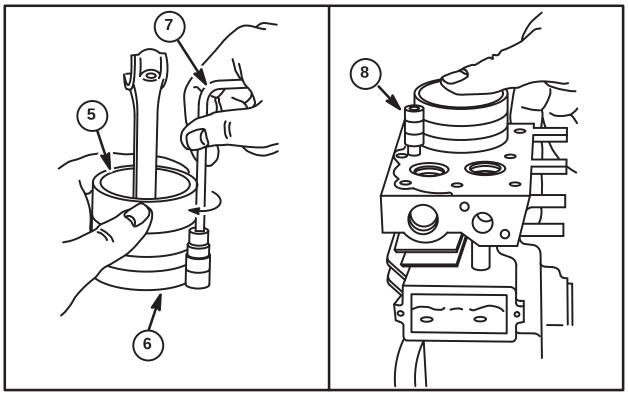

Fig. 13

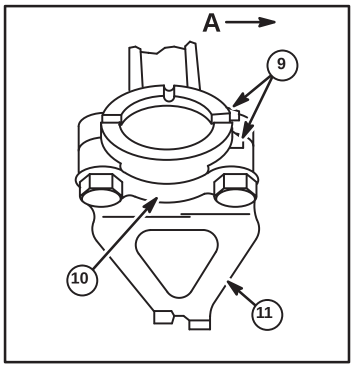

Fig. 14

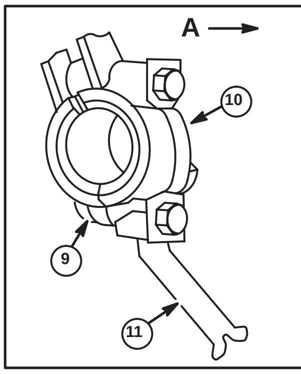

Fig. 15

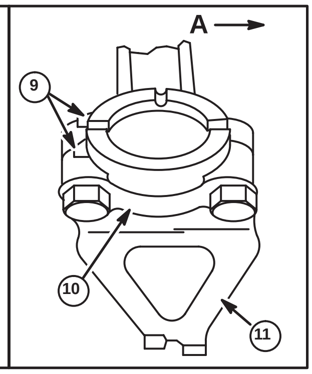

Fig. 16

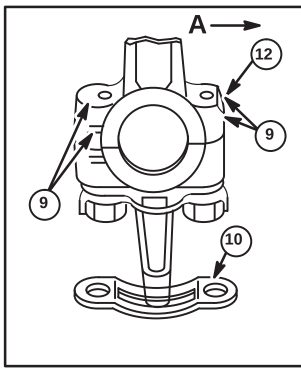

Fig. 17

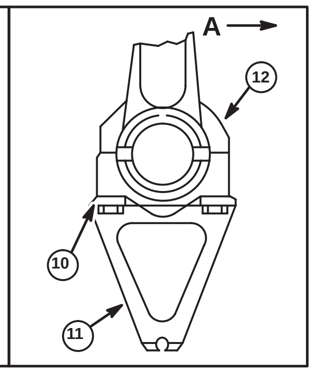

Fig. 18

7. Torque bolts with Torque Wrench, Tool #19197 or 19393, to specifications listed in Table No. 4, Page 8.

   NOTE: Some Model Series 280000 engine connecting rods using two different size connecting rod bolts.

   A. **FIRST** torque 3/8” hex connecting rod screw to 160 in. lbs. (18 Nm).

   B. **NEXT** torque 1/2” hex connecting rod screw to 260 in. lbs. (23 Nm), Fig. 19.

8. Rotate crankshaft at least two complete revolutions to be sure connecting rod and crankshaft turn freely and connecting rod does not interfere with cylinder or cam gear.

   NOTE: If connecting rod interferes with cylinder or cam gear, rod is installed incorrectly or cam gear is out of time. Verify correct timing and connecting rod installation before proceeding.

9. If rod and crankshaft are free, bend rod lock (10, when used) against flats on screw heads (13), Fig. 20.

   NOTE: Some service rods are shipped with two thick washers under bolt heads. Remove and discard these washers. Use two thin washers when no dipper is used. Use one thin washer under bolt not holding dipper. No washers are required when dipper is held by both bolts or equipped with washer head bolt.

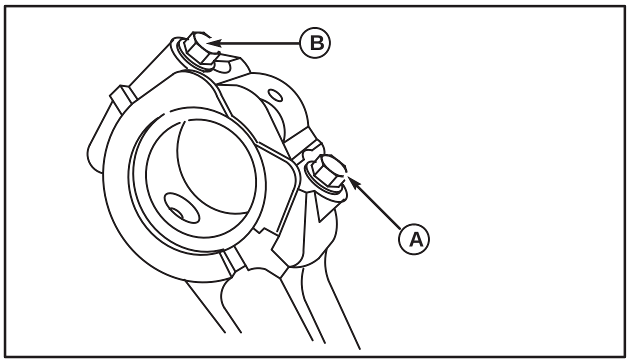

Fig. 19

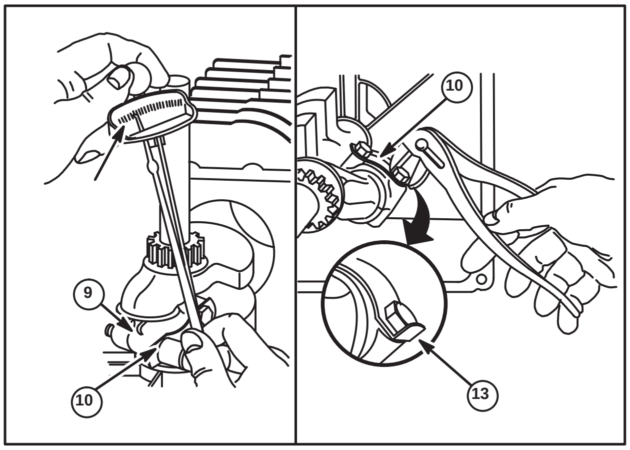

Fig. 20

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 8 OF THIS SECTION.

SPECIFICATION TABLES

TABLE NO. 1
Ring End Gap Reject Size

	Compres-sion Rings Inches (mm)	Oil Ring Inches (mm)
Aluminum Cylinder Bores	.035 (.89)	.045 (1.14)
Cast Iron Cylinder Bores	.030 (.76)	.035 (.89)

TABLE NO. 2
Connecting Rod Reject Size

Basic Model Series	Crank Pin Bearing	Piston Pin Bearing
Aluminum Cylinder	Inches (mm)	Inches (mm)
60000	.876 (22.25)	.492 (12.50)
80000	1.001 (25.43)	.492 (12.50)
90000, 100700, 110000, 120000 with small crankpin before Date Code 970113XX	1.001 (25.43)	.492 (12.50)
120000 with large crankpin after Date Code 900112XX	1.097 (27.86)	.6271 (15.928)
100200, 100900	1.001 (25.43)	.555 (14.10)
130000	1.001 (25.43)	.492 (12.50)
170000	1.095 (27.81)	.674 (17.12)
190000	1.127 (28.63)	.674 (17.12)
220000, 250000, 280000	1.252 (31.80)	.802 (20.37)
Cast Iron Cylinder		
230000	1.189 (30.20)	.736 (18.69)
240000	1.314 (33.38)	.674 (17.12)
300000, 320000	1.314 (33.38)	.802 (20.37)

TABLE NO. 3
Piston Pin Reject Sizes

Basic Model Series	Piston Pin O.D.	Pin Bore I.D.
Aluminum Cylinder	Inches (mm)	Inches (mm)
60000, 80000, 90000,100700, 110000, 120000 with small pin before Date Code 970113XX	.489 (12.42)	.491 (12.47)
120000 with large pin after Date Code 970112XX	.6242 (15.855)	.6265 (15.913)
100200, 100900	.552 (14.02)	.554 (14.07)
130000	.489 (12.42)	.491 (12.47)
170000, 190000	.671 (17.04)	.673 (17.09)
220000, 250000, 280000	.799 (20.29)	.801 (20.35)
Cast Iron Cylinder		
230000	.734 (18.64)	.736 (18.69)
240000	.671 (17.04)	.673 (17.09)
300000, 320000	.799 (20.29)	.801 (20.35)

TABLE NO. 4
Connecting Rod Screw Torque

Basic Model Series	Torque
Aluminum Cylinder	in. lbs. (Nm)
60000, 80000, 90000, 100000, 110000, 120000, 130000	100 (11)
170000	165 (19)
190000, 220000, 250000	185 (21)
280000 Both Screws Same Size	185 (21)
280000, Two Sizes of Screws	160, Small (18) Small 260, Large (23) Large
Cast Iron Cylinder	
230000, 240000, 300000, 320000	190 (22)

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 8 OF THIS SECTION.

SECTION 10
Crankshafts, Cam Gears, Gear Reductions & Auxiliary Drives

Section Contents

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

Section Contents, Cont'd.

AUXILIARY DRIVES

CRANKSHAFT REMOVAL

Remove Crankshaft and Cam Gear, Aluminum Cylinder Engines

NOTE: On Models Series equipped with ball bearing(s), the crankshaft and cam gear must be removed together, Fig. 1.

1. Remove rust or burrs from the PTO end of crankshaft.
2. Remove crankcase cover or sump. If sump or cover sticks, tap lightly on alternate sides near dowels with soft hammer.
3. Turn crankpin near top-dead-center (1) to align crankshaft (3) and cam gear (2) timing marks.
4. Lift out cam gear.
5. Remove flywheel as described in Section 2.
6. Remove connecting rod and piston. Remove crankshaft.

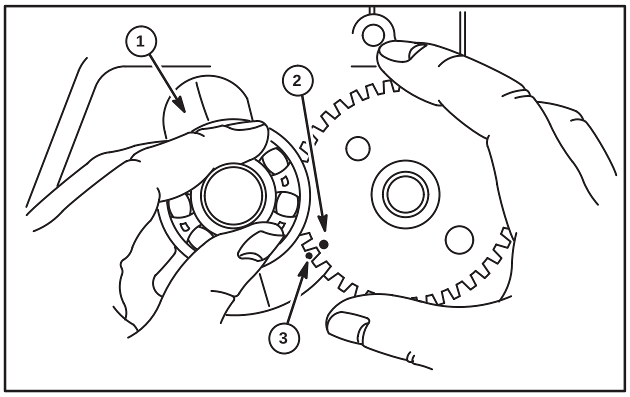

Fig. 1

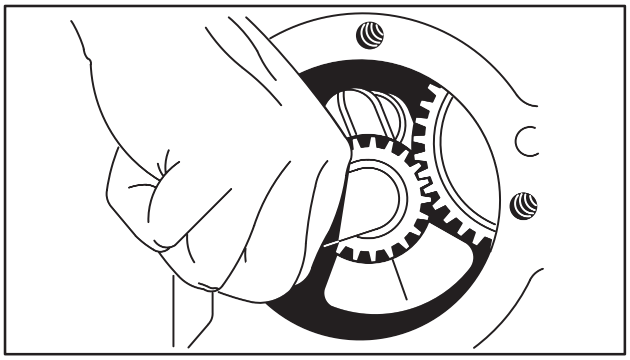

Fig. 2

Remove Crankshaft Cast Iron Cylinder Engines Model Series 230000 – Plain Bearings

1. Remove rust or burrs from the PTO end of crankshaft.
2. Remove crankshaft cover.
3. Rotate crankshaft to approximate position shown in Fig. 2.
4. Pull out crankshaft from PTO side, turning as needed to clear cam gear.

10

Model Series 230000, 240000, 300000, 320000, 32K400 – Ball Bearings

NOTE: On 240000, 300000, 320000, 32K400 the piston and connecting rod must be removed from engine to allow crankshaft removal.

1. Remove rust or burrs from the PTO end of the crankshaft.
2. Remove crankcase cover and bearing support.
3. Rotate crankshaft to position shown, Fig. 2.

NOTE: On some models, it may be necessary to position crankshaft approximately 180° from position shown in Fig. 2.

4. Pull out crankshaft, turning as needed to clear cam gear.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

Camshaft Drive Gear Removal
Cast Iron Engines
Except Model Series 300000 and 320000

1. Use a long, blunt punch (1) to drive the cam gear shaft (4) and plug (5) out from the PTO side (2) toward the flywheel side (3), Fig. 3. Do not burr or peen end of shaft while driving out.
2. Hold camshaft drive gear while removing punch to avoid damage to the gear.

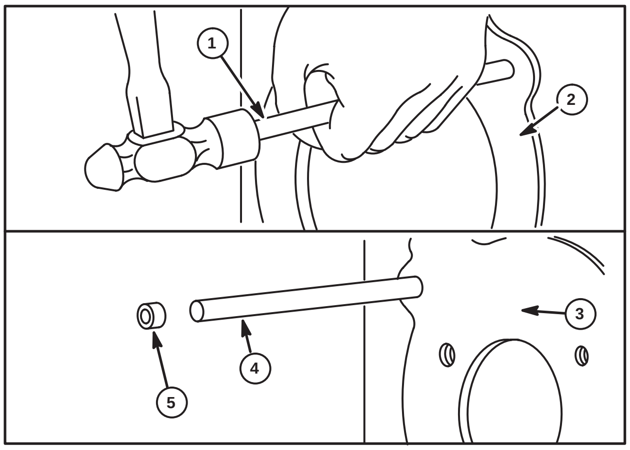

Fig. 3

Model Series 300400, 320400

1. Remove short bolt (1) and Belleville washer (2) from PTO drive gear (3), Fig. 4.
2. Loosen long bolt and Belleville washer two turns on magneto side and tap head of bolt with hammer to loosen cam gear shaft.
3. Turn bolt out while pushing out cam gear shaft, Fig. 5.
4. Remove bolts from cam gear bearing, Fig. 6 and while holding cam gear, remove cam gear bearing and cam gear.

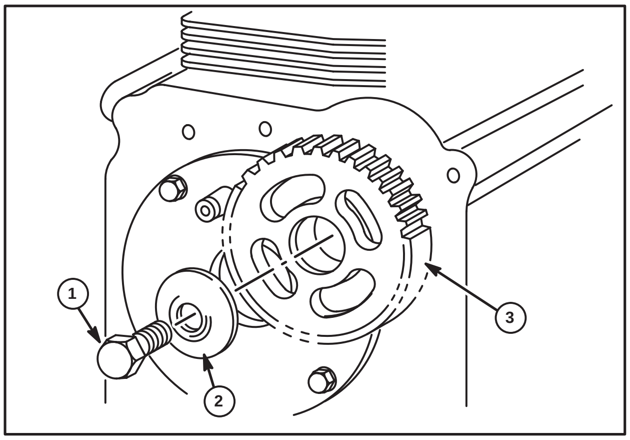

Fig. 4

Model Series 301400, 302400, 325400, 326400, 32K400

1. Loosen long bolt and Belleville washer (2) two turns and tap head of bolt with hammer (3) to loosen cam gear (1) from shaft, Fig. 5.
2. Turn bolt out while pushing out cam gear shaft.

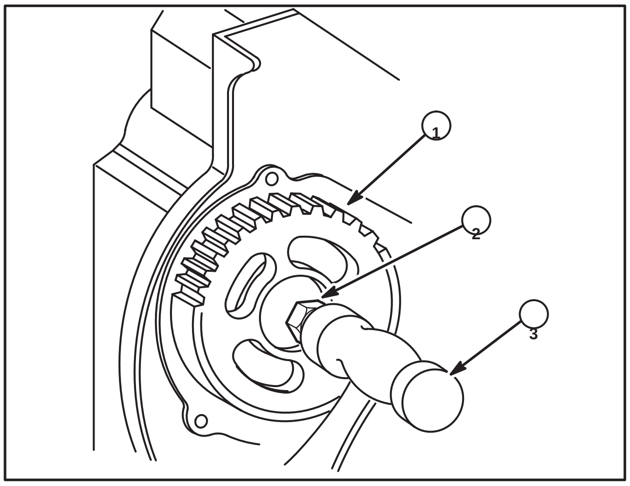

Fig. 5

3. Remove bolts (5) from cam gear bearing, Fig. 6. While holding cam gear, remove cam gear bearing and cam gear.
   Save any shims (4, if used).

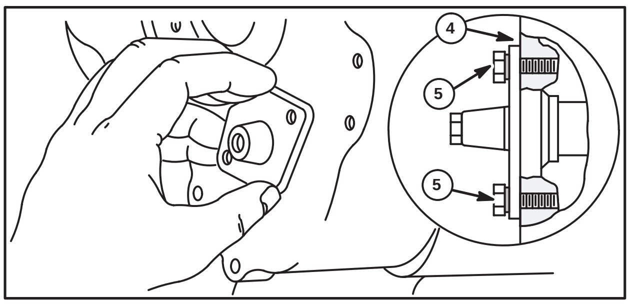

Fig. 6

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

10

CHECK CRANKSHAFT

All Engines

Fig. 7 shows various crankshaft locations to be checked. Table No. 1, Specifications, shows reject sizes for those dimensions.
Inspect the gear teeth (1) for wear or damage.
Measure the PTO end journal (2), crankpin journal (3) and magneto end journal (4).
Inspect the crankshaft plunger flat or keyway (5). Discard the crankshaft if the flat or keyway are damaged.
Inspect the threads (6) for wear or damage.

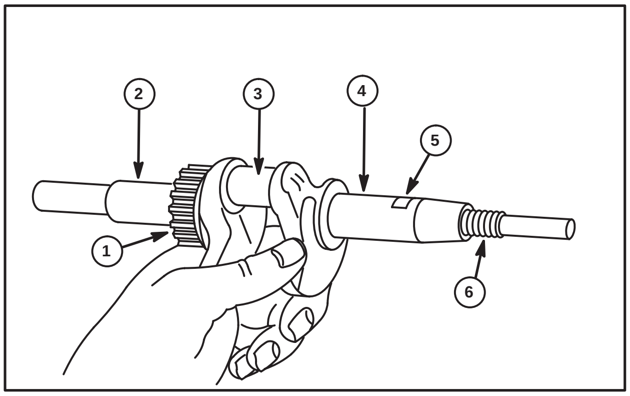

Fig. 7

Undersize crankpin journals may be suitable for re-grinding and re-fitting with undersize connecting rod, see note below. Scrap the crankshaft if it is worn beyond specification.
Check keyways for wear or deformation. Deburr keyway edges to prevent scratching bearing and oil seals.

CAUTION:

DO NOT straighten bent crankshafts.

NOTE: .020” (.51 mm) undersize connecting rods may be obtained for use on reground crankpin journals. See Table No. 2, Page 25 for grinding dimensions. Complete instructions are included with undersize rod. (See Illustrated Parts List to find appropriate undersize connecting rod.)

Check Cam Gear – All Engines

Inspect gear teeth for wear and nicks. Cam gear journals and lobe rejection sizes are shown in Table No. 3, Specifications, Page 26.

Checking Compression Release (Mechanical Yoke Type)

Mechanical yoke type compression releases use a spring loaded yoke (2) at the exhaust cam lobe (1) to open the exhaust valve during starting. When engine starts, centrifugal force causes the yoke to overcome spring tension and swings away from exhaust tappet returning engine to normal compression, Fig. 8.

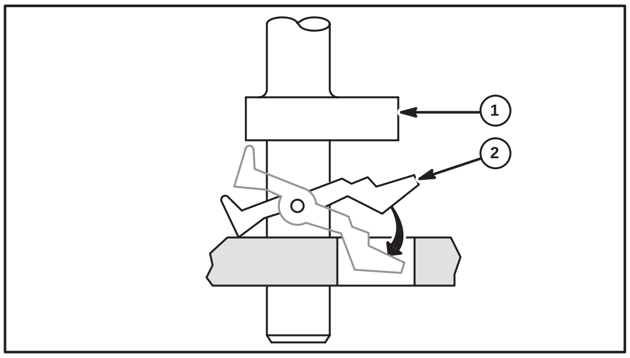

Fig. 8

To Check: To check, move yoke away from face of cam gear and release. Yoke should return to compression release position without binding or sticking. Replace cam gear if yoke binds, yoke pivot pin is worn, or return spring is broken.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

Model Series 111200, 111900

This cam gear has a mechanical compression release on the exhaust cam lobe plus Easy-Spin® (1). In the starting position, the actuator cam (3) moves the rocker cam (2) so it will open the exhaust valve at the same time as the Easy-Spin® lobe opens the intake valve. When the engine starts, the actuator cam moves down and the exhaust valve operates normally.

1. To check, move actuator cam to the running position, Fig. 9.
2. Push rocker cam against the actuator cam.

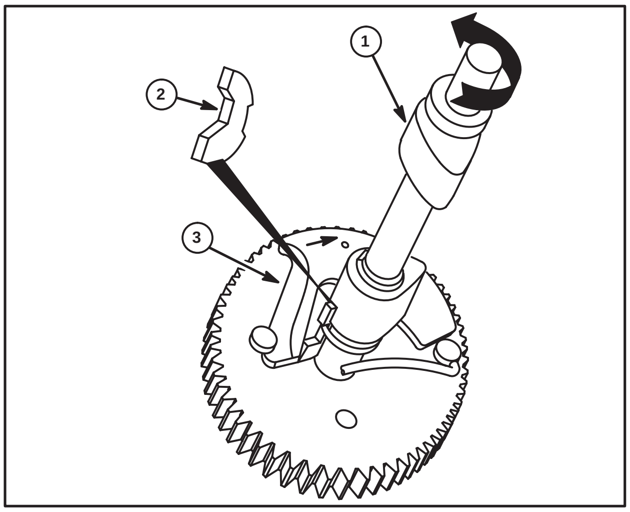

Fig. 9

3. Release the actuator cam. Actuator cam spring (4) should pull actuator cam against the shoulder pin (5), causing rocker cam to raise up to starting position, Fig. 10.
4. There should be no binding. Replace if binding exists.

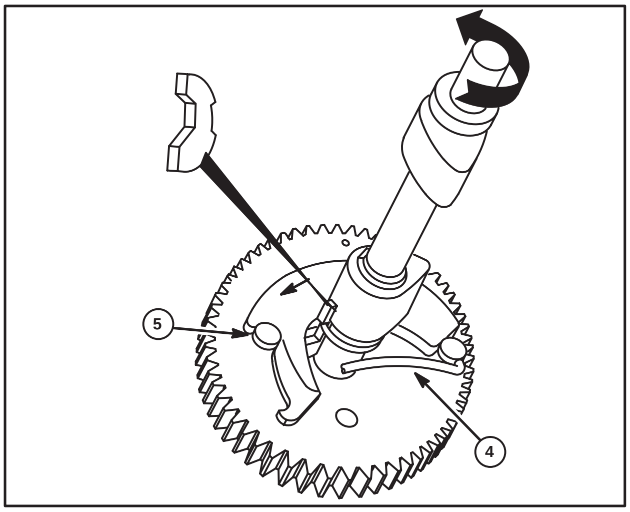

Fig. 10

BALL BEARINGS

Remove

The ball bearing (3) is a press fit on the crankshaft (2). If bearing is to be removed, use an arbor press (1), as shown in Fig. 11.

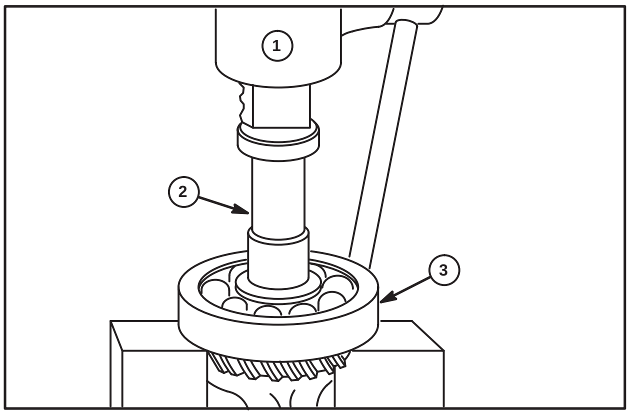

Fig. 11

Install

1. Heat bearing in hot oil 250° F (120° C) max.

   NOTE: Bearing must not rest on the bottom of the pan in which it is heated.

⚠ WARNING

HOT OIL will cause severe burns if splashed on skin.

- Always use protective gloves and shop rags when handling hot ball bearings.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

10

2. Place crankshaft in soft jawed vise with bearing side up. When bearing is sufficiently heated, it will slip over the crankshaft bearing journal.
3. Grasp bearing (2) with the shield down and slip on the crankshaft bearing journal (1), Fig. 12.
4. The bearing will tighten on the shaft as it cools. DO NOT QUENCH.

NOTE: Bearing shield faces crankshaft crankpin.

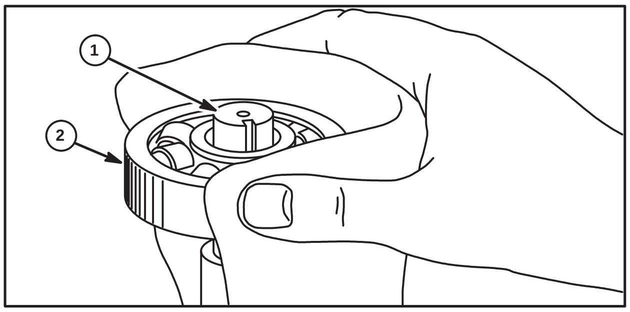

Fig. 12

INSTALL CRANKSHAFT AND CAM GEAR

Aluminum Cylinders – Plain Bearing

1. Install valve tappets.
2. Apply oil to the crankshaft journal (1).
3. Install crankshaft to magneto side of engine (2), using Seal Protector Kit, Tool #19356. See Table No. 4, Page 27, Specifications, for correct seal protector color code.
4. Turn crankshaft until timing mark (3) is facing carburetor side of cylinder. Install cam gear (4) with timing mark aligned to crankshaft timing mark, Fig. 13.

NOTE: Many Model Series have a removable timing gear. Install timing gear with inner chamfer toward crank pin. This assures the timing mark will be visible, Fig. 13.

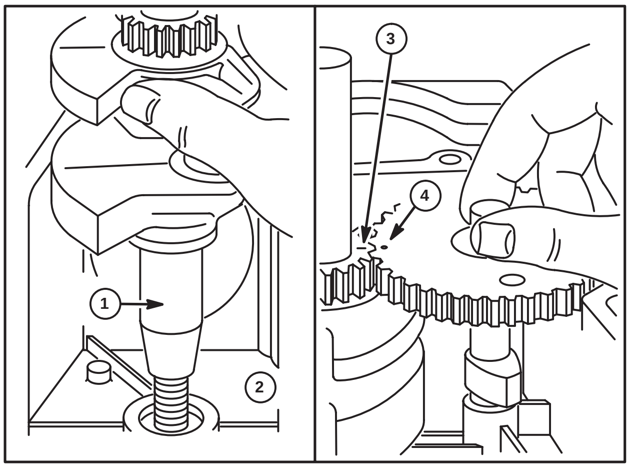

Fig. 13

Aluminum Cylinders – Ball Bearing

On ball bearing crankshafts, the crankshaft gear teeth are not visible. The timing mark is on the crankshaft counterweight (3).

1. Install valve tappets.
2. Install crankshaft, using Seal Protector Kit, Tool #19356. See Table No. 4, Page 27, Specifications, for correct seal protector color code.
3. Install both crankshaft and cam gear (2) together, with timing marks (1, 3) aligned, Fig. 14.

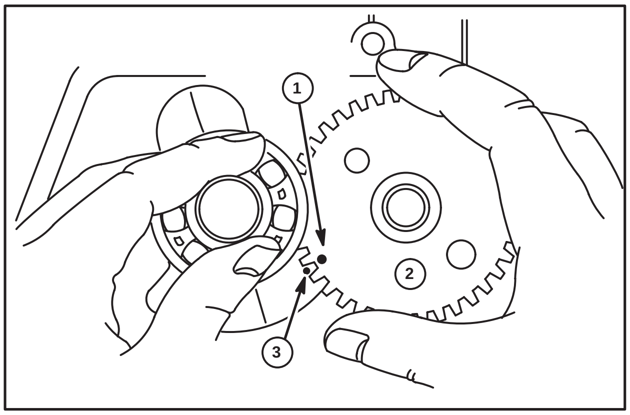

Fig. 14

Install Crankcase Cover or Sump All Aluminum Model Series

Use Seal Protector to protect oil seal when installing crankcase cover or sump. See Table No. 4, Page 27, Specifications, for correct seal protector color code. DO NOT FORCE COVER OR SUMP. Make sure mechanical governor gear (1) is engaged with cam gear.

Torque Crankcase Cover or Sump All Aluminum Model Series

Torque crankcase cover or sump to specifications listed in Table No. 6, Page 27, Specifications.

NOTE: On Model Series 100900, 130700, 131700, and 130900 a spring washer (3) is used on cam gear (2) as shown in Fig. 15. Model Series 130780, 130980, 131780, and 132980 do not use a spring washer.

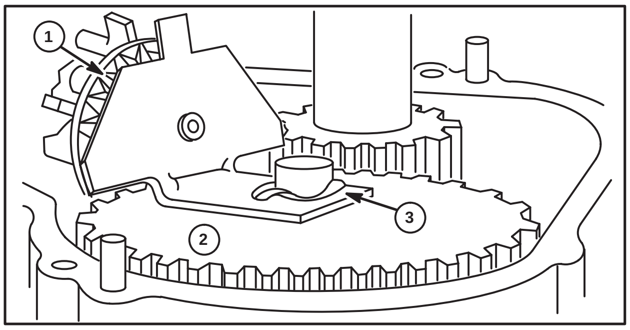

Fig. 15

INSTALL CRANKSHAFT AND CAM GEAR Cast Iron Cylinders

Plain Bearing

1. Assemble tappets in cylinder and insert cam gear.
2. Push camshaft into cylinder from flywheel (magneto) side thru cam gear.
3. With a blunt punch and arbor press or hammer, press or drive camshaft until end is flush with outside of cylinder on power take-off side.
4. Place a small amount of sealer such as Permatex 2® on camshaft plug, when used, and press in plug on flywheel side of cylinder.
5. Install crankshaft aligning timing marks (1), Fig. 16.

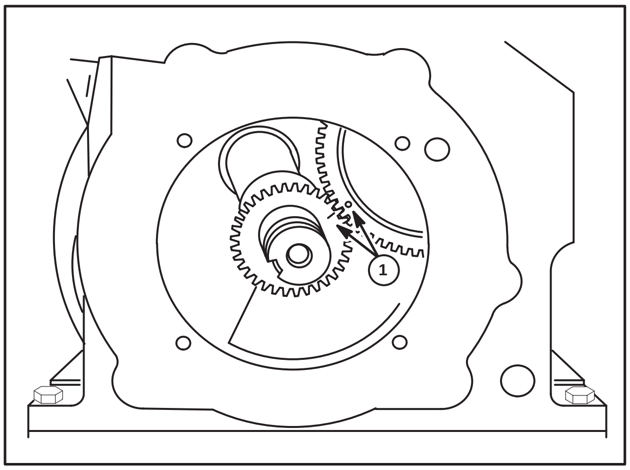

Fig. 16

Ball Bearing Except Model Series 300000, 320000

1. Install breaker plunger (when used) and tappets.
2. Insert cam gear (2) into cylinder.

NOTE: On some models, push cam gear forward into recess in front of cylinder (3).

3. Install crankshaft (1) into cylinder.
4. Rotate crankshaft and cam gear until timing marks align. Push cam gear into engagement with crankshaft gear, maintaining alignment.
5. Install camshaft into cylinder and cam gear from magneto side of cylinder until flush with PTO side of cylinder.
6. Place a small amount of sealant on plug and press into camshaft hole on flywheel side of cylinder, Fig. 17.

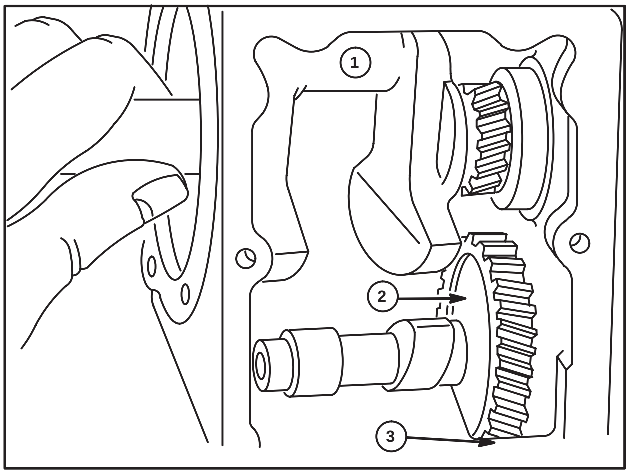

Fig. 17

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Ball Bearing
Model Series 300000, 320000

1. Install breaker plunger (2, when used) and tappets (1).
2. Insert cam gear from PTO side of cylinder (3), Fig. 18.
3. Slide cam gear shaft (4) through PTO side and into cam gear, Fig. 19.
4. Install magneto side cam gear bearing on cylinder.
5. Torque bearing screws to 90 in. lbs. (10 Nm).
6. Install long cam gear bolt (5) 5–1/2” (140.00 mm) finger tight to prevent loss of camshaft, Fig. 20.

Check Cam Gear End Play

Cam gear end play is machined at the factory and requires no adjustment unless magneto side cam bearing or cam gear is replaced. End play should be .002” (.05 mm) – .008” (.20 mm).

1. Push cam gear against magneto side of cylinder and insert feeler gauge between cam gear and PTO side of cylinder.
2. If end play is more than .008” (.20 mm), use service bearing assembly Kit #299706. Kit contains a new bearing and shims, .005” (.13 mm), .007” (.18 mm), and .009” (.23 mm) thick to adjust end play. Install new bearing without shims and measure end play. If .002” (.05 mm) or less, add shims to obtain proper end play.
3. Torque bearing screws to 90 in. lbs. (10 Nm).

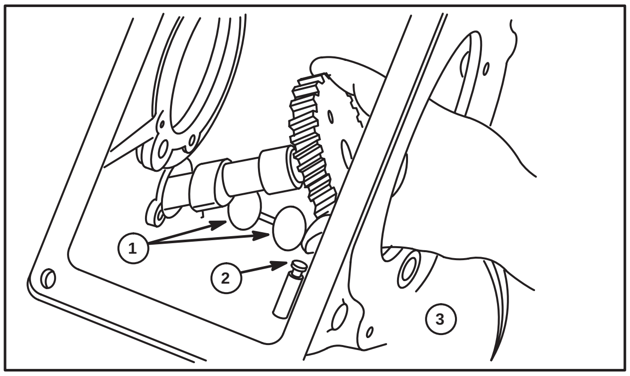

Fig. 18

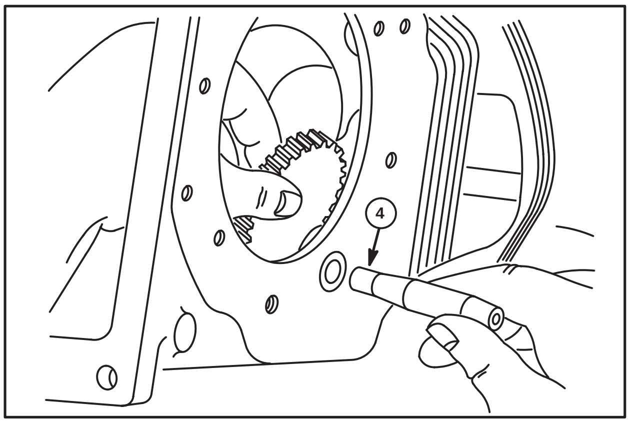

Fig. 19

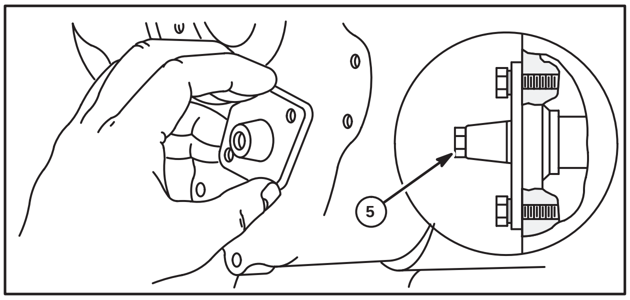

Fig. 20

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Install Crankshaft
Model Series 300000, 320000

Timing mark (1) is a notch on crankshaft throw directly in line with gear tooth that will engage cam gear at timing mark on cam gear (2).

1. Mark top of tooth (3) with chalk or crayon.
2. Align timing marks and install crankshaft, using care not to damage crankpin, Fig. 21.

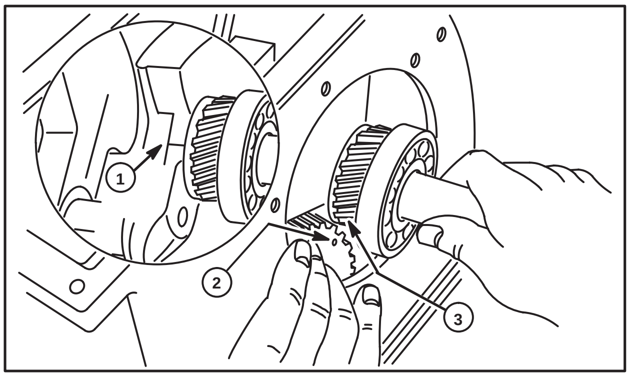

Fig. 21

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

Install Bearing Supports Model Series 230000, 240000, 300000, 320000

Install bearing supports with new gaskets. Torque PTO side bearing support (2) bolts to 190 in. lbs. (21 Nm) and flywheel side bearing support (1) bolts to 90 in. lbs. (10 Nm), Fig. 22.

Crankshaft End Play All Model Series

Crankshaft end play is .002" – .008" (.05 mm – .20 mm) on all models except as listed in Table No. 5, Page 27. Specifications. Procedures for adjusting end play differ according to engine type. See Text.

Check and Adjust Crankshaft End Play Aluminum Cylinders – Plain Bearings

When crankcase cover or sump is installed with a .015" (.38 mm) thick gasket, end play should be within specification.

If end play is less than required, use additional gaskets (2), .005" (.13 mm), .009" (.23 mm), or .015" (.38 mm) alone or in combination, to adjust, Fig. 23.

NOTE: If end play exceeds specification with one .015" (.38 mm) thick gasket, a thrust washer (1) is available for use on the P.T.O. end of the crankshaft (except Model Series 100700, 120000, flywheel end only), with additional .005" (.13 mm), .009" (.23 mm) or .015" (.38 mm) gasket to reduce end play, Fig. 23.
Gaskets (2) are available in thicknesses of: .015" (.38 mm), .009" (.23 mm), 005" (.13 mm).

- 220624 .0625 thrust washer for .875" (22.23 mm) dia. crankshaft.
- 220708 .0625 thrust washer for 1.000" (25.4 mm) dia. crankshaft.
- 222949 .062 thrust washer for 1.181" (30.0 mm) dia. crankshaft.
- 222951 .062 thrust washer for 1.378" (35.0 mm) dia. crankshaft.

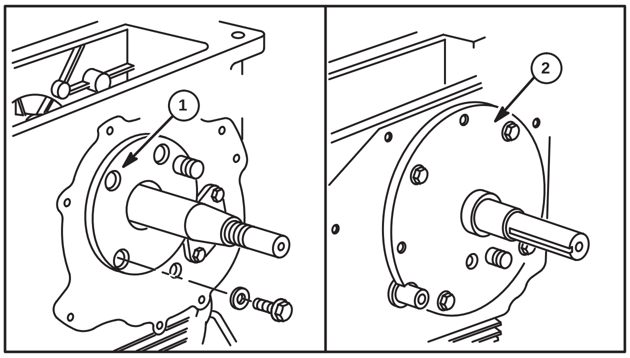

Fig. 22

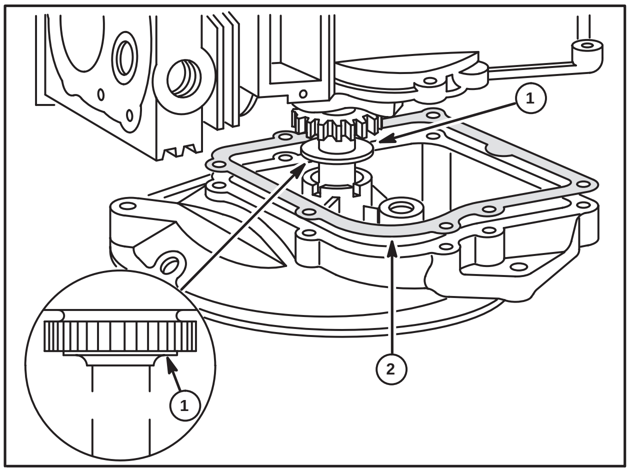

Fig. 23

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

Aluminum Cylinders – PTO Ball Bearing

End play is adjusted the same way as on plain bearing engines. If thrust washer is required, it is used on the magneto end of the crankshaft.

NOTE: Thrust washers cannot be used on engine with two ball bearings. Replace worn parts.

Model Series 230000, 240000 Plain and Ball Bearing

With one .020” (.51 mm) thick gasket and magneto bearing support in place, use a feeler gauge (1) to measure end play. End play should be .002 – .008” (.05 – .20 mm), Fig. 24.

If end play is less than required, use additional gaskets, .005” (.13 mm), .009” (.23 mm) or .015” (.38 mm) as needed, alone or in combination, to adjust.

If end play is more than specification, use a thinner gasket to adjust.

If end play is more than specification using one .005” (.13 mm) thick gasket, a thrust washer (2) can be used on the PTO end of the crankshaft, Fig. 25. After installing a thrust washer measure the end play, and adjust as required.

NOTE: Thrust washers cannot be used on crankshaft with two ball bearings. Replace worn parts.

Model Series 300000, 320000

End play is machined at the factory and does not have to be checked unless the bearing supports or crankshaft has been replaced.

If end play is less than .002” (.05 mm), add service shims .005” (.13 mm), .010” (.25 mm) or .015” (.38 mm) to get proper end play. If end play is more than .008” (.20 mm), use service bearing support kit Part #299705, which includes the above shims to get proper end play.

10

GEAR REDUCTION DISASSEMBLE Model Series 60000, 80000, 100200, 110000, 130000

Drain and Disassemble Gear Reduction

1. Note position of gear reduction assembly on engine.
2. Remove oil vent plug (2).
3. Loosen four gear case cover screws (4).
4. Break cover (3) loose from gear case (1) assembly to drain gear case.
5. After gear case is drained, remove screws and cover, Fig. 26.

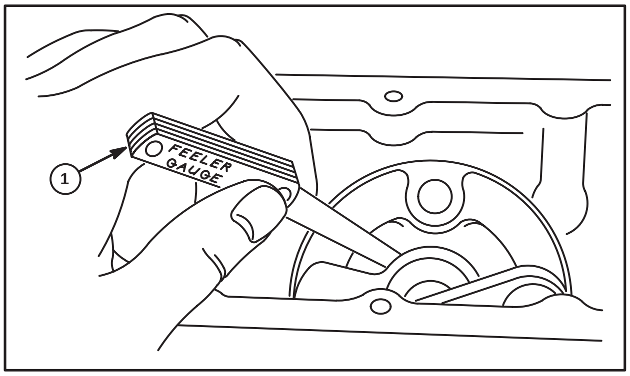

Fig. 24

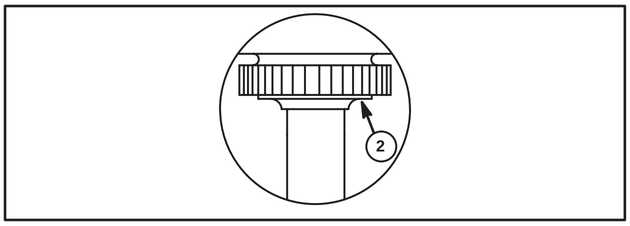

Fig. 25

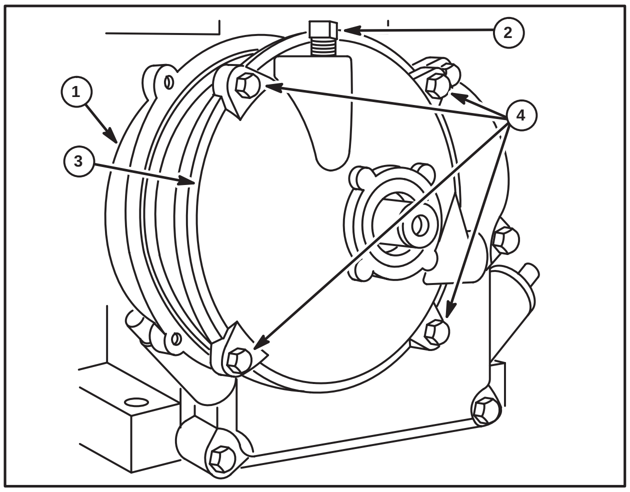

Fig. 26

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

Remove Output Gear-PTO Shaft Assembly and Gear Case Assembly

1. Remove shaft assembly (2) from gear case (4).
2. Bend down two screw locks (1, if equipped), and remove two long cap screws (3).
3. Remove two short cap screws and lock washers (5).
4. Slide gear case off engine, Fig. 27.

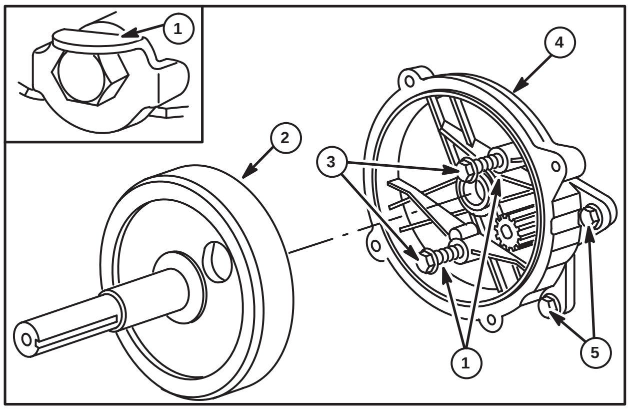

Fig. 27

Inspect Output Gear-PTO Shaft, Gear Case and Cover Assemblies

Inspect seals for cracks, tears, or hardening.
Inspect crankshaft pinion gear and drive gear for worn, cracked, or chipped teeth.
Inspect gear case and cover for cracks, damaged mounting or gasket surfaces.
Replace any component if damaged or worn.

ASSEMBLE

Install Seals and Gear Case Assembly

1. Install seals with sealing lip (1) toward engine side of gear case (2) or cover assemblies (3) until seal is flush with case or cover, Fig. 28.

   NOTE: The housing must be installed in the same position as when removed, Fig. 30.

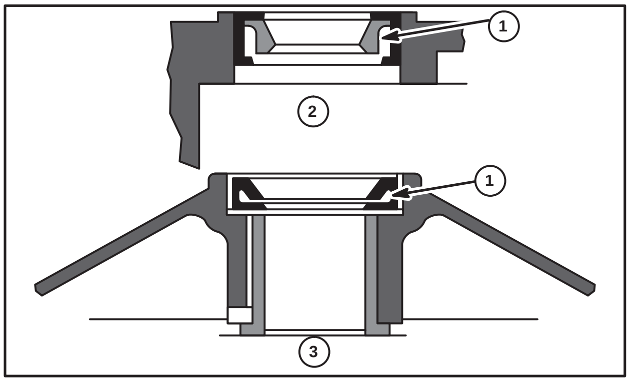

Fig. 28

2. Install cork gasket on crankcase cover (when used).
3. Slide gear case assembly onto crankshaft and bearing housing assembly.
4. Bend lock tabs (if used) up against flats on head of cap screws, Fig. 29.
5. Install two short screws (5) with lock washers.
6. Install two long screws (6) and screw locks (4, if used) with lock tabs flat.
7. Torque four screws to 140 in. lbs. (16 Nm).
8. Slide output gear and PTO shaft assembly into gear case bearing and engage crankshaft pinion gear.
9. Insert seal protector into seal of gear case cover. See Table No. 4, Page 27, Specifications, for correct seal protector color code.
10. Place new gasket on gear case assembly.
11. Place the gear case assembly on the engine in the original position.

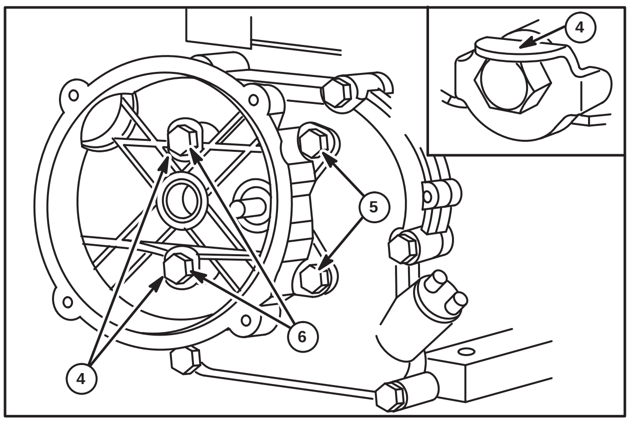

Fig. 29

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

NOTE: Standard bearing housing position is 9 O'Clock (A), in relation to the engine crankshaft (7). Optional positions are 12 O'Clock (B), 3 O'Clock (C) and 6 O'Clock (D).

12. Slide cover and seal protector on to gear case and drive shaft until cover is seated on new gasket. Remove seal protector.
13. Torque cover screws (8) to 90 in. lbs. (10 Nm), Fig. 31.

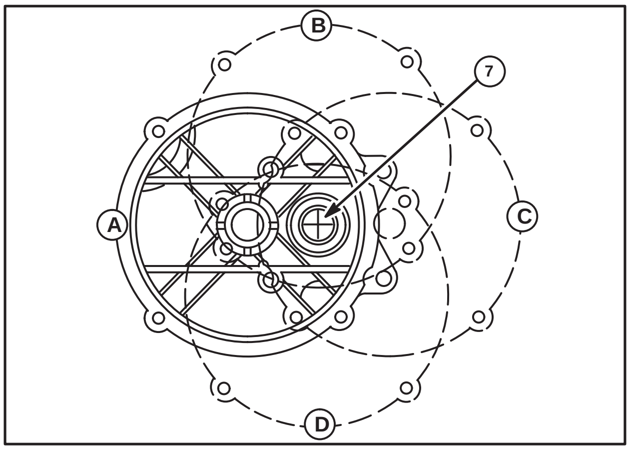

Fig. 30

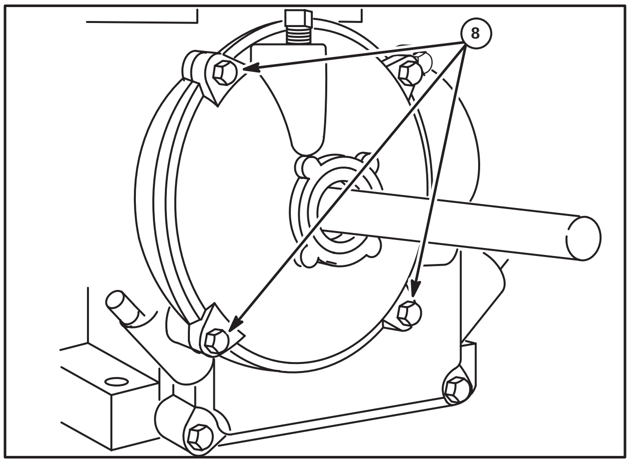

Fig. 31

Fill Gear Case with Lubricant

1. Remove oil level plug (2) and vent plug (1).
2. Fill gear case just to the point of overflowing at the lower hole with proper oil. See Section 8, Lubrication.
3. Install oil level plug in lower hole and torque to 90 in. lbs. (10 Nm).
4. Install vent plug in top hole and torque to 40 in. lbs. (5 Nm), Fig. 32.

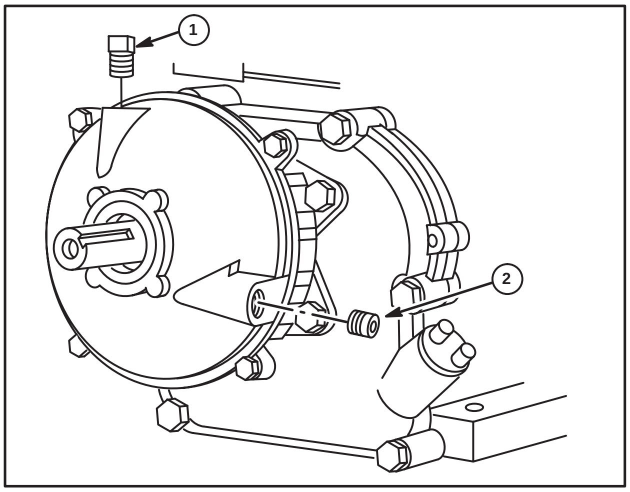

Fig. 32

Disassemble and Drain Gear Reduction Counterclockwise Rotation (CCR) Model Series 170000, 190000, 220000, 230000, 240000,

1. Remove oil vent plug (1, if equipped).
2. Remove drain plug (3) from bottom of cover assembly (2).
3. After gear case is drained, loosen and remove four cap screws and cover, Fig. 33.

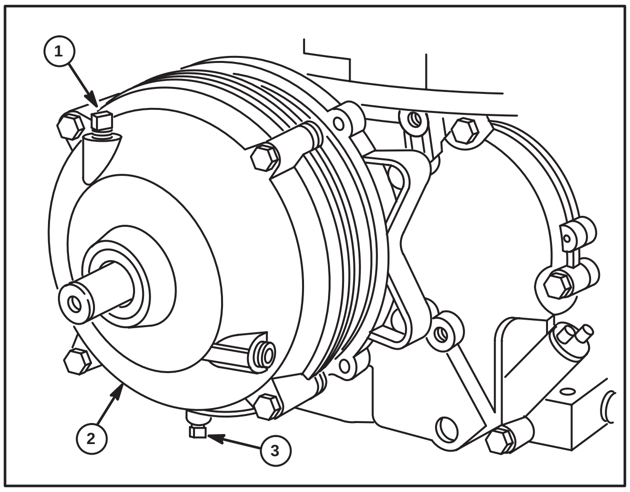

Fig. 33

Remove Drive Shaft and Gear Case Assembly

1. Note position of gear case assembly, Fig. 36.
2. Remove drive shaft assembly (2) from gear case.
3. Bend down two screw locks (1, if equipped). Remove four cap screws (3).
4. Slide gear case off engine, Fig. 34.

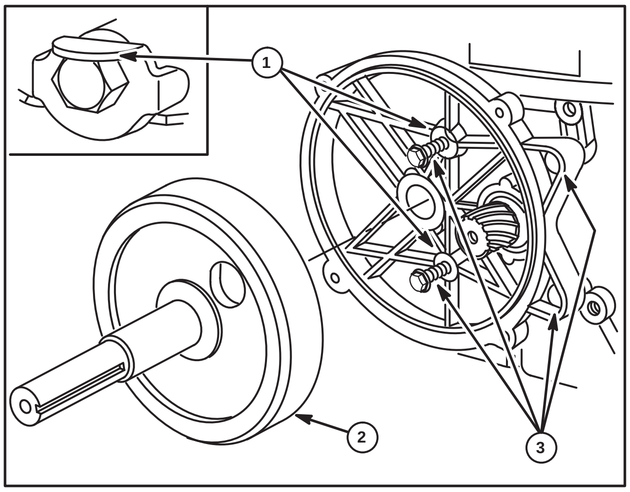

Fig. 34 – Removing Gear Case

Inspect Output Gear – PTO Shaft, Gear Case and Cover Assemblies

Inspect seals for cracks, tears, or hardening.

Inspect crankshaft pinion gear and drive gear for worn, cracked, or chipped teeth.

Inspect gear case and cover assemblies for cracks, damaged mounting or gasket surfaces.

Replace any component if damaged or worn.

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

ASSEMBLE

Install Seals and Gear Case Assembly

1. Install seal with sealing lip (1) towards engine side of gear case (2) or cover (3) until seal is flush with surface of case (when used) or cover, Fig. 35.

   NOTE: The housing must be installed in the same position as when removed.

   NOTE: Standard bearing housing position is 9 O'Clock (A), in relation to the engine crankshaft (4). Optional positions are 12 O'Clock (B), 3 O'Clock (C) and 6 O'Clock (D), Fig. 36.

2. Slide gear case assembly and new gasket onto crankshaft and crankcase cover assembly.
3. Install two short screws (6) and lock washers.
4. Install two long screws (7) and screw locks (5, if used) with lock tabs flat.
5. Torque four screws to 140 in. lbs. (16 Nm).
6. Bend lock tabs up against flats on head of cap screws, Fig. 37.

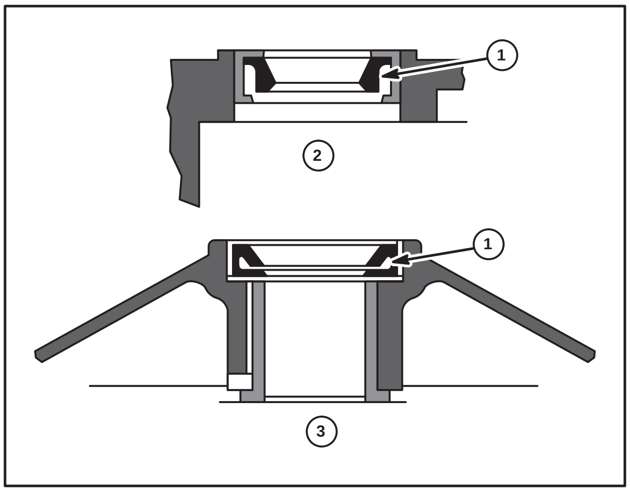

Fig. 35 – Installing Seals

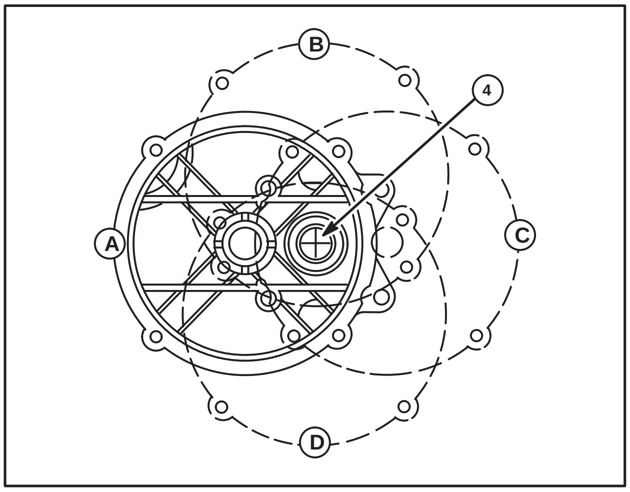

Fig. 36

7. Slide drive shaft assembly into gear case bearing and engage crankshaft pinion gear.
8. Insert seal protector into seal of gear case cover. See Table No. 4, Page 27, Specifications, for correct seal protector color code.
9. Place new gasket on gear case assembly.
10. Slide cover and seal protector unto gear case until cover is seated on new gasket.
11. Remove seal protector (9).

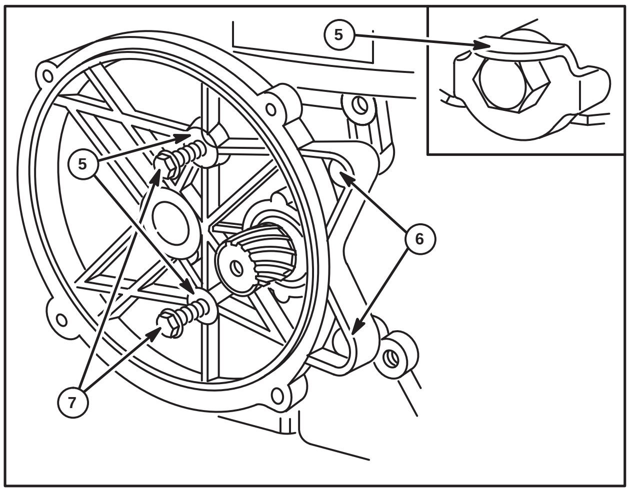

Fig. 37

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

12. Torque cover screws (8) to 190 in. lbs. (21 Nm), Fig. 38.

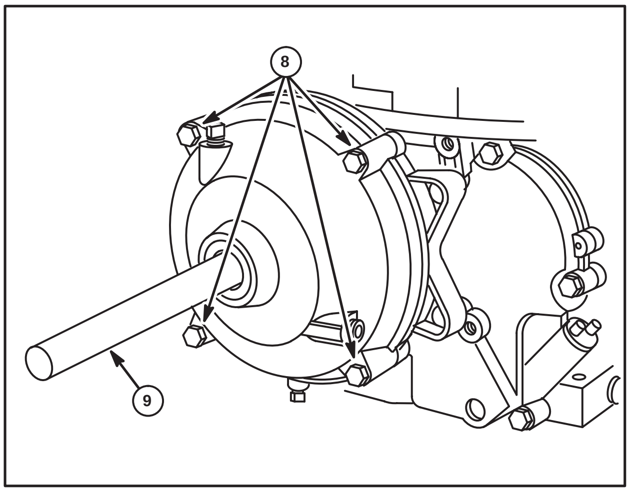

Fig. 38

Fill Gear Case with Lubricant (Fig. 39)

1. Install drain plug (2) in bottom of gear case (if equipped). Torque to 65 in. lbs. (7 Nm).
2. Remove oil level plug (3).
3. Fill gear case just to the point of overflowing at the lower hole with the proper oil. See Section 8, Lubrication.
4. Install oil level plug in lower hole (if equipped). Torque to 90 in. lbs. (10 Nm).
5. Install vent plug (1) in top hole, (if equipped). Torque to 40 in. lbs. (5 Nm).

NOTE: On Model Series 230000, 240000, the gear reduction and the engine use the same oil supply. After initial fill, start and run engine briefly. Then stop engine, recheck oil level and add oil as required to bring level to full.

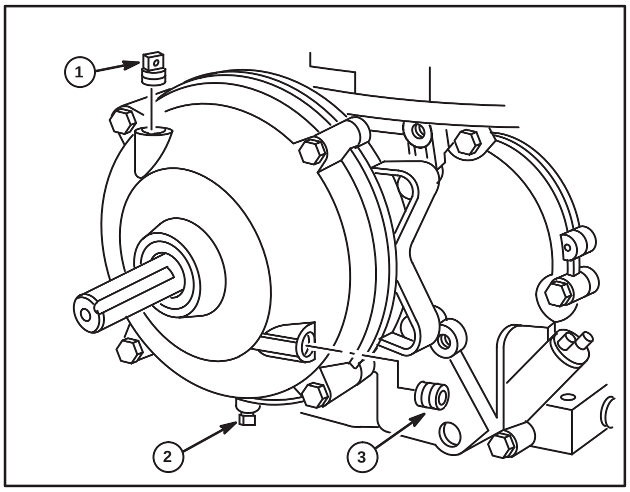

Fig. 39

Model Series 230000
Clockwise PTO Rotation
Drain and Disassemble

Note position of gear reduction case on engine, Fig. 36.

1. Loosen all the cover cap screws (1) one to two turns.
2. Break cover (2) loose from case. Drain oil.
3. After gear case is drained, remove cap screws and cover, Fig. 40.

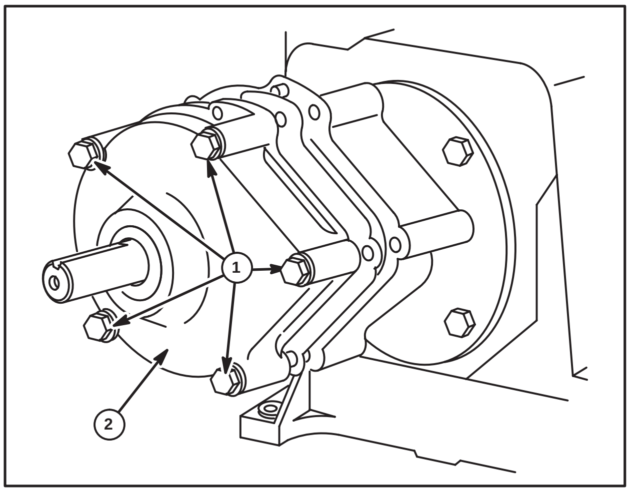

Fig. 40

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

Remove Drive Gear – PTO Shaft Assembly and Gear Case

Remove four cap screws (5) and lock washers.
Slide gear case (3) and drive shaft assembly (4) off engine, Fig. 41.

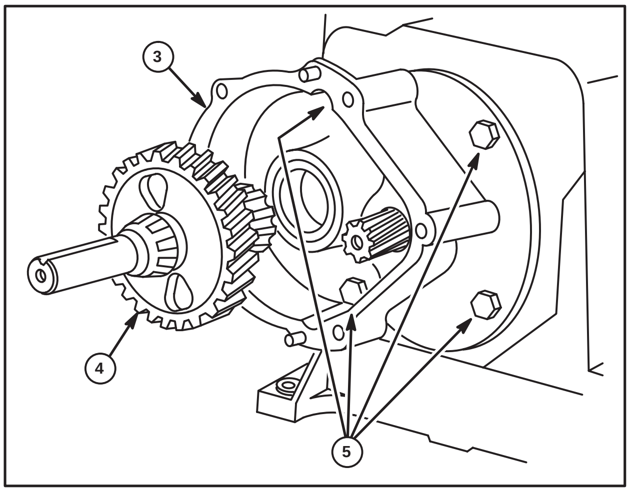

Fig. 41

Remove Bearings

Bearing cup in gear case cover is a slip fit, while bearing cup may be either a slip or press fit in gear case. When removing bearing cups take note of which cup has shims. Remove roller bearing by pressing the shaft and gear assembly out of the bearing with an arbor press. Do not reuse bearings.

Inspect Gear Case and Cover Assemblies

Inspect seals for cracks, tears, or hardening.
Inspect crankshaft pinion gear and drive gear for worn, cracked, or chipped teeth.
Inspect gear case and cover assemblies for cracks, damaged mounting or gasket surfaces.
Inspect bearing cup and tapered rollers bearings for roughness, pitting and cracks.
Replace any component if damaged or worn.

ASSEMBLE

Install Tapered Roller Bearings

1. Heat bearing (1) in hot oil, 350° F (177° C) max.

   NOTE: Bearing must not rest on the bottom of the pan in which it is heated.

2. Place drive shaft (2) and gear assembly in soft jawed vise with bearing side up. When bearing is hot it will become a slip fit on the drive shaft journal.
3. Grasp bearing and thrust it down on the drive shaft against flange of gear, Fig. 42.
4. The bearing will tighten on the shaft while cooling. DO NOT QUENCH.

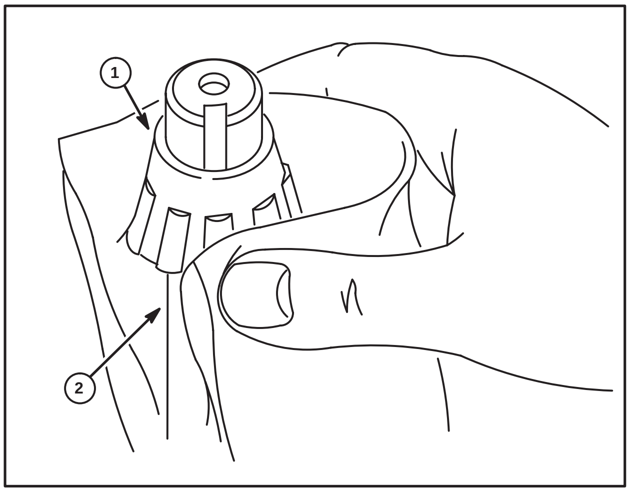

Fig. 42

Install Seals

Install seal with sealing lip (1) toward engine side of gear case cover (2) until metal case of seal is flush with gear case cover, Fig. 43.

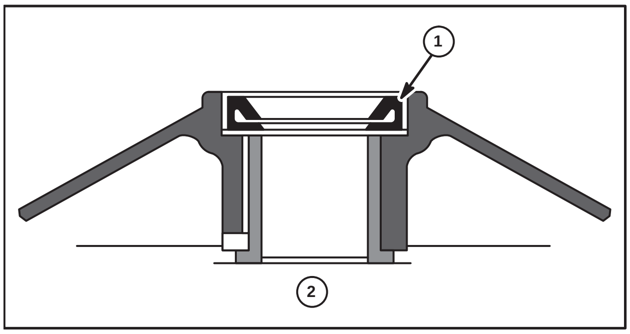

Fig. 43

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

Install Gear Case Assembly

Install gear case in same position as when removed from engine, Fig. 44. Torque screws with lock washers to 140 in. lbs. (16 Nm).

NOTE: Standard bearing housing position is 9 O'Clock (A), in relation to the engine crankshaft (3). Optional positions are 12 O'Clock (B), 3 O'Clock (C) and 6 O'Clock (D), Fig. 44.

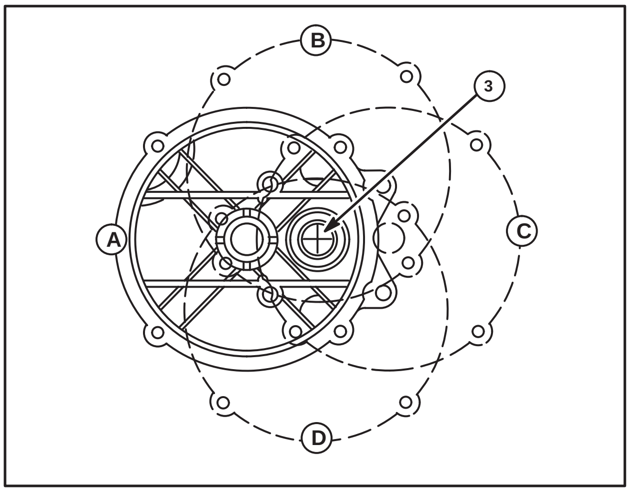

Fig. 44

Install Gear Case Cover Assembly

1. Place bearing cup in bearing cup counterbore of gear case cover without shims.
2. Slide output gear PTO shaft assembly into gear case bearing and engage crankshaft pinion gear.
3. Place bearing cup in bearing cup counterbore of gear case assembly without shims.
4. Place a new cover gasket on gear case assembly dowel pins.
5. Use Seal Protector (2) to protect oil seal when installing crankcase cover or sump. See Table No. 4, Page 27, Specifications, for correct seal protector color code.
6. Slide gear case cover (3) assembly and seal protector onto gear case assembly.
7. Install screws (1) and lock washers. Torque screws to 190 in. lbs. (21 Nm), Fig. 45.

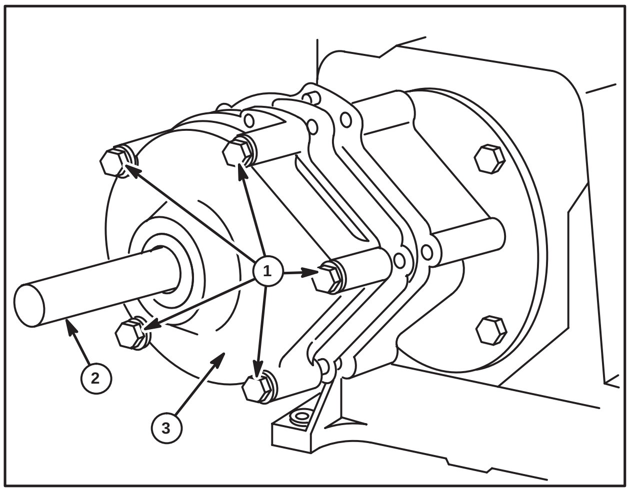

Fig. 45

Adjust Roller Bearing Pre-load

1. Place a dial indicator (1) against end of drive shaft (2), Fig. 46.
2. Push in on drive shaft and turn shaft slowly to seat bearing in bearing cup, indicated by no further needle movement on dial indicator.
3. Set dial indicator to zero.
4. Pull out on drive shaft and rotate drive shaft slowly to seat bearing.
5. Note dial indicator reading.
6. Repeat both steps to verify dial indicator reading.

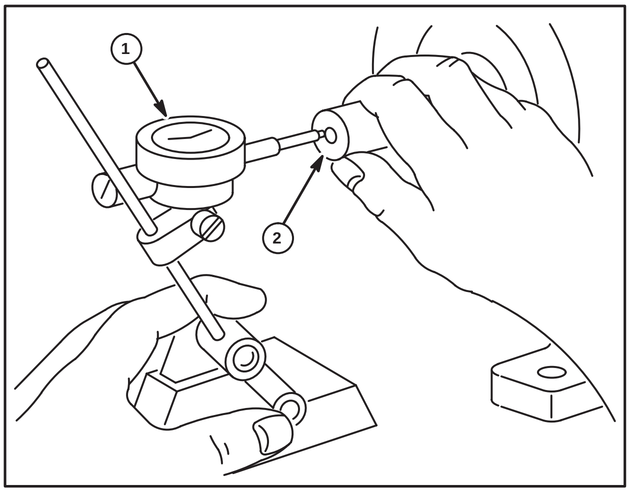

Fig. 46

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

NOTE: If a dial indicator is not available, use a sprocket or pulley (3) and feeler gauge (4) to check end play as shown in Fig. 47.

7. Remove gear case cover assembly and drive shaft (if shims were behind bearing cup in gear case assembly). Shims are available in .003" (.08 mm) and .010" (.25 mm) thicknesses.
8. Use as many shims as needed to equal total end play plus .002" (.05 mm) to .005" (.13 mm).
9. Install shims behind bearing cup and reinstall cup, drive shaft assembly and gear case cover assembly.

Fill Gear Case with Lubricant

On Model Series 230000 the gear reduction and the engine use the same oil supply.

1. Fill the crankcase with the proper oil. See Section 8, Lubrication.
2. Start and run engine briefly.
3. Stop engine, recheck oil level. Add oil as required to bring engine oil level up to full (1), Fig. 48.

Auxiliary PTO Without Clutch Model Series 92580, 92980, 94580, 94980, 110980, 111980, 121780, 122780, 124780

This auxiliary PTO shaft (5) is perpendicular to the crankshaft. It rotates at the rate of one revolution for every 8-1/2 revolutions of the crankshaft. On these models, the cam gear (3), worm gear (4) and oil slinger (1) are supplied as an assembly and are not serviceable separately, Fig. 49.

NOTE: If rotation is counterclockwise, the thrust washer (2) is placed next to the worm gear on camshaft.

10

Remove Sump All Model Series except 120000

1. Remove rust or burrs from the PTO end of the crankshaft.

NOTE: One of the six sump mounting screws is located under the auxiliary drive cover.

2. Remove the cover.
3. Lift out shaft stop (1), Fig. 50.

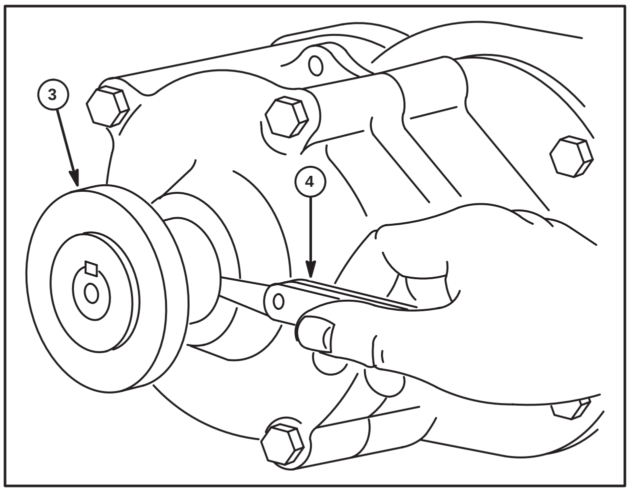

Fig. 47

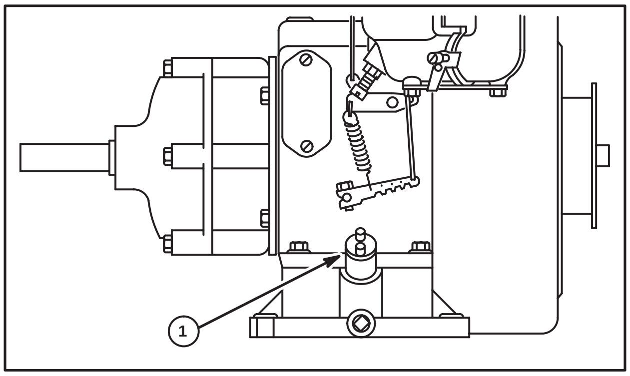

Fig. 48

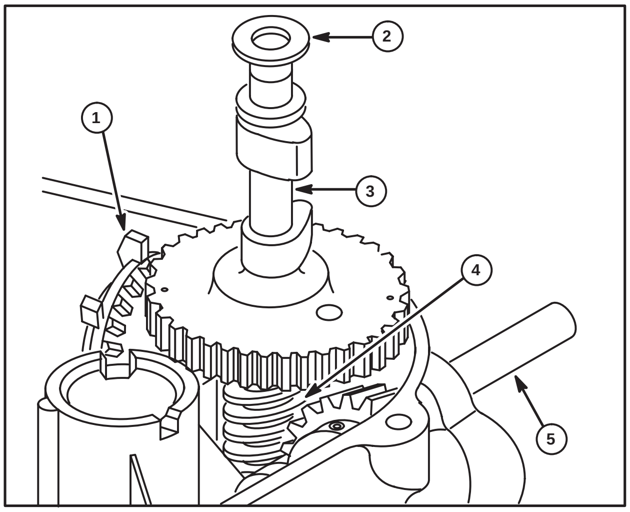

Fig. 49

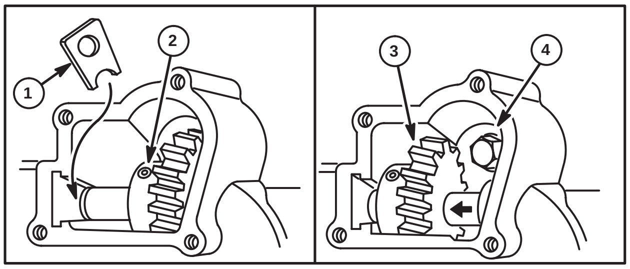

Fig. 50

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

4. Slide gear and shaft (3) sideways to expose head of sump mounting screw.
5. Use 7/16" socket to remove sump screw (4).
6. Remove remaining screws and remove sump.

NOTE: Use care when driving out roll pin (2) to prevent damage to threads.

Replace gasket (7) when installing cover (6), Fig. 51. Put non-hardening sealant on cover screws (5) .

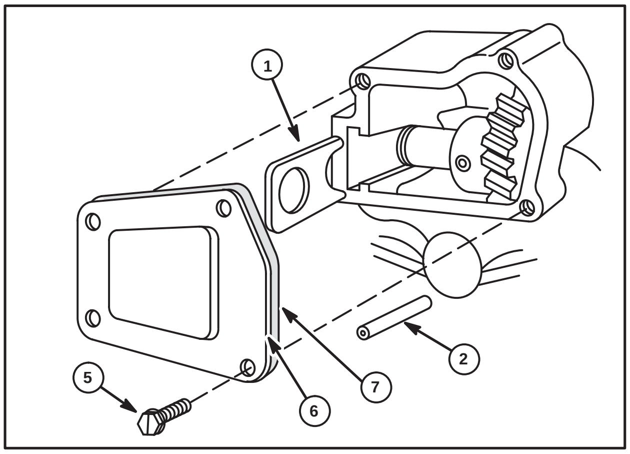

Fig. 51

Remove Sump and Auxiliary PTO Drive Shaft, Model Series 120000

1. Remove all rust and burrs from crankshaft before removing sump.
2. Remove seven sump bolts and lift off sump.
3. To remove auxiliary PTO shaft, remove Allen screw from sump (1), Fig. 52.
4. With a 3/16" (4.75 mm) pin punch drive out roll pin in bevel gear thru Allen screw hole.
5. Remove PTO shaft stop and slide out PTO shaft.

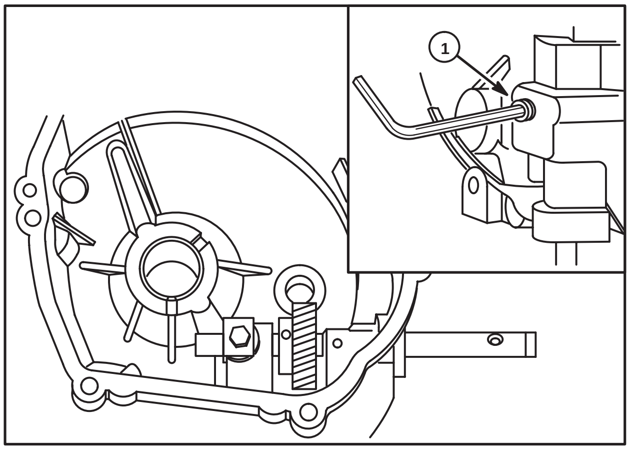

Fig. 52

Remove Sump and Auxiliary Drive Shaft with Clutch, Model Series 110980

This auxiliary PTO shaft is perpendicular to the crankshaft. It rotates at the rate of one revolution for every 8-1/2 revolutions of the crankshaft. Rotation of the shaft is controlled by a clutch on the cam gear. The clutch is engaged or disengaged by a control lever mounted on the oil sump.

Early production cam gears (A) has a groove (1) on the clutch, Fig. 53, are serviced as an assembly consisting of cam gear oil slinger, clutch hub, clutch spring and clutch sleeve assembly. Later production cam gears (B) eliminate the groove (2), and are serviced as individual parts except for the cam gear which consists of cam gear, oil slinger and clutch hub.

1. Remove rust or burrs from the PTO end of the crankshaft.

NOTE: Sump is held on by six screws. Five screws are exposed. The sixth screw is under the auxiliary drive cover, Fig. 50.

2. Remove cover and lift out shaft stop, Fig. 51.

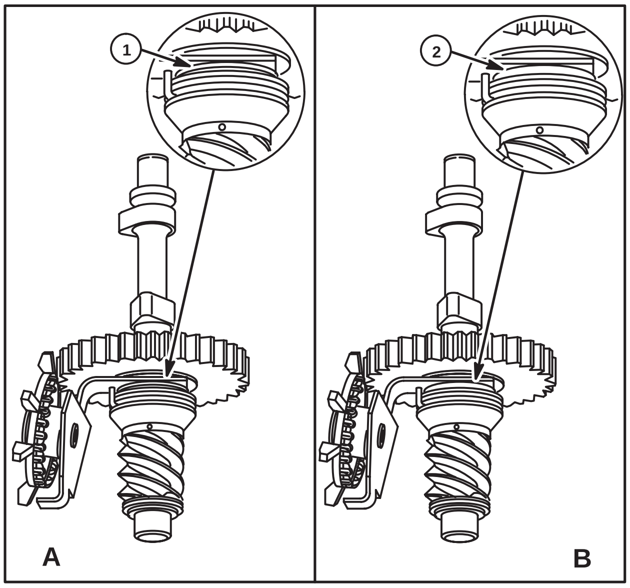

Fig. 53

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

3. Slide drive shaft and gear over to expose head of cap screw. Cap screw can be removed with 7/16” socket.
4. Remove remaining screws and remove sump.

Inspect Clutch Operation

1. Push on spring tang (3), Fig. 54, turning spring and clutch sleeve in a counterclockwise direction.
2. Spring and sleeve should rotate approximately 1/8 turn. Worm gear should not rotate in the same direction.
3. With clutch released, worm gear should rotate freely in both directions.

Check Cam Gear

Check worm gear end play using feeler gauges at point (4), Fig. 55. End play should not be less than .004” (.10 mm), or more than .017” (.43 mm).

Cam Gear Disassembly – Early Design

1. Remove “E” ring retainer.
2. Slide off copper washer, thick thrust washer, worm and thin thrust washer.
3. Cam gear, oil slinger, clutch sleeve and springs are serviced as an assembly.

Inspect Parts

Inspect for worn, burred or broken parts and replace as required.

Assemble Cam Gear – Early Design

1. Slide worm gear with thin thrust washer on cam gear.
2. Slide on thick thrust washer. Slide on copper colored washer with gray coated side toward thick thrust washer.
3. Install “E” ring retainer and check worm end play as previously described. Inspect cam gear assembly as previously described.

Disassemble Cam Gear – Current Design

1. Remove “E” ring.
2. Slide off thrust washers and worm gear.
3. Use thin blade screwdriver or similar tool to pry lower clutch spring tab (2) out of hole in clutch sleeve (1), Fig. 56.
4. Remove clutch sleeve.

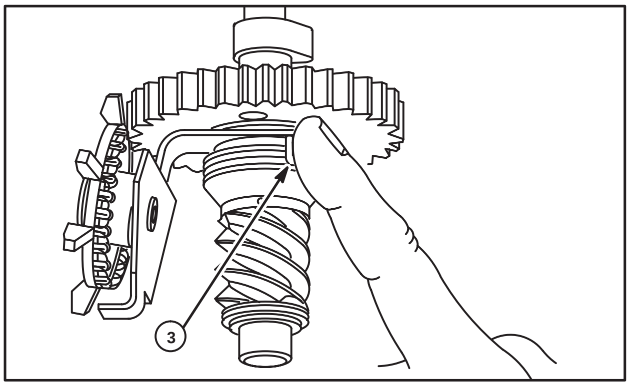

Fig. 54

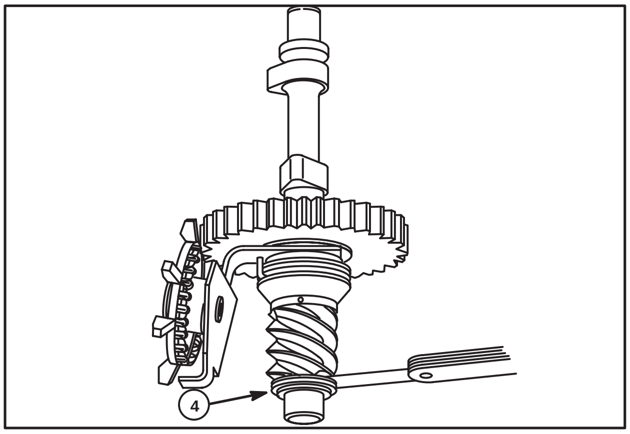

Fig. 55 – Check Cam Gear

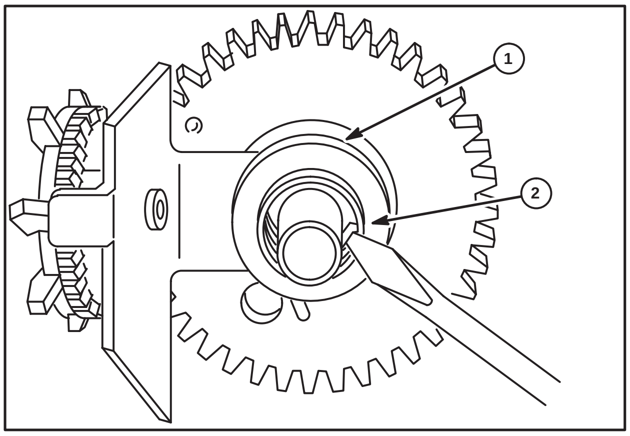

Fig. 56

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

5. Slide clutch spring down, Fig. 57 and lift out upper spring tab (3) to remove spring. Cam gear, oil slinger and clutch drive hub are serviced as an assembly.

Inspect Parts

Inspect for worn, broken or burred parts. Replace as required.

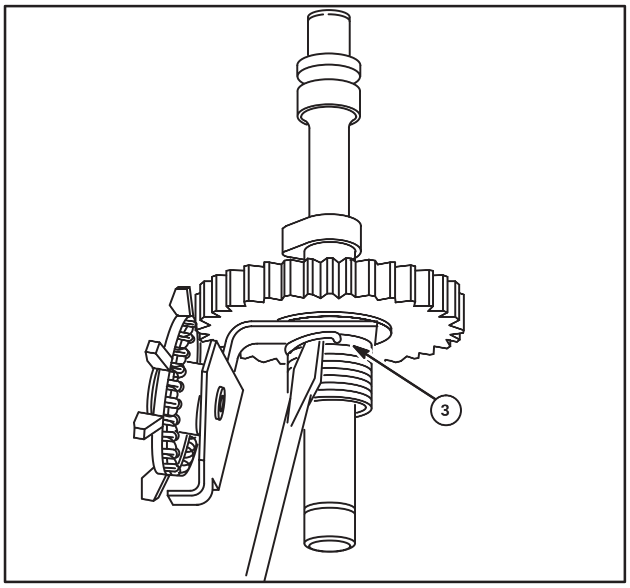

Fig. 57

Assemble Cam Gear – Current Design

1. Assemble clutch spring as shown in Fig. 58.
2. Align hole in clutch sleeve (4) with tab or spring and slide on.

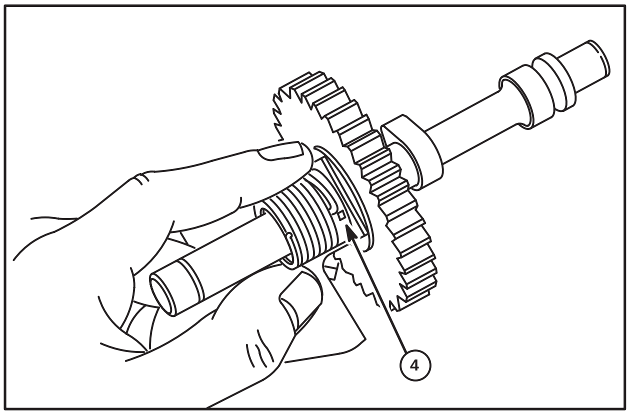

Fig. 58 – Assemble Clutch Spring

3. Depress spring tab, if required. When clutch sleeve is in place, spring tab (5) should be in sleeve hole (6), Fig. 59.
4. Slide thin thrust washer and worm on cam gear. Slide in thick thrust washer.
5. Slide on copper washer with gray coated side toward thrust washer.
6. Install “E” ring and check worm gear end play as previously described. Inspect cam gear assembly as previously described.

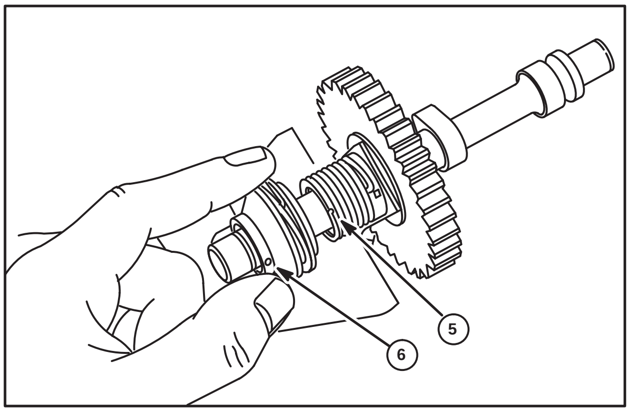

Fig. 59

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

Remove Control Lever Shaft

1. Remove “E” ring (1) from groove in shaft (2), Fig. 60.
2. Slide control lever and shaft (3) out slowly until lever clears boss on sump.
3. Slowly release spring tension and then remove shaft, spring and “O” ring seal.
4. Inspect shaft assembly for loose lever, worn or broken parts. Replace as needed.

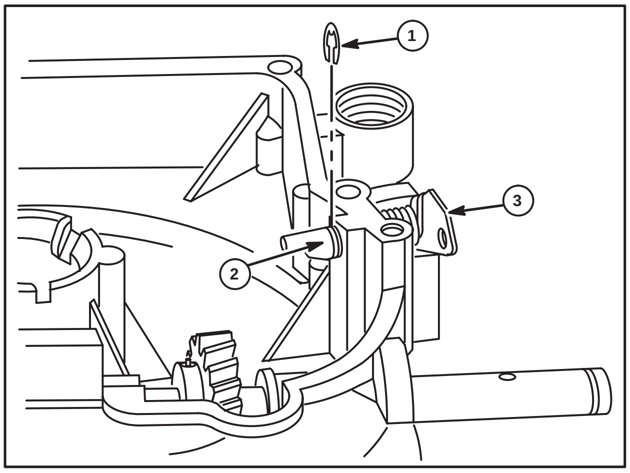

Fig. 60

Assemble Control Lever and Shaft Assembly

1. Install return spring (1) on shaft and lever assembly (3) as shown in Fig. 61.
2. Install “O” ring seal (2) on shaft.
3. Lubricate “O” ring and shaft lightly with engine oil.
4. Slide control lever assembly (3) into shaft bore, Fig. 62, as far as it will go.
5. Rotate lever clockwise to put tension on return spring.
6. When lever clears stop boss (4), push lever and spring in until lever stops.

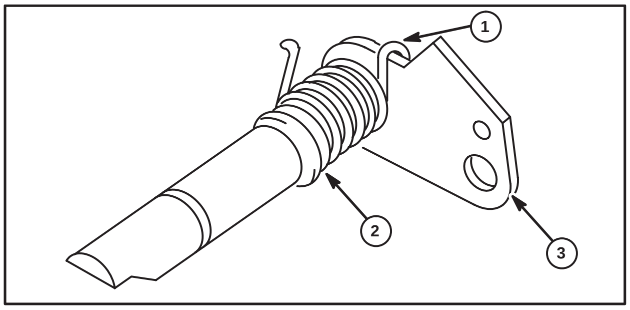

Fig. 61

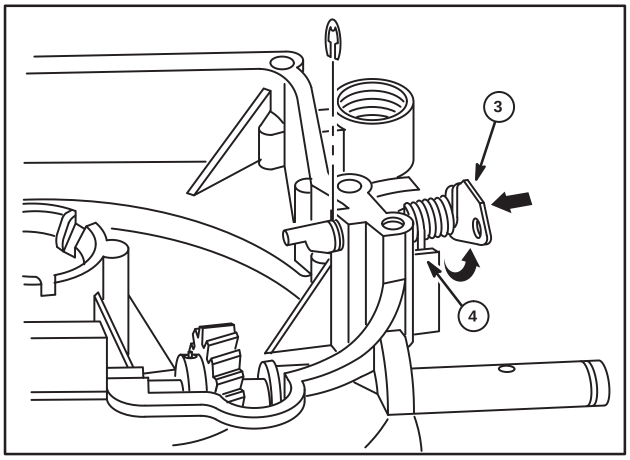

Fig. 62

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

7. Install "E" ring. Leg of spring (5) may need to be pushed against sump, Fig. 63.

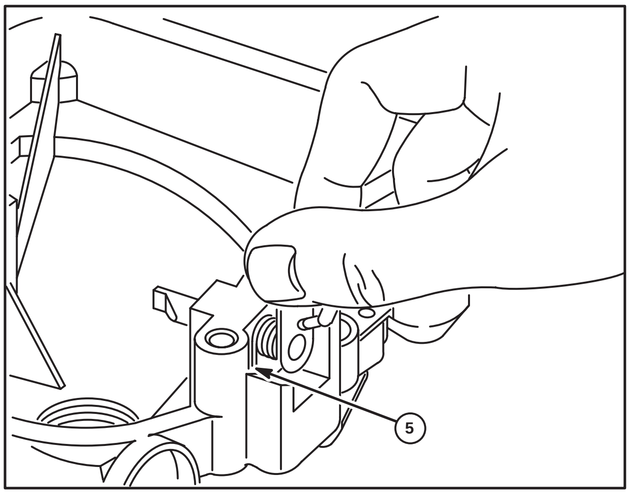

Fig. 63

Cylinder Clip Washer

When replacing clip washer in cylinder, be sure flat on clip washer (1) is in line with flat on cam bearing boss and spring tabs are on both sides of cam bearing web (2), Fig. 64.

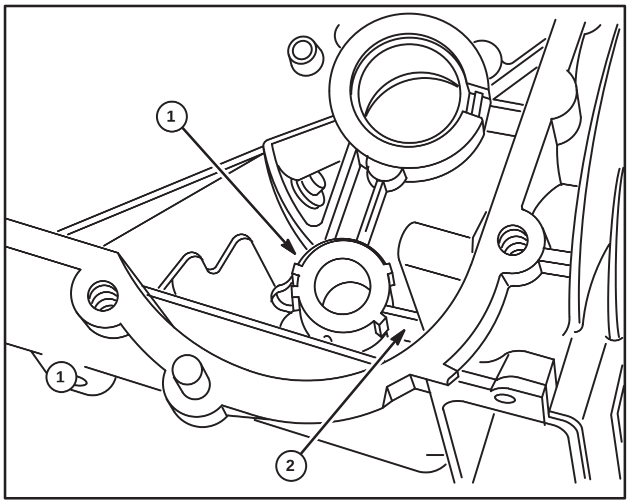

Fig. 64

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

SPECIFICATION TABLES

TABLE NO. 1 – CRANKSHAFT REJECT SIZES

MODEL SERIES	PTO JOURNAL	CRANKPIN JOURNAL	MAGNETO JOURNAL
ALUMINUM CYLINDER	**Inches (Millimeters)**	**Inches (Millimeters)**	**Inches (Millimeters)**
60000	.873 (22.17)	.870 (22.10)	.873 (22.17)
80000*, 90200, 92000*, 93000*, 94000, 95000, 96000	.873 (22.17)	.996 (25.30)	.873 (22.17)
110700*, 110900*, 111900*	.873 (22.17)	.996 (25.30)	.873 (22.17)
100200, 100900, 130000	.998 (25.35)	.996 (25.30)	.873 (22.17)
100700, 120000 with small crankpin before Date Code 97011300	1.060 (26.92)	.996 (25.30)	.873 (22.17)
120000 with large crankpin after Date Code 97011200	1.060 (26.92)	1.097 (27.86)	.873 (22.17)
170000	1.179 (29.95)	1.090 (27.69)	.997 (25.32)
190000	1.179 (29.95)	1.122 (28.50)	.997 (25.32)
220000, 250000, 280000	1.376 (34.95)	1.247 (31.67)	1.376 (34.95)
CAST IRON CYLINDER			
230000♦	1.3769♦ (34.97)	1.1844 (30.07)	1.3769 (34.97)
240000♦	Ball♦	1.3094 (33.25)	Ball
300000, 320000	Ball	1.3094 (33.25)	Ball

* Auxiliary Drive Models PTO Journal Reject Size 1.003 in. (25.48 mm)
# Synchro-Balance® Magneto Journal Reject Size 1.179 in. (29.95 mm)
♦ Gear Reduction PTO 1.179 in. (29.95 mm)

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

TABLE NO. 2, .020” (.51 mm) UNDERSIZE CONNECTING ROD CRANKPIN GRINDING DIMENSIONS

CRANKSHAFT			
MODEL SERIES	**Crankpin Dia.**	**Fillet Radius**	**Crankshaft Throw**
80000, 90000	.9788/.9783” (24.862/24.849 mm)	.130/.110” (3.30/2.79 mm)	1.0100/.990” (25.654/25.146 mm)
100200, 100900	.9788/.9783” (24.862/24.849 mm)	.088/.070” (2.24/1.78 mm)	1.0645/1.0605” (27.038/26.937 mm)
100700, 110000	.9788/.9783” (24.862/24.849 mm)	.130/.110” (3.30/2.79 mm)	.9750/.9650” (24.765/24.511 mm)
120000, Small Crankpin Before Date Code 97011300	.9788/.9783” (24.862/24.849 mm)	.130/.110” (3.30/2.79 mm)	1.020” (25.91 mm)
120000, Large Crankpin After Date Code 97011200	1.0791/1.0783” (27.409/27.389 mm)	.085/.075” (2.16/1.91 mm)	1.020” (25.91 mm)
130000	.9788/.9783” (24.862/24.849 mm)	.130/.110” (3.30/2.79 mm)	1.2210/1.2170” (31.013/30.912 mm)
170000	1.0724/1.0720” (27.239/27.229 mm)	.130/.110” (3.30/2.79 mm)	1.1895/1.1855” (30.213/30.111 mm)
190000	1.1043/1.1039” (28.049/28.039 mm)	.130/.120” (3.30/3.05 mm)	1.3770/1.3730” (34.976/34.874 mm)
220000	1.1293/1.1289” (28.684/28.674 mm)	.130/.120” (3.30/3.05 mm)	1.1895/1.1855” (30.213/30.111 mm)
233400	1.1668/1.1664” (29.637/29.627 mm)	.130/.110” (3.30/3.05 mm)	1.6350/1.6150” (41.529/41.021 mm)
240000	1.2918/1.2914” (32.812/32.802 mm)	.130/.110” (3.30/3.05 mm)	1.6350/1.6150” (41.529/41.021 mm)
250000, 280000	1.1293/1.1289” (28.684/28.674 mm)	.130/.120” (3.30/3.05 mm)	1.3145/1.3105” (33.388/33.287 mm)
300000, 320000	1.2918/1.2914” (32.812/32.802 mm)	.130/.120” (3.30/3.05 mm)	1.6350/1.6150” (41.529/41.021 mm)

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

TABLE NO. 3 – CAM GEAR REJECT SIZES

MODEL SERIES	CAM GEAR JOURNAL	CAM LOBE
ALUMINUM CYLINDER	**Inches (mm)**	**Inches (mm)**
60000, 80000*	.498 (12.65)	.883 (22.43) or See Note Below
82500, 82900, 92000, 93000, 94000, 95000, 96000	.498 (12.65)	.883 (22.43)
90200, 100700, 120000	.498 (12.65)	See Note Below
110000	.436 Mag. .498 P.T.O. (11.07 Mag. 12.65 P.T.O.)	.870 (22.10)
100200, 100900, 130000	.498 (12.65)	.950 (24.13)
170000, 190000	.498 (12.65)	.977 (24.82)
220000, 250000, 280000	.498 (12.65)	1.184 (30.07)
CAST IRON CYLINDER		
230000	.497 (12.62)	1.184 (30.07)
240000	.497 (12.62)	1.184 (30.07)
300000, 320000	.8105 Mag. .6145 P.T.O. (20.59 Mag. 15.61 P.T.O.)	1.184 (30.07)

* Auxiliary Drive Models PTO .751 in. (19.08 mm)@@@@

NOTE: On Model Series 60000, 80000 with plastic cam gear and all 90200, 100700, 120000 replace cam gear if cam lobes are pitted or galled.

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

TABLE NO. 4
Seal Protectors

Tool #	Color	Crankshaft Journal Size
19334/1	White	.787 (19.99 mm)
19334/2	Red	.875 (22.23 mm)
19334/3	Blue	.984 (24.99 mm)
19334/4	Orange	1.000 (25.40 mm)
19334/5	Brown	1.062 (26.97 mm)
19334/6	Green	1.181 (30.00 mm)
19334/7	Yellow	1.378 (35.00 mm)
19356/8	Purple	1.317 (33.45 mm)
19356/9	Black	1.503 (38.18 mm)

TABLE NO. 5

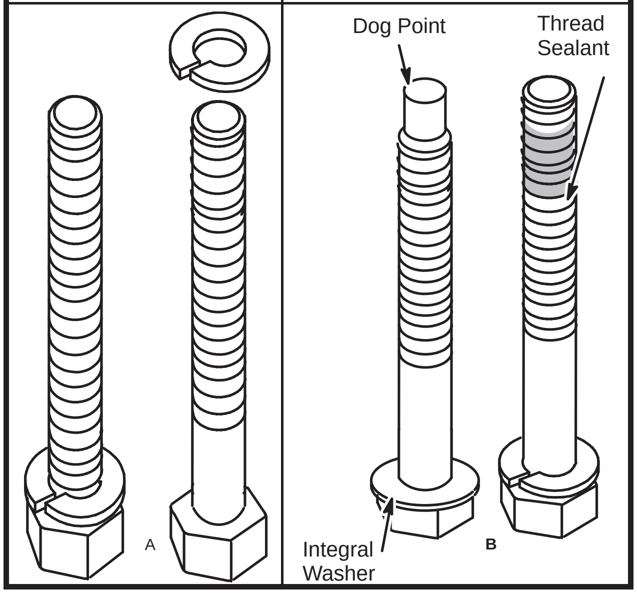
MODEL SERIES	CRANKSHAFT END PLAY
90000■	Horizontal .002 – .010” Vertical .002 – .030” (Horizontal 0.05 – 0.25 mm) (Vertical 0.05 – 0.76 mm)
10A000, 10B000, 10C000	.002 – .030” (0.05 – 0.76 mm)
100700	.002 – .030” (0.05 – 0.76 mm)
120000	.002 – .030” (0.05 – 0.76 mm)
130000, 170000, 190000	.002 – .030”▶ (0.05 – 0.76 mm)▶
220000, 250000	.002 – .030” (0.05 – 0.76 mm)
280000	.002 – .023” (0.05 – 0.58 mm)

■ All Model Series 90000 engines with second to last digit of date code being 5 (example, 88042151)

▶ End Play for Horizontal Crankshaft Model Series 130000, 170000, 190000 using threaded crankshaft on pump applications is .002 – .008” (0.05 – 0.20 mm)

TABLE NO. 6
Crankcase Cover or Sump Torque

Model Series	Torque In. Lbs. (Torque Nm)
60000, 80000, 90000, 120000	85 (10)
100200, 100900	120 (14)
100700, 110000	85 (10)
130000	120 (14)
140000, 170000, 190000, 220000, 250000, 280000	140, see A below (16)
280000	200, see B below (23)



NOTE: SPECIFICATION TABLES BEGIN ON PAGE 24 OF THIS SECTION.

10

SECTION 11
Cylinders & Bearings

Section Contents

11

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 10 OF THIS SECTION.

INSPECTION

All Models

Always inspect the cylinder after engine disassembly. Visual inspection will show cracks, stripped bolt holes, broken fins or cylinder wall damage.

Use Telescoping Gauge (4), Tool #19404, shown in the middle (2) position, Fig. 1, with a dial caliper, or use an inside micrometer to measure bore size at right angles to cylinder bore.
TABLE NO. 1, Specifications, lists the standard bore sizes.

Measure the cylinder bore at right angles at each of three locations. Measure at the top (1), middle (2) and bottom (3) of piston ring travel.

If the bore is more than .003” (.08 mm) oversize, or .002” (.04 mm) out of round on cast iron cylinders, or .003” (.06 mm) out of round on aluminum cylinders, it must be resized, or see NOTE below.

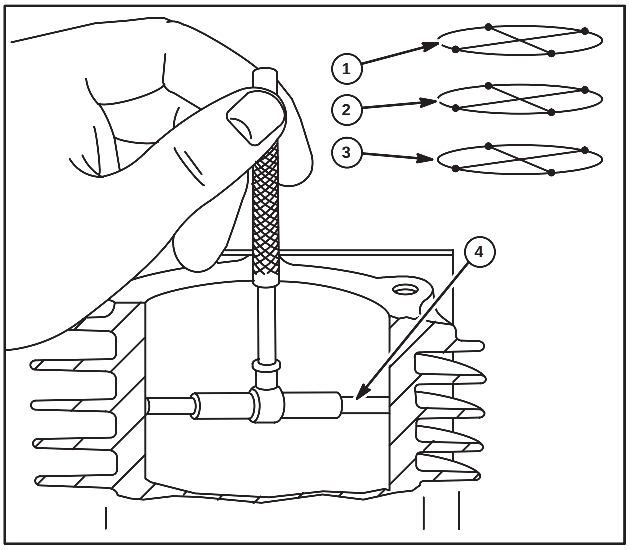


Fig. 1

NOTE: Chrome ring sets are available for some engine models. See Service Bulletin #479 or Illustrated Parts List. Chrome rings are used to control oil consumption in bores worn up to .005” (.13 mm) over standard. The cylinder bore receiving chrome rings does not need glaze breaking or cross hatch. If glaze breaking or installing of cross hatch is desired, the entire engine block must be thoroughly cleaned in hot water using common dish soap or other commercially available soap.
To install a proper crosshatch, see “Cylinder Finish” on page 4.

NOTE: When installing new <u>non-chrome</u> piston rings in a cylinder bore that is within specification, the bore should be reconditioned. Correct cylinder cross hatch ensures proper ring lubrication and break-in. See ‘‘Cylinder Finish,” page 4. Some engine models produced at the factory have diamond bored cylinders which do not exhibit a cross hatch finish. The diamond bore cylinders are <u>reconditioned</u> using the same procedure as a conventional cylinder.

RESIZING CYLINDER BORE

ALWAYS RESIZE TO EXACTLY .010” (.25 mm), .020” (.51 mm), OR .030” (.76 mm) OVER STANDARD BORE SIZE AS SHOWN IN TABLE NO. 1, SPECIFICATIONS. If this is done accurately, the stock oversize piston and rings will fit correctly and proper clearances will be maintained. Cylinders, either cast iron or aluminum, can be accurately resized with hone sets listed in TABLE NO. 8, Specifications.

Use stones and lubrication recommended by hone manufacturers for various cylinder bores to obtain proper cylinder wall finish.

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

Honing can be done with a portable electric drill, or a drill press.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 10 OF THIS SECTION.

Set Up For Honing

1. Clean cylinder at top and bottom to remove burrs and pieces of base or head gaskets.
2. Fasten cylinder to a heavy iron bracket or use honing plate (2), Fig. 2, Illustration A. Some cylinders require shims (3).
3. Use a level to align drill press spindle with bore (1).
4. 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.
5. Place hone drive shaft in chuck of drill or portable drill.
6. Slip hone into cylinder, Fig. 2, Illust. B.
7. Connect drive shaft to hone and set stop on drill press so hone can only extend 3/4” (19 mm) to 1” (25 mm) from top and bottom of cylinder, Fig. 2, Illust. C. If using a portable drill, cut a wood block to place inside of cylinder as a stop.

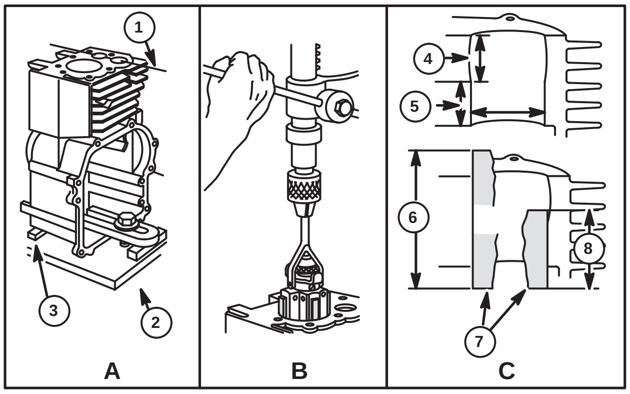


Fig. 2

Hone Cylinder

1. Place hone in middle of cylinder bore.
2. Tighten adjusting knob with finger or small screw-driver until stones fit snugly against cylinder wall. DO NOT FORCE.

NOTE: Hone should operate at 300 to 700 RPM. Lubricate hone as recommended by manufacturer.

3. Connect drive shaft to hone. Be sure that cylinder and hone are centered and aligned with drive shaft and drill spindle.
4. Start drill and, as hone spins, move it up and down at lower end of cylinder. Fig. 2, Illust. C.

CAUTION:
DO NOT allow the honing stones to travel out of the cylinder block during the honing operation.

NOTE: The bottom of the cylinder (5, below the ring travel area) is round and not worn, so it will guide the hone to straighten cylinder bore. As the diameter of the cylinder increases, gradually increase stroke length until hone (7) travels full length of bore (4 and 5). Do not extend hone more than 3/4” (19 mm) to 1” (25 mm) at either end of cylinder bore (6). Some cylinders may be worn unevenly within the ring travel area (4). Additional time spent honing the least worn areas should provide a smooth, equal sized cylinder bore.

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 10 OF THIS SECTION.

5. As cutting tension decreases, stop hone and tighten adjusting knob.
6. Check cylinder bore frequently after cooling, with an accurate micrometer.

NOTE: On cast iron cylinders, change to finishing stones when within .001” (.04 mm) of desired size.

ALWAYS HONE .010” (.38 mm), .020” (.51 mm), OR .030” (.76 mm) ABOVE THE STANDARD DIMENSIONS IN TABLE NO. 1.

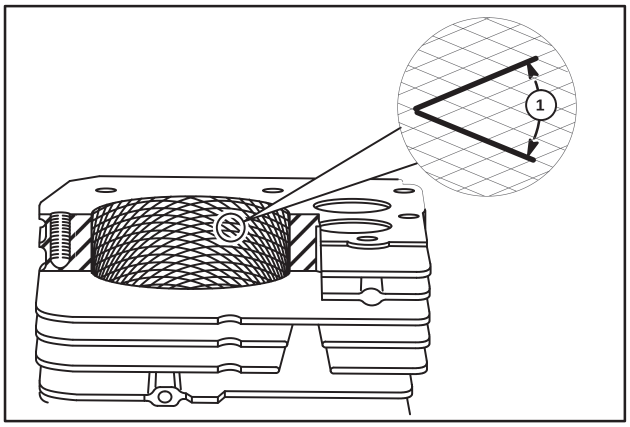


Fig. 3

Cylinder Finish

The finish on a resized or reconditioned cylinder should have a 45 degree (1) crosshatch appearance, Fig. 3. Proper stones, lubrication and drill speed along with rapid movement of hone within the cylinder during the last few strokes, will produce this finish.

Cylinder Cleaning

NOTE: It is most important that the entire cylinder and crankcase be thoroughly cleaned after honing.

Wash the cylinder and crankcase carefully in commercial parts cleaning solvent. Then wash cylinder and crankcase thoroughly using a stiff brush with **SOAP AND HOT WATER**. Clean until all traces of honing grit are gone.

NOTE: Honing grit is highly abrasive and will cause rapid wear to all the internal engine components unless it is completely removed.

BEARINGS

Ball Bearings (See Section 10)

Plain Bearings
Checking

Bearings should be replaced if scored or if plug gauge (1) will enter. Try gauge at several locations in bearing, Fig. 4. See gauge listing in TABLE NO. 6 or 7, Specifications. If gauge is not available, refer to TABLE NO. 2, Specifications, for reject dimensions.

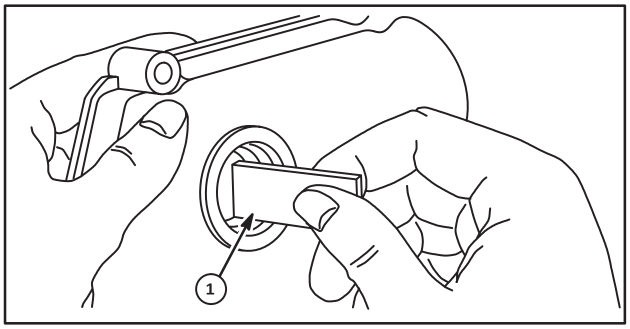


Fig. 4

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 10 OF THIS SECTION.

Check Cam Gear Bearing

Check cam gear bearing using Tool #19164, Plug Gauge (2), as shown, Fig. 5. If 1/4" (6 mm) 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, 112200, 111900, 112900, Tool #19164, Plug Gauge is used on the sump or crankcase cover cam gear bearing. Reject size for cylinder cam gear bearing is .443" (11.00 mm) or larger. On auxiliary drive Model Series 110980, PTO reject size is .493" (12.52 mm.) No gauge is available for these bearings.

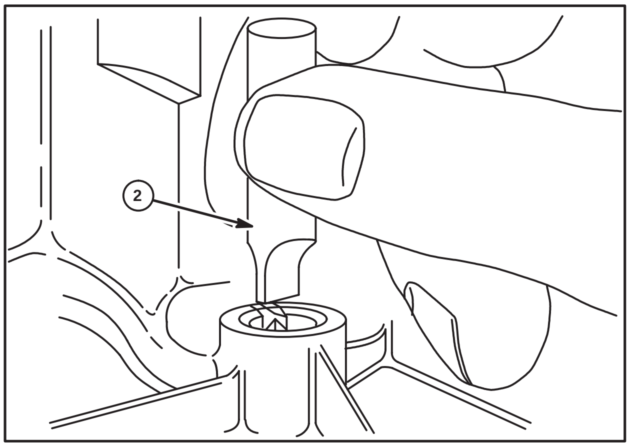

Fig. 5

REPAIR CYLINDER AND SUMP OR CRANKCASE COVER BEARINGS

Aluminum Cylinder Engines

Most aluminum cylinder engines use the aluminum cylinder material as the bearing surface. If the bearing is worn beyond reject, as measured by plug gauge listed in TABLE NO. 6, (Magneto side), or TABLE NO. 7, (PTO side), the bearings can be reamed out and rebushed with either a steel backed aluminum or a DU bearing. If gauge is not available, refer to TABLE NO. 2, for reject dimensions. Refer to Illustrated Parts List by Model Series and Type Number for bearing part numbers.

Some engines are built with replaceable DU or needle bearing. Measure DU bearings as noted above.

1. Select tools needed to repair bearing from Table No. 6.
   Typical tools include: flat washers (1), large valve springs (2), wing nut (3), pilot, Tool #19066 (4), counterbore reamer (5), threaded extension (6, optional), reamer guide bushing (7), pilot guide bushing (8), Fig. 6.
2. Remove and discard oil seal from bearing to be repaired.
3. Place pilot guide bushing (8) in the bearing opposite the bearing to be repaired (10). Flange of bushing should be on the inside of the crankcase.

   NOTE: Pilot (4), can be modified by welding a 4–1/2" (114 mm) long, 3/8" (9 mm) dia. threaded extension (6), to the end of the tool.
   If the tool is modified, place pilot guide bushing flange (8) on the outside of crankcase, Fig. 6.

4. Assemble the flat washers (1), large valve springs (2), reamer (5), and wing nut (3) to pilot tool.

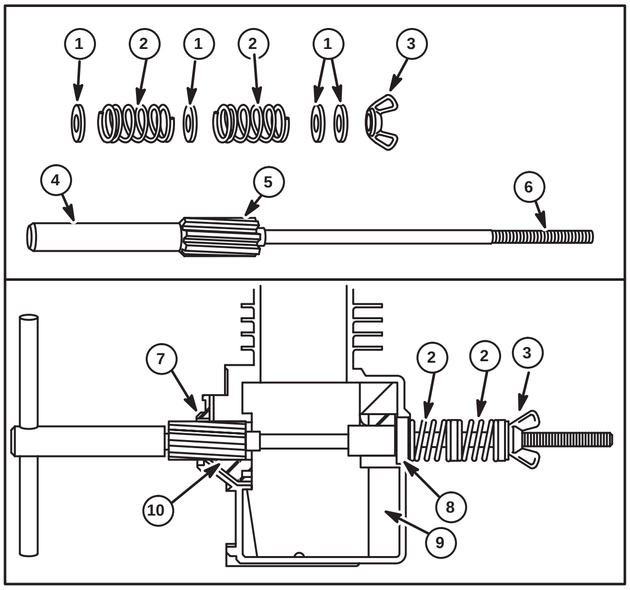

Fig. 6

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 10 OF THIS SECTION.

5. Insert reamer guide bushing (7) to bearing to be repaired (10).
6. Tighten wing nut (3) to compress valve springs (2).

Repair Procedure

1. Place reamer guide bushing (3) in oil seal bore of bearing to be repaired. The reamer guide bushing and pilot guide bushing (1) will center the counterbore reamer, even if the bearings are worn.
2. Place counterbore reamer (2) on pilot and insert into cylinder until tip of pilot enters pilot guide bushing and counterbore reamer enters reamer guide bushing, Figs. 7 and 8.
3. Turn counterbore reamer clockwise with steady pressure until it is completely through the worn bearing. Lubricate reamer with kerosene or similar solvent/lubricant while reaming.

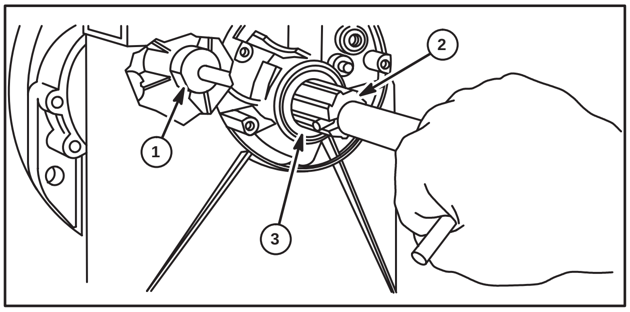

Fig. 7

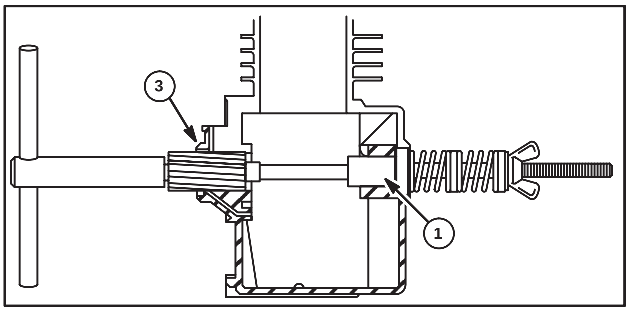

Fig. 8

NOTE: Do not ream counterbore without lubricant. Aluminum will build up on reamer flutes damaging reamer counterbores.

4. Remove sump or crankcase cover. Remove reamer and pilot from crankcase. DO NOT REMOVE REAMER THROUGH COUNTER-BORED BEARING.
5. Remove guide bushings and clean out all chips.

Install Bushing, Cylinder (Steel Backed Aluminum NLA)

1. Hold new bushing against cylinder or crankcase cover with notch (1) next to reamed out bearing and in line with notch in cylinder or cover (2).
2. Note position of split in bushing.
3. With a hammer and chisel or screwdriver at a 45 degree angle (3), make a notch in reamed out bearing opposite split in bearing, Fig. 9.

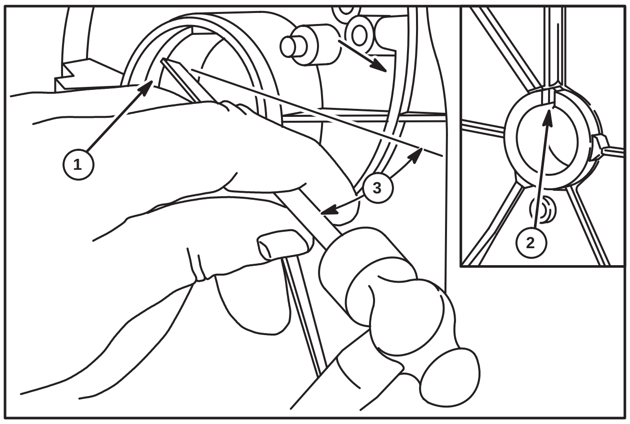

Fig. 9

11

NOTE: On Model Series 171700, 191700, magneto bearing replacement, place bushing against inside of cylinder with notch in line with oil hole in cylinder (4) and against reamed out bearing. Note position of split in bearing. With a chisel or a screwdriver and a hammer, make a notch on inside edge of reamed out bearing opposite split, Fig. 10.

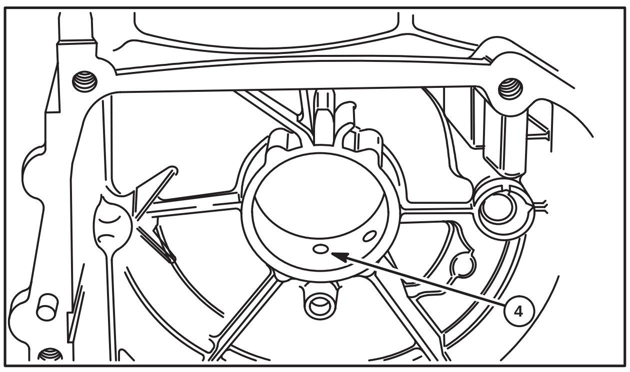

Fig. 10

4. Select tools needed from Table No. 4, to press in new bushing.

5. Press in new bushing keeping notch in line with notch in cylinder or crankcase cover until outer edge of new bushing is flush with outer end of reamed out bushing.
6. If notch does not line up, bushing can be pressed into recess of cylinder support and reinstalled.

On Model Series 171700, 191700, 193700, 195700, 196700 magneto bushing notch (6) should be in line with oil hole (5). Oil hole should be open after installation, Fig. 11.

7. Stake bushing into notch that was made in cylinder before bushing was pressed in. Reassemble cylinder and cover.
8. Use tools from TABLE NO. 6, to finish ream bushing using kerosene or other solvent lubricant until reamer is completely through bushing.
9. Remove cover and reamer together.
10. Clean out all chips.
11. Install new oil seal, as required.

On rebushed cylinders that were breaker point equipped, a burr may occur in breaker point plunger hole. Use Finish Reamer, Tool #19058, to remove burr.

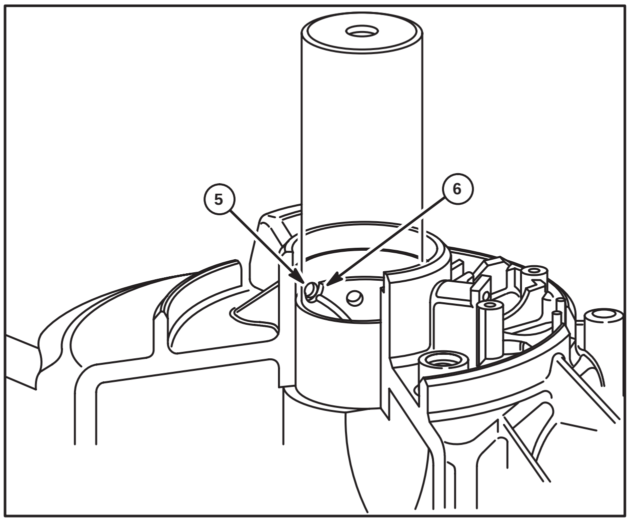

Fig. 11

Install Bushing, Sump (Steel Backed Aluminum)

1. Place bushing on outside of sump with the two notches in line with the oil grooves on the inside and against reamed out bearing.
2. Note position of split in bushing.
3. With a chisel or screwdriver and hammer, make a notch in reamed out bearing (1) opposite split in bushing, Fig. 12.
4. Select tools from TABLE NO. 6 to press in new bushing.
5. Press in new bushing until bushing is flush with outer edge of reamed out bearing. If notches do not line up, busing can be pressed through into recess of cylinder support and reinstalled.
6. Stake bushing into notch that was made before bushing was pressed in.
7. Reassemble cylinder and sump and finish ream new bushing with tools from TABLE NO. 6. Lubricate reamer with kerosene or other solvent lubricant until reamer is completely through bushing.
8. Remove sump and reamer together and clean out all chips. Install new oil seal.

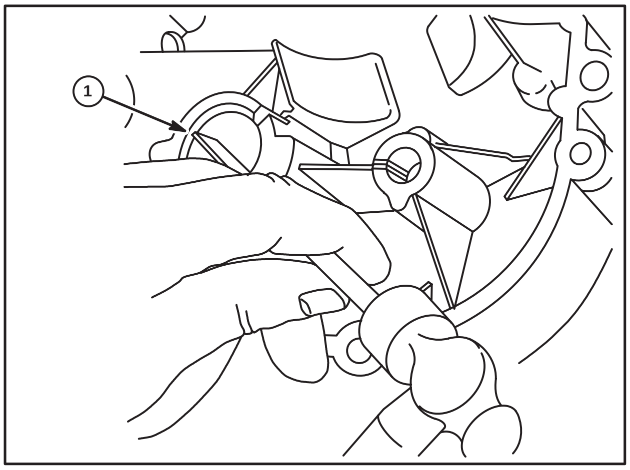

Fig. 12

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 10 OF THIS SECTION.

Install DU Bushing, Cylinder or Crankcase Cover

1. Place DU bearing on cylinder or cover bearing with oil hole in cylinder or cover bearing. If cover bearing does not have oil hole, place split (when present) of bearing (1) as shown in Fig. 13.

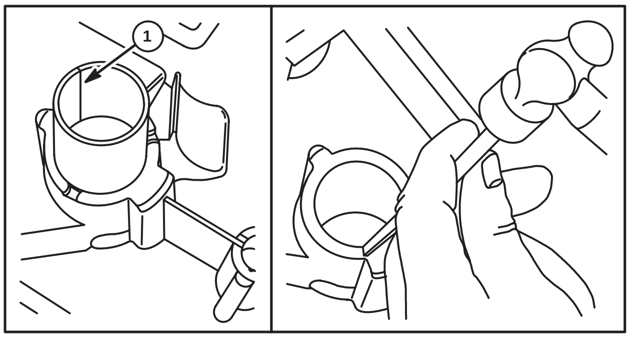

Fig. 13

2. With suitable driver (2), press bearing (1) as shown to dimension shown in TABLE NO. 3.
   If no dimension is given for Model Series, press bushing until flush with seal surface, Fig. 14.

Measure from seal surface on magneto side and from sump or crankcase cover thrust surface.

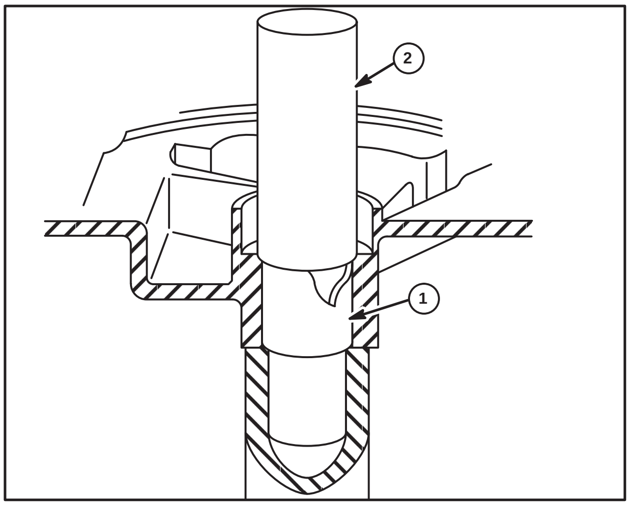

Fig. 14

3. Stake bearing (1) as shown:
   Cylinder or crankcase cover, Model Series 60000, 80000, 90000, 9K400, 100200, 100900, 110000, 120000, 130000, 135400, 13K400, Fig. 15.

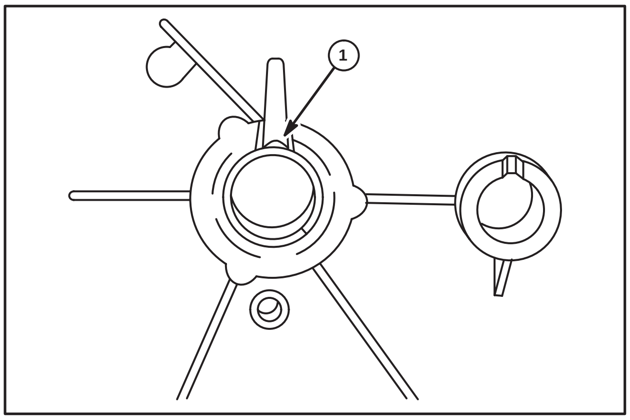

Fig. 15

Sump, Model Series 60000, 80000, 90000, 100200, 100900, 110000, 120000, 130000, Fig. 16.

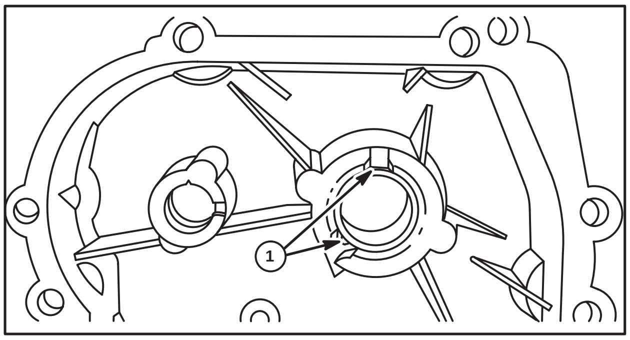

Fig. 16

NOTE: SPECIFICATION TABLES BEGIN ON PAGE 10 OF THIS SECTION.

Cylinder or crankcase cover, Model Series 190000, 220000, 250000, 280000, Fig. 17.

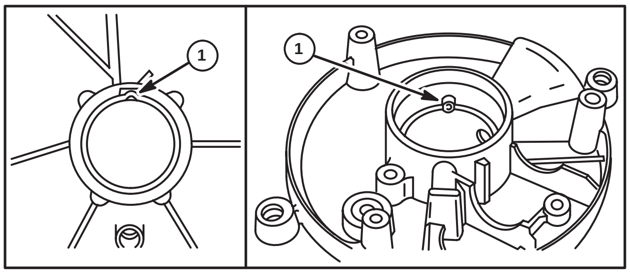

Fig. 17

Sump, Model Series 220000, 250000, 280000, Fig. 18.

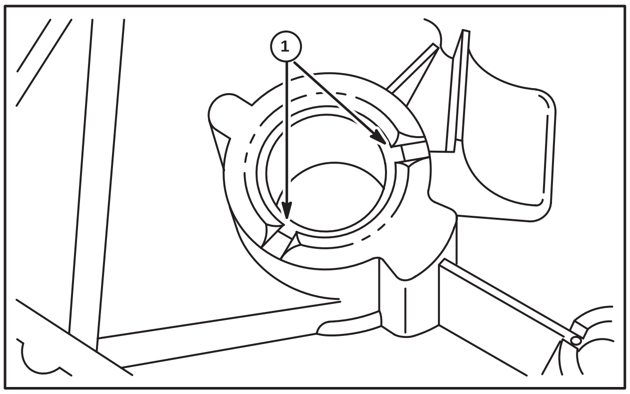

Fig. 18

REPLACE OIL SEAL

The oil seal (1) is assembled with the sharp edge of the rubber toward the inside of the engine. Lubricate inside diameter of oil seals with engine oil before assembling engine.

Most oil seals are pressed in (Illustration A), flush with the hub (2). However, Model Series 60000, 80000, 100000 and 130000 using a ball bearing with mounting flange have the seal pressed in (Illustration B), 3/16” (4.75 mm) below crankcase mounting flange (3), Fig. 19.

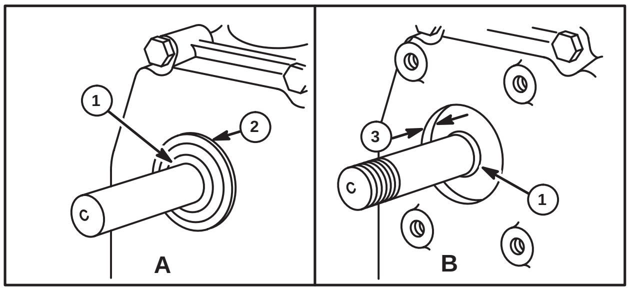

Fig. 19

Install Crankcase Cover or Sump All Aluminum Model Series

Use Tool #19356, Seal Protector Kit, TABLE NO. 4, Page 11, to protect oil seal when installing crankcase cover or sump. DO NOT FORCE COVER OR SUMP. Make sure mechanical governor gear is engaged with cam gear.

Torque Crankcase Cover or Sump All Aluminum Model Series

Torque crankcase cover or sump to specifications listed in TABLE NO. 5, Page 11, Specifications.

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SPECIFICATION TABLES

TABLE NO. 1

Model Series	Standard Bore Size Diameter	
Aluminum Cylinder	**Max. Inches (Max. mm)**	**Min. Inches (Min. mm)**
60000 after Ser. #5810030	2.3750 (60.33)	2.3740 (60.30)
80000	2.3750 (60.33)	2.3740 (60.30)
90000, 9K400, 100700	2.5625 (65.09)	2.5615 (65.06)
100200, 100900	2.5000 (63.50)	2.4990 (63.47)
110000	2.7812 (70.64)	2.7802 (70.62)
120000	2.6885 (68.288)	2.6875 (68.263)
130000, 135400, 13K400	2.5625 (65.09)	2.5615 (65.06)
170000, 190000, 19K400	3.0000 (76.20)	2.9990 (76.17)
220000, 250000, 280000	3.4375 (87.31)	3.4365 (87.29)
Cast Iron Cylinder		
230000	3.4375 (76.20)	3.4365 (76.17)
240000	3.0625 (77.786)	3.0615 (77.762)
300000	3.4375 (87.31)	3.4365 (87.29)
320000, 32K400	3.5625 (90.488)	3.5615 (90.462)

TABLE NO. 2
Cylinder Bearing Reject Size Chart

Model Series	Magneto Bearing	PTO Bearing
Aluminum Cylinder	**Inches (mm)**	**Inches (mm)**
60000, 80000*	.878 (22.30)	.878 (22.30)
90000*, 9K400	.878 (22.30)	.878 (22.30)
100700, 120000	.878 (22.30)	1.065 (27.50)
100200, 100900, 130000, 135400, 13K400	.878 (22.30)	.878 (25.50)
110000*	.878 (22.30)	.878 (22.30)
170000#, 190000#, 19K400	1.004 (25.50)	1.185 (30.10)
220000, 250000, 280000	1.383 (35.13)	1.383 (35.13)
Cast Iron Cylinder		
230000♦	1.382 (35.10)	1.382 (35.10)
240000, 300000, 320000, 32K400	BALL	BALL

♦ Gear Reduction PTO – 1.185” (30.10 mm)

* Auxiliary drive models PTO Bearing Reject Size 1.003” (25.50 mm)

Synchro-Balanced® Magneto Bearing Reject Size 1.185” (30.10 mm)

TABLE NO. 3 – DU® Bearing Depth

Model Series	Depth Mag.	Depth P.T.O.
60000, 80000, 90000, 9K400, 1002000, 100900, 110000, 130000, 135400, 13K400	1/32” (0.79 mm)	1/32” (0.79 mm)
170000, 190000, 19K400	3/32” (2.36 mm)	1/32” (0.79 mm)
171700, 191700, 193700, 195700, 196700	1/64” (0.38 mm)	*
220000, 250000, 280000	7/64” (2.77 mm)	1/8” (3.18 mm)

*Replace sump if PTO bearing is worn or use steel backed aluminum bearing. See Illustrated Parts List for part number.

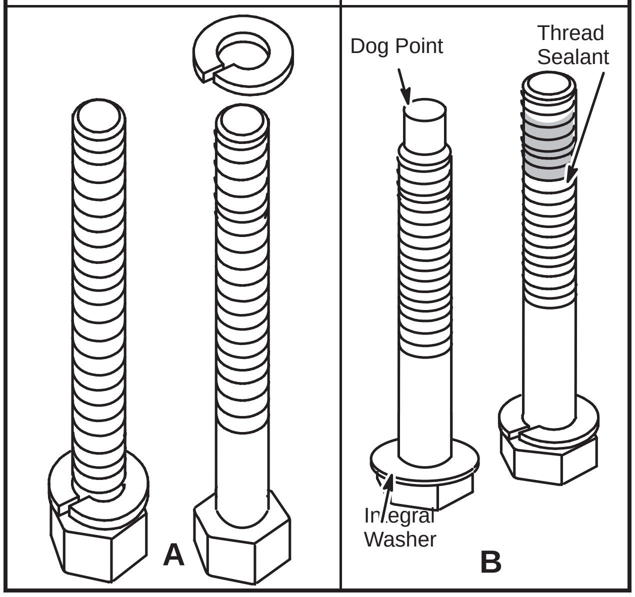
NOTE: SPECIFICATION TABLES BEGIN ON PAGE 10 OF THIS SECTION.

TABLE NO. 4
Seal Protectors

Tool #1	Color	Crankshaft Journal Size
19334/1	White	.787" (19.98 mm)
19334/2	Red	.875" (22.23 mm)
19334/3	Blue	.984" (24.99 mm)
19334/4	Orange	1.000" (25.40 mm)
19334/5	Brown	1.062" (26.97 mm)
19334/6	Green	1.181" (30.00 mm)
19334/7	Yellow	1.378" (35.00 mm)
19356/8	Purple	1.317" (33.45 mm)
19356/9	Black	1.503" (38.18 mm)

TABLE NO. 5
Crankcase Cover or Sump Torque

Model Series	Torque In. Lbs. (Torque Nm)
60000, 80000, 90000, 9K400, 120000	85 (10)
100200, 100900	120 (14)
100700, 110000	85 (10)
130000, 135400, 13K400	120 (14)
140000, 170000, 190000, 19K400, 220000, 250000, 280000	140, see A below (16)
280000, 32K400	200, see B below (23)



NOTE: SPECIFICATION TABLES BEGIN ON PAGE 10 OF THIS SECTION.

TABLE NO. 6
Magneto Bearing Repair Tool Chart

Aluminum Model Series	Cylinder Support	Pilot	Counter-bore Reamer	Reamer Guide Bushing Mag.	Bushing Driver	Pilot Guide Bushing PTO	Finish Reamer	Plug Gauge
60000, 80000, 90000	19123	19096	19099	19101	19124	19094* 19097■	19095*♦	19166
92590*, 92990*, 110900*, 111900*, 112900	19123	19096	19099	19101	19124	∉	19095*♦	19166
100200, 100900, 130000	19123	19096	19099	19101	19124	19168	19095♦	19166
100700, 120000	19123	19096	19099	19101	19124	19373	19095♦	19166
170000, Steel Backed 190000, Aluminum 192700, Bearing	19227	19096	19172	19170	19179	19169	19173*♦	19178
170000, DU 190000, Bearing 192700 194700	19227	–	–	–	19179	–	–	19178
171700, Steel Backed 191700, Aluminum 193700, Bearing	19227	19096	19174	19201	19179	19169	19175*♦	19178
171700, DU 191700, Bearing 193700 195700 196700	19227	19096	19281	19301	19179	19169	–	19178
220000, 250000, 280000	19227	19220●	19224●	19222●	19226●	19220●	–	19219
Cast Iron Model Series								
230000, 240000, 300000, 320000	**Replace Support and Cover**							19117

♦ Tools for steel backed aluminum bushing, only in positions shown.
∉ Use sump or crankcase cover with 7/8” (22 mm) diameter bearing and 19094 guide.
● Tools for DU Bushing only, in positions shown.
* Plain bearing crankcase cover.
■ Ball bearing crankcase cover.
NOTE: Tools listed may be used to install either steel backed aluminum bushing or DU bushing except as noted above.

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 10 OF THIS SECTION.

TABLE NO. 7
PTO Bearing Repair Tool Chart

Aluminum Model Series	Cylinder Support	Pilot	Counter-bore Reamer	Reamer Guide Bushing Mag.	Bushing Driver	Pilot Guide Bushing PTO	Finish Reamer	Plug Gauge
60000, 80000, 90000, 9K400	19123	19096	19099	19100	19124	19094	19095*♦	19166
92590*, 92990*, 110900*, 111900*, 112900	19123	19096	19099	19101	19124	19094	19095*♦	–
100200, 100900, 130000, 135400, 13K400	19123	19096	19172	19186V 19170H	19124	19094	19173∉ ♦	19178
100700, 120000	Replace Sump If Bearing is Worn or Damaged							
170000, 190000, 192700, 194700,	19227	19096	19174♦	19171♦	19179	19168	19175♦	19178
171700, 191700, 193700, 195700, 196700, 19K400	19227	19096	19174♦	19171♦	19179	19169	19175♦	19178
220000, 250000, 280000	19227	19223●	19224●	19222●	19226●	19220●	–	19219
Cast Iron Model Series								
230000, 240000, 300000, 320000, 32K400	**Replace Support and Cover**							19117

♦ Tools for steel backed aluminum bushing, only in positions shown.
• Tools for DU Bushing only, in positions shown.
* Plain bearing crankcase cover.
■ Ball bearing crankcase cover.
NOTE: Tools listed may be used to install either steel backed aluminum bushing or DU bushing except as noted above.

TABLE NO. 8
Cylinder Hones

Hone Set #	Bore Material	Bore Size	Stone Set #	Carrier Set #
19205	Aluminum	1–7/8 to 2–3/4” (48 mm to 70 mm)	19206	19205
19205	Aluminum	2–5/8 to 3–1/2” (67 mm to 89 mm)	19207	19205
	Cast Iron	1–7/8 to 2–3/4” (48 mm to 70 mm)	19303 (60 grit)	19205
	Cast Iron	1–7/8 to 2–3/4” (48 mm to 70 mm)	19304 (220 grit)	19205
19211	Cast Iron	2–1/2 to 3–5/16” (63 mm to 84 mm)	19212 (60 grit) 19213 (220 grit)	19214 19214
19211	Cast Iron	3–5/16 to 4–1/8” (84 mm to 105 mm)	19212 (60 grit) 19213 (220 grit)	19215 19215

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NOTE: SPECIFICATION TABLES BEGIN ON PAGE 10 OF THIS SECTION.

SECTION 12
Synchro-Balance® and Oscillating Counter Balance

Section Contents

Operation

Briggs & Stratton uses two methods of internally balancing engines.

One system uses driven counterweights that rotate in the direction opposite (180°) of the crankshaft counterweights, Fig. 1.

The other system uses a counterweight that oscillates opposite to the direction of the piston, Fig. 2. Each system performs the function of substantially reducing engine vibration, thereby giving exceptionally smooth engine performance.

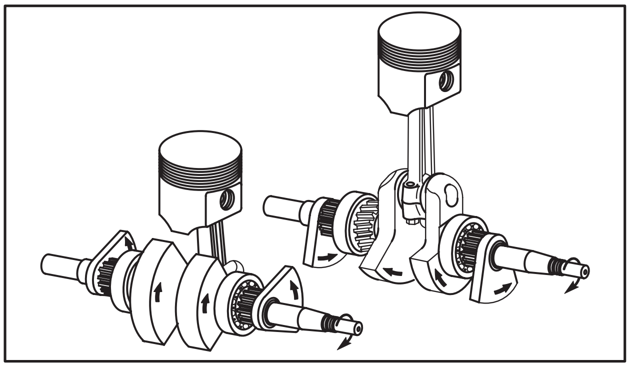


Fig. 1

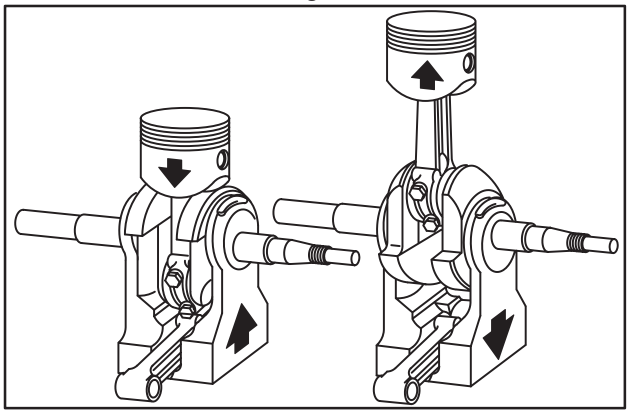
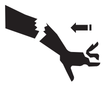


Fig. 2

ASSEMBLE AND TIME ROTATING SYNCHRO-BALANCE®, HORIZONTAL CRANKSHAFT CAST IRON ENGINES



WARNING

Rapid retraction of starter cord (kick-back) will pull hand and arm toward engine faster than you can let go.

Broken bones, fractures, bruises or sprains could result.

- On some Model Series 326400 engines, the Synchro-Balance® cover did not have the balance gear and bearing.
  DO NOT ATTEMPT TO START THESE ENGINES until balance gear and bearing are reinstalled to prevent kickback when starting.

1. Remove all traces of oil or dirt from tapered surfaces of drive gears and camshaft before assembling gears to camshaft.
2. Rotate crankshaft until piston is at top dead center.
3. Remove 5–1/2” (14 mm) cam gear shaft bolt (2).
4. Place magneto end timing gear (6) on cam gear taper.
5. Install bolt (2) with Belleville washer (1), finger tight, Fig. 3.

   NOTE: On Model Series 300400 and 320400 only, place PTO-end timing gear on the other end of camshaft. Install short cam gear bolt with Belleville washer, finger tight, Fig. 4.

6. To time drive gears, insert short pieces of 1/4” (6 mm) rod (3) through 1/4” (6 mm) holes in drive gear, and into locating holes in crankshaft bearing support plates, Fig. 3.

   NOTE: For Model Series 300400 and 320400 also see Fig. 4.

7. With 1/4” (6 mm) rods in place and piston at exactly TOP DEAD CENTER, torque drive gear bolt(s) to 200 in. lbs. (23 Nm). Be certain piston does not move.
8. Remove the 1/4” (6 mm) rods.
9. Install idler gear(s) (5).
10. Install snap-in “E” rings (4) to retain gears. No further timing is necessary, Fig. 3 and Fig. 4.

The counterweights and ball bearings are an integral part of the covers and cannot be serviced. Lubricate ball bearings and gears with a few drops of engine oil.

NOTE: Piston must be at top dead center.

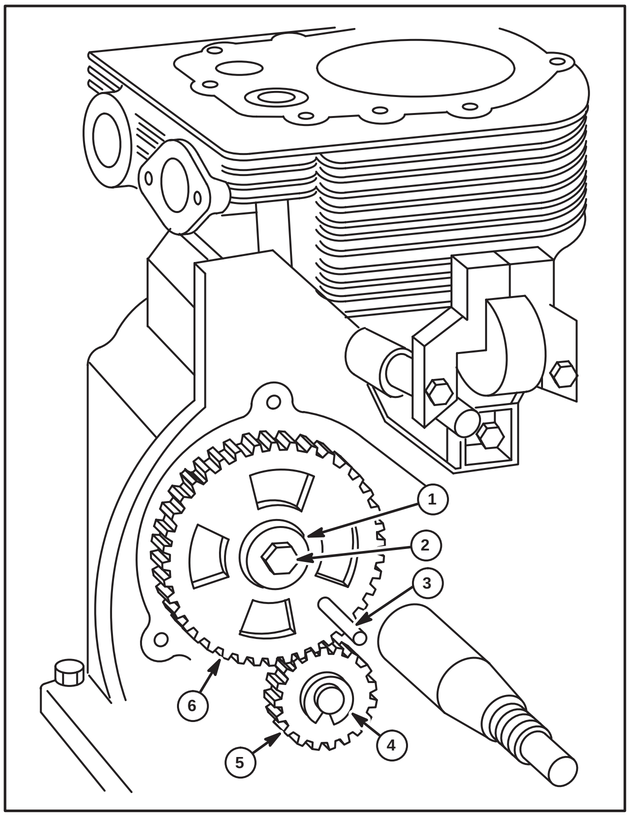


Fig. 3

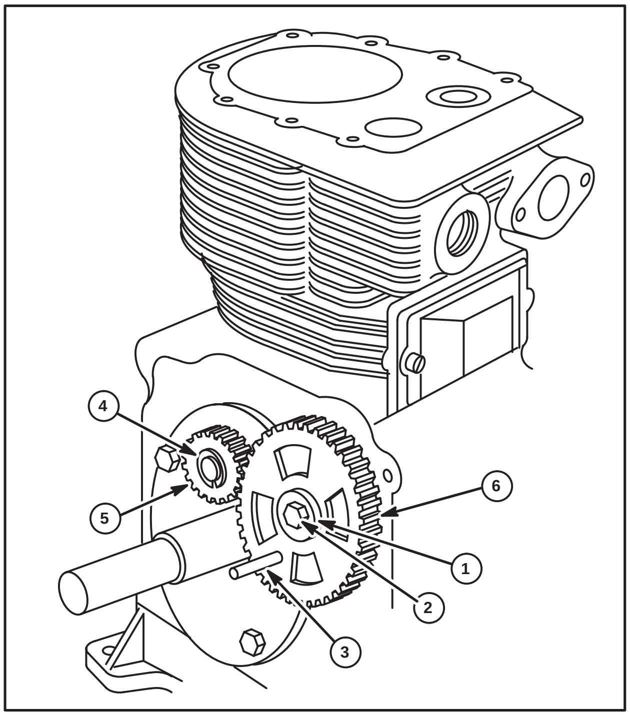


Fig. 4

Time Counterweight

1. Remove the timing hole screw (5) from flywheel cover (1) or PTO cover (2), Fig. 5.
2. Insert a short piece of 1/8” (3 mm) rod (3) through timing hole in cover and into machining hole in counterweight, Fig. 5. The rod holds the counterweight in the proper position while cover is installed on engine.

NOTE: One of the screws holding the breather can also be used, instead of 1/8” (3 mm) rods.

3. Install cover assembly and gasket, using seal protector to avoid damage to oil seal. Make sure that bolt holes line up with tapped holes in cylinder.
4. To minimize gear backlash, push magneto side cover toward idler gear. Torque bolts to 120 in. lbs. (14 Nm).

NOTE: For Model Series 300400 and 320400 repeat above for PTO cover. Torque bolts to 200 in. lbs. (23 Nm).

5. Remove timing rods or screws.
6. Coat threads of timing hole screws (5) with a non-hardening sealant such as Permatex® II. Install screw and fiber sealing washer (4).

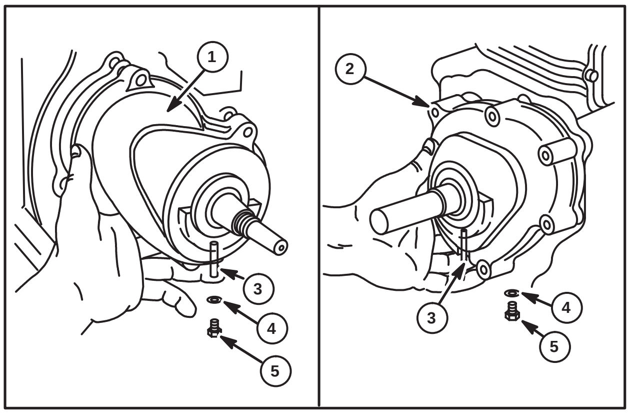


Fig. 5

ROTATING COUNTERBALANCE HORIZONTAL CRANKSHAFT MODEL SERIES 250000

This Model Series utilizes two gear driven counterweights in constant mesh with the crankshaft gear.

The cut-away view illustrates these gears, mounted in the crankcase cover. The Synchro-Balance® counterweights rotate in opposite direction to crankshaft rotation, Fig. 6.

The gear driven counterweights must be properly aligned when cover is installed.

If counterweights are removed from crankcase cover, exercise care in handling or cleaning to prevent loss of needle bearings.

Assemble Counterweights

1. Install counterweights on shafts in crankcase cover.
2. Install counterweight retainers. Torque screws to 50 in. lbs. (6 Nm).

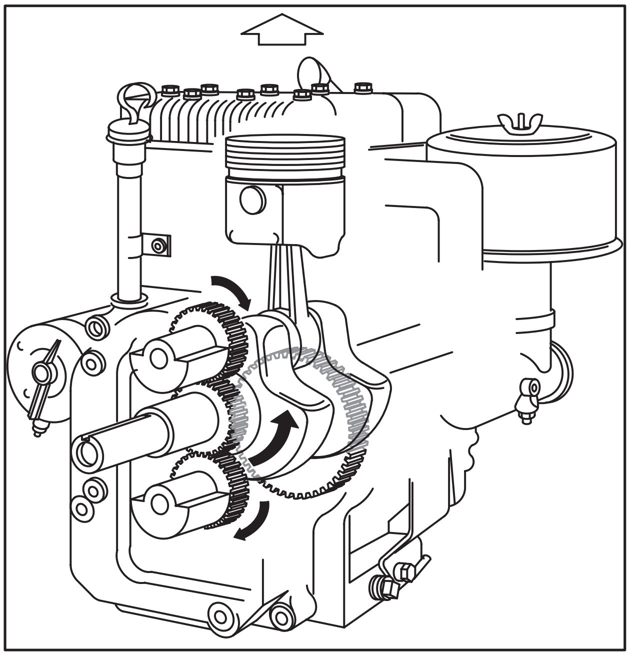


Fig. 6

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Time Counterweights Gears

1. Remove two small screws (1) from cover.
2. Insert 1/8” (3 mm) diameter locating pins (3) through screw hole and into timing hole provided in counterweights (2), Fig. 7.

   NOTE: Breather screws and extended dipstick tube screw may be used in place of locating pins.

3. With piston at TOP DEAD CENTER, install the crankcase cover assembly and cover gasket.
4. Remove the locating pins or screws.
5. Coat threads of timing hole screws with a non-hardening sealant such as Permatex® II. Install screws and fiber sealing washers.

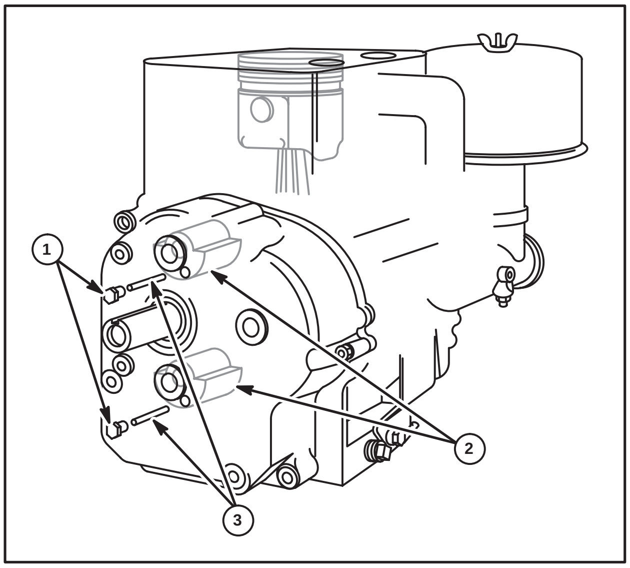

Fig. 7 – Timing Counterbalance Gears

OSCILLATING COUNTERBALANCE SYSTEM VERTICAL CRANKSHAFT

Disassemble

1. Remove sump.
2. Open connecting rod lock (when used) and remove connecting rod screws.
3. Remove connecting rod and piston (1) from engine.
4. Remove crankshaft and counterweight assembly (2), Fig. 8.
5. Remove crankshaft gear. If gear is tight, pry gear off with two screwdrivers, Fig. 9. Do not damage gear.

   NOTE: Save timing gear key on Model Series 171700. On current production Model Series 252700, 253700, 255700, 256700, and all 280000 engines the woodruff key (3) can be removed if required, Fig. 9.

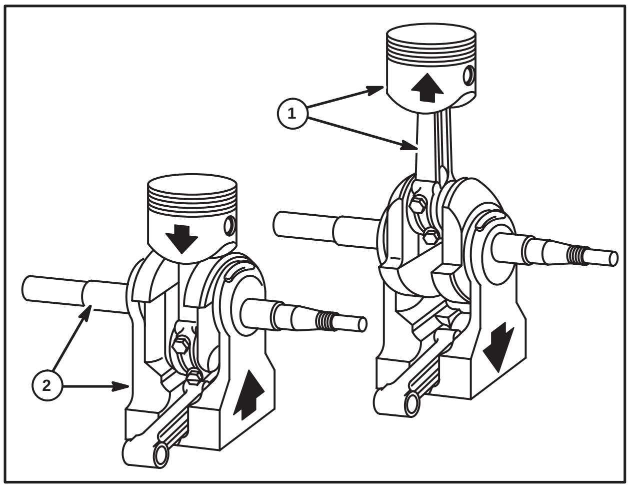

Fig. 8

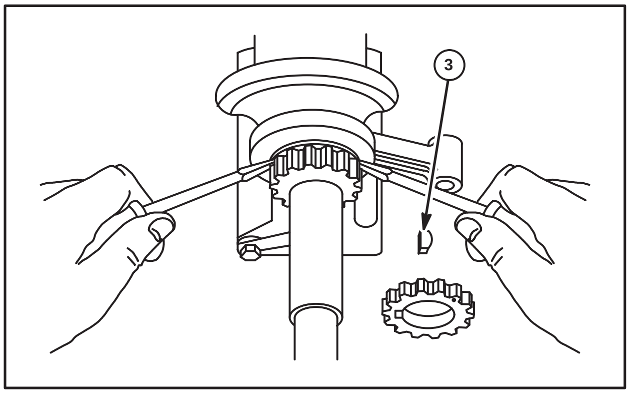

Fig. 9

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6. Remove PTO side weight (4), dowel pin(s) (5), link (7) and spacer(s) (8) (when used).
7. Remove crankshaft from magneto side counterweight (6), Fig. 10.
8. Open lock tab (when used) (9) and remove screw(s) from counterweight.

NOTE: Newer assemblies contain only one screw, one dowel pin and are not equipped with spacers and lock.

Inspect Counterbalance System

Check counterweight bearings and crankshaft eccentrics for wear as listed in Table No. 1, Page 6, Specifications.

If counterweight bearings are discolored, scored or worn to reject, the counterweight assembly must be replaced as a set. If crankshaft eccentrics are discolored, scored or worn to reject, the crankshaft and eccentrics must be replaced as a set except on current production Model Series 252700, 253700, 255700, 256700 and all 280700, 281700, 283700, and 286700 with woodruff keys. Only the eccentrics need to be replaced on models with woodruff keys.

Assemble Counterweight Assembly and Crankshaft

1. Assemble magneto side eccentric on crankshaft (6) with chamfer toward crankpin. Make sure eccentric is seated against counterweight on crankshaft.
2. Slide flywheel side counterweight onto crankshaft, Fig. 11.
3. Place crankshaft and counterweight in a vise (10) with soft vise jaws or shop rags to protect magneto journal.
4. Install dowel pin(s). Slip link over dowel pin with rounded edge of free end up, Fig. 11.
5. Slide PTO side counterweight onto dowel pin(s) and crankshaft eccentric.
6. Install screw(s), spacer(s) (when used) and lock tab (when used). On counterweights with one screw, torque screw to 115 in. lbs. (13 Nm). On counterweights with two screws, torque screws to 80 in. lbs. (9.0 Nm) and bend lock tab against flat of screw.

NOTE: On counterweight assemblies using one screw, rotate crankshaft to check for binding. If binding exists, loosen and re-torque screw. Check again for freedom of rotation.

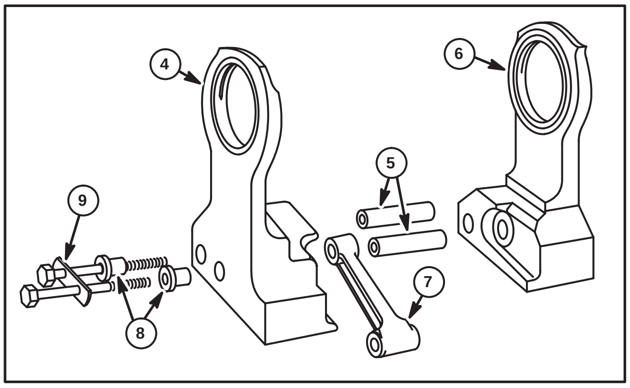

Fig. 10

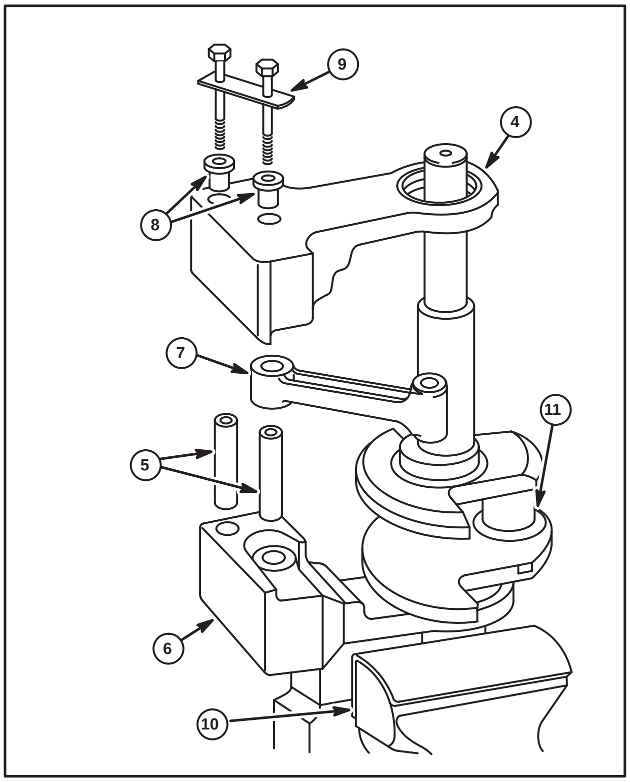

Fig. 11

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7. If woodruff key was removed, re-install in crankshaft. Slide crankshaft gear onto crankshaft with chamfer toward eccentric. If gear is tight, heat gear to expand it before installing.
8. Lay cylinder on its side with cylinder head to the left. Use Seal Protector Kit, Tool #19334 or #19356 in magneto crankshaft seal.
9. Place crankshaft and counterweight assembly into cylinder. Start magneto journal into magneto bearing.
10. Align link with crankcase link pin and push assembly into place, Fig. 12.
11. Install connecting rod and piston with lubrication hole in rod toward magneto side. This will expose rod assembly marks to view.
12. Assemble the cap screws and screw locks with dipper (Model Series 171700) toward cam gear side.
13. Torque screws and bend up locks. Install tappets, cam gear, etc. in usual manner, Section 10.

TABLE NO. 1

Model Series	Eccentric	Bearing
170000, 190000	1.870” (47.51 mm)	1.881” (47.78 mm)
250000	2.120” (53.85 mm)	2.131” (54.13 mm)
280000	2.202” (55.93 mm)	2.212” (56.18 mm)

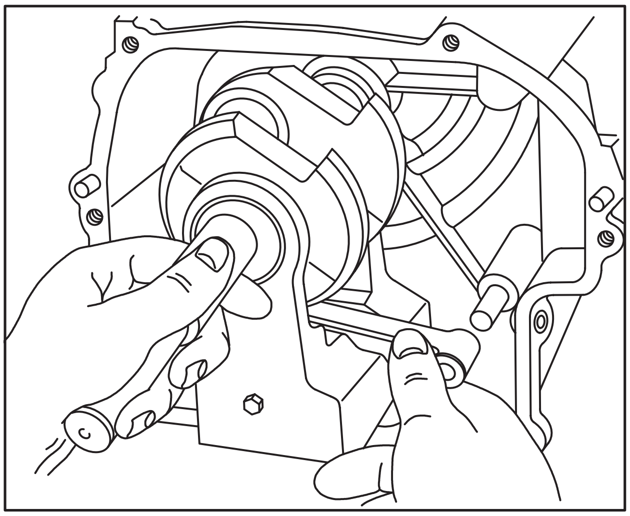

Fig. 12

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