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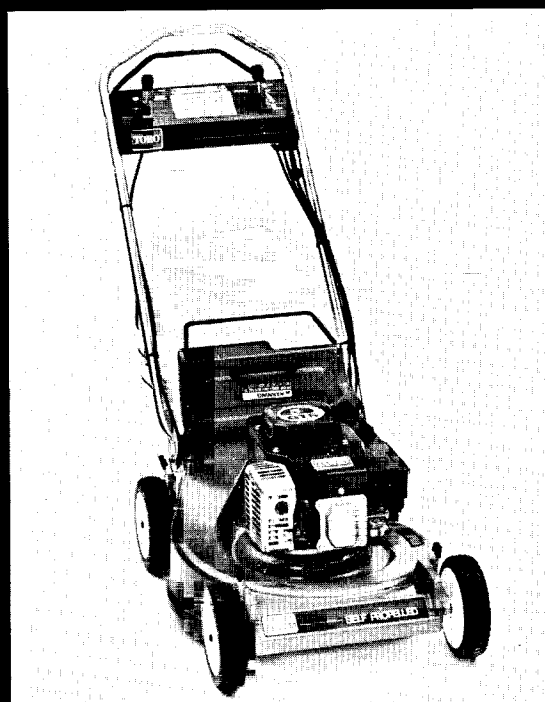
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TORO®

Vacu-Power[®]
Mower

SERVICE MANUAL



ABOUT THIS MANUAL

This service manual was written expressly for Toro Vacu-Power® Mowers. The Toro Company has made every effort to make the information in this manual complete and correct.

This manual was written with the service technician in mind. It is organized so that information used most often is up front. As a result, you will find reference information on safety, identification, specifications, troubleshooting and maintenance, all in the front third of the manual.

Disassembly, inspection and reassembly procedures are covered in the last two-thirds of the manual and are grouped by component. We tried to cover each common repair with its own section or sub-section. For example, you will find that BBC control box service and BBC bellcrank system service are addressed separately.

Most sections will include some component theory. This information can be found at the front of each service procedure section.

We are hopeful that you will find this manual a valuable addition to your shop. If you have any questions or comments regarding this manual, please contact us at the following address:

**The Toro Company
Consumer Service Department
8111 Lyndale Avenue South
Minneapolis, MN 55420**

The Toro Company reserves the right to change product specifications or this manual without notice.

SAFETY INSTRUCTIONS



Safety alert

Servicing of any outdoor power equipment requires care and common sense to prevent injury. **"CAUTION"** statements have been placed throughout this manual to enhance safety. Whenever you encounter the word **CAUTION** - read the instruction because it has to do with safety. Failure to comply with the instruction may result in personal injury or death.

This manual is intended as a service and repair manual for Toro servicing dealers. The safety instructions provided in this manual are for the troubleshooting and service of the product only. The individual Operator's Manuals will contain safety and instructional information on the operation of Vacu-Power mowers.

Operator's Manuals are available through:

The Toro Company
Publications Department
8111 Lyndale Avenue South
Minneapolis, MN 55420 U.S.A.

SAFETY TIPS...

Avoid lacerations and amputations...

Stay clear of all moving parts whenever the engine is running. Treat all normally moving parts as if they were moving whenever the engine is running or has the potential to start.

Avoid burns...

Do not touch engine while running or shortly after running.

Avoid falls...

Do not operate the mower on slippery surfaces or if footing is questionable.

Avoid fires and falls...

Wipe up any spilled fuel or oil.

Avoid asphyxiation...

Never operate an engine in a confined area without proper ventilation.

Avoid possible eye injuries...

Wear eye protection when working with springs or cables and when running engine.

Avoid unexpected starting of engine...

Always turn off key and disconnect spark plug wire before attempting any cleaning, adjustment or repair.

Avoid possible fires and explosions...

Use a container designed for gasoline. Avoid spilling gasoline and never smoke while working around gasoline.

Avoid accidental misuse of fuel...

Always store fuel in a container designed for gasoline that is properly labeled.

Avoid possible injury due to inferior parts...

Use only Toro original parts to insure that important safety criteria are met.

Avoid injury to bystanders...

Always clear the area of bystanders before starting or testing a lawn mower.

Avoid injury due to projectiles...

Always clear the area to be mowed of sticks, rocks and other debris that could be picked up and thrown by the mower.

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PRODUCT IDENTIFICATION



Each Toro Walk Power Mower is assigned a model and serial number. The model number has five digits and reflects the engine, deck style and features of the

mower. In addition to the model number, each product also has a unique serial number which serves to differentiate it from other products with the same model number. The serial number has seven digits, the first of which identifies the year of manufacture (ie. 0022576 indicates that the product was built in the 1990 model year).

These numbers are printed on a decal that is about 1" high and 3" wide. The decal can be found on the top side of the cutting deck between the rear wheels on some models. On others, it can be found under the control panel. Always refer to these numbers when ordering parts or requesting information on the mower.

Engine model and serial numbers differ from the chassis model and serial numbers. Engine numbers can generally be found on the blower housing of the engine. Use this information when ordering parts or requesting information regarding the engine.

SPECIFICATIONS

General Specifications

Item	Specification
Engine	See appropriate Engine Specification Manual
Housing	Die Cast Aluminum
Blade	53.3 cm (21.00") heat treated alloy steel
Wheels	Polypropylene with oil impregnated bushings
Tires	20.3 X 5.1 cm (8.0 X 2.0") wide radial style
Handle Construction	2.5 cm (1") diameter, 16 gauge chrome plated steel tubing.
Handle Adjustments	Adjustable to three different positions. Folds without the use of tools.
Height-of-Cut	Wheels individually adjustable from 25 to 75 mm in 13 mm increments (1" to 3" in 1/2" increments)
Width of Cut	53.3 cm (21")
Overall Width	57.2 cm (22.5")
Overall Length	85.7 cm (33.75")
Overall Height (handle down)	40.6 cm (16"), wheels in lowest height-of-cut

Zone Start Model Specifications

Item	Specification
Blade Attachment	Flanged sintered iron hub and single bolt
Brake Material	Non-asbestos
Brake Type	Spring loaded brake contacting bottom of flywheel

BBC Model Specifications

Item	Specification
Blade Brake and Clutch	Split sheave pulley clutch and self-energizing brake
Brake Material	Non-asbestos
Blade Attachment	Sintered iron hub rotating on two precision bearings
Brake Spring	Compression type

SPECIFICATIONS (cont'd)

Self-Propelled Model Specifications

Item	Specification
Ground Speed #1	2.9 kph (1.8 mph) @ 3000 rpm 1.9 kph (1.2 mph) @ 2000 rpm
Ground Speed #2	4.3 kph (2.7 mph) @ 3000 rpm 2.9 kph (1.8 mph) @ 2000 rpm
Ground Speed #3	6.1 kph (3.8 mph) @ 3000 rpm 4.0 kph (2.5 mph) @ 2000 rpm
Gearbox	Die cast aluminum with stamped steel cover
Gearbox Lubricant	177 cc (6 oz.) No. 2 lithium-based grease,
Clutch	Gearbox pivots on output shaft to tighten or loosen belt
Wheel Pinions	15 tooth gear with wheel pinion clutches
Wheel Gears	42 tooth permanently fastened to wheel hub with rivets

Service Specifications

Item	Specification
Traction Cable (beginning of engagement)	Control bar 3.81 cm (1.50") from handle
BBC Cable Adjustment	BBC bellcrank spring (engaged) $2.59 \pm .127$ cm ($1.02 \pm .05$ ")
Blade to Housing Clearance	$.432 \pm .203$ cm ($.170 \pm .080$ ")
Blade Position @ Front	Flush with bottom of housing
Blade Position @ Rear	$.635 \pm .152$ cm ($.250 \pm .060$ ") from bottom of housing
Blade Tip to Ground Clearance @ 1" HOC	Front $2.77 \pm .15$ cm ($1.09 \pm .060$ ") Rear $4.32 \pm .15$ cm ($1.70 \pm .060$ ")
Blade Tip to Ground Clearance @ 1.5" HOC	Front $4.07 \pm .15$ cm ($1.60 \pm .060$ ") Rear $5.49 \pm .15$ cm ($2.16 \pm .060$ ")
Blade Tip to Ground Clearance @ 2" HOC	Front $5.38 \pm .15$ cm (2.10 ± 0.60 ") Rear $6.60 \pm .15$ cm (2.60 ± 0.60 ")
Blade Tip to Ground Clearance @ 2.5" HOC	Front $6.60 \pm .15$ cm (2.60 ± 0.60 ") Rear $7.70 \pm .15$ cm (3.03 ± 0.60 ")
Blade Tip to Ground Clearance @ 3" HOC	Front $7.85 \pm .15$ cm ($3.09 \pm .060$ ") Rear $8.74 \pm .15$ cm ($3.44 \pm .060$ ")
Wheel Toe In/Out	.318 cm (.125") max
Wheel Camber	.318 cm (.125") max
Transmission Lubricant	No. 2 lithium-base grease
Transmission Capacity	177 cc (6 oz.)

SPECIFICATIONS (cont'd)

Vacu-Power Torque Specifications

Fastener	Torque
Engine Mounting Screws	37.4 N•m (325 in. lbs.)
Engine Belt Guide Screws (SP only)	25.5 N•m (225 in. lbs.)
Crankshaft Nut	79 N•m (58.0 ft. lbs.)
Crankshaft Bolt (Zone Start)	72 N•m (53.0 ft. lbs.)
Blade Nuts (BBC units)	38.0 N•m (330 in. lbs.)
BBC Brake Rod Screw	14.4 N•m (125 in. lbs.)
BBC Brake Lever Screw	10.9 N•m (95 in. lbs.)
BBC Control Box Screws	2.6 N•m (22.5 in. lbs.)
BBC Spring Retainer Screw	2.6 N•m (22.5 in. lbs.)
BBC Idler Pulley Nut	11.5 N•m (100 in. lbs.)
Cable Support Bracket	28.8 N•m (250 in. lbs.)
ZS Brake Plate Mounting Screw	10.4 N•m (90 in. lbs.)
ZS Brake Pivot Bolt	10.4 N•m (90 in. lbs.)
Transmission Cover Screws	13.6 N•m (118 in. lbs.)
Transmission Belt Guide Screws	14.7 N•m (130 in. lbs.)
Transmission End Cap Screws	25.5 N•m (225 in. lbs.)
Transmission Cable Clamp Screws	17.3 N•m (150 in. lbs.)
Handle Studs	40.3 N•m (350 in. lbs.)
Handle Latch Screws	24.7 N•m (215 in. lbs.)
Handle Rope Guide Nut	7.5 N•m (65 in. lbs.)
Control Bar Locknuts	9.2 N•m (80 in. lbs.)
Spring Arm Screws	8.6 N•m (75 in. lbs.)
Pivot Arm Nuts	37.4 N•m (325 in. lbs.)
Wheel Bolt Nuts	29.5 N•m (260 in. lbs.)
Screen Panel Screws	25.9 N•m (225 in. lbs.)
Outer Discharge Ramp Screw	25.9 N•m (225 in. lbs.)
Inside Discharge Ramp Screw	14.4 N•m (125 in. lbs.)
Under Deck Cover Screws	25.9 N•m (225 in. lbs.)
Door Handle Screws	7.2 N•m (63 in. lbs.)

TROUBLESHOOTING

The Troubleshooting Section has been divided into five sections. Use the guide below to locate information on the symptom you are observing, then turn to the proper page for possible causes and remedies.

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TROUBLESHOOTING (cont'd)

Quality Of Cut

Symptom: Scalping

Possible Cause	Remedy
Height-of-cut too low	Raise height-of-cut
All wheels not in same height of cut	Move height-of-cut adjusters to uniform height
Lawn has ruts	Repair lawn

Symptom: Stragglers (some grass blades left uncut)

Possible Cause	Remedy
Blade sail worn away	Replace blade
Incorrect blade	Check part number
Blade on upside down	Install blade correctly
Grass mowed too soon after watering	Wait 1 to 2 days after watering to mow
BBC belt slipping	Properly tension BBC belt
Some stragglers are normal	Adjust operator's expectations

Symptom: Clumping

Possible Cause	Remedy
Excessive blade to ramp clearance	Adjust engine and grass ramp, see page 70
Grass too long	Use bag or optional side discharge chute
Grass too wet	Allow grass to dry before mowing

Symptom: Uneven height of cut

Possible Cause	Remedy
Wheels in different height of cut	Adjust wheels to uniform height
Blade not level	Check blade levelness
Spongy turf	Allow turf to dry

Symptom: Bag will not fill completely

Possible Cause	Remedy
Grass too wet	Allow grass to dry before mowing
Excessive blade to ramp clearance	Adjust engine and grass ramp positioning, see page 70
Back of bag frame too high	Use bag frame, P/N 71-2970 (std. on '90 and newer)

Symptom: Mower picks up too much dust

Possible Cause	Remedy
Lawn too dry	Water the day before cutting
Height-of-cut too low	Raise height-of-cut
Vacuum too aggressive for conditions	Use blade, P/N 42-1000

TROUBLESHOOTING (cont'd)

Transmission

Symptom: Drive slips

Possible Cause	Remedy
Transmission belt slightly loose	Adjust belt per Operator's Manual
Transmission belt worn or damaged	Replace transmission belt
Output shaft roll pin sheared	Replace roll pin
Intermediate shaft key sheared	Replace intermediate shaft key
Pinion and wheel gears misaligned	Replace defective gears
Wheel Pinion Clutch Malfunctioning	Repair wheel pinion clutch

Symptom: Intermittent drive

Possible Cause	Remedy
Transmission belt slightly loose	Adjust belt per Operator's Manual
Shift keys sticking down in slots	Clean key slots, then lightly grease slot area
Shift keys in between gears	Adjust gear selector cable, if difficulty persists, see Service Bulletin 43
Sheared output shaft roll pin	Replace roll pin

Symptom: Transmission slow going into gear

Possible Cause	Remedy
Shift keys sticking down in slots	Clean key slots, then lightly grease slot area
Shift keys in between gears	Adjust gear selector cable; if difficulty persists, see Service Bulletin 43
Sheared output shaft roll pin	Replace roll pin

Symptom: Inaccurate gear selection

Possible Cause	Remedy
Flexing of gear selection cable	Install new shift lever and cable per Service Bulletin 43

Symptom: First gear too fast

Possible Cause	Remedy
Normal gearing not to operator's preference	Adjust engine speed to 2850 rpm, recommend customer slip belt by feathering control bar

TROUBLESHOOTING (cont'd)

Transmission (cont'd)

Symptom: Difficult to pull backwards

Possible Cause	Remedy
Operator not moving forward 25 mm (1") after releasing control bar	Inform operator of proper operating technique
Transmission belt turning input pulley when control bar is disengaged	Adjust or replace traction belt
Contact between wheel and wheel cover	Repair or replace wheel cover
Wheel pinion clutch malfunctioning	Inspect wheel pinion clutch and repair as necessary

Symptom: Only one wheel drives

Possible Cause	Remedy
Wheel/pinion gears not mating properly	Replace defective gears
One wheel pinion clutch malfunctioning	Inspect and repair wheel pinion clutch

TROUBLESHOOTING (cont'd)

BBC

Symptom: Blade does not stop within three seconds

Possible Cause	Remedy
BBC cable not adjusted properly	Adjust BBC cable
Brake pad worn	Replace brake plate
Brake plate binding at pivot point	Service pivot point
Brake plate spring malfunctioning	Inspect and repair brake plate system

Symptom: Control bar does not stay in middle position

Possible Cause	Remedy
Detent (buckling) spring malfunctioning	Replace spring (P/N 66-0190)
Control hook and cable lever not disengaging	Repair and replace leaf spring (P/N 52-7410)

Symptom: Blade slow coming up to speed

Possible Cause	Remedy
BBC cable misadjusted	Adjust BBC cable
BBC belt slipping	Replace belt
Binding in BBC brake plate pivot point	Service BBC brake plate
Grass build up in BBC area	Clear BBC area of debris

Symptom: BBC disengages when control bar is raised

Possible Cause	Remedy
BBC cable too tight	Adjust BBC cable
Brake plate binding	Service brake plate pivot point
Grass build up in BBC area	Clear BBC area of debris

Symptom: BBC does not engage

Possible Cause	Remedy
Torsion spring (P/N 46-5510) in control box malfunctioning	Replace torsion spring
Brake plate binding at pivot point	Service brake plate pivot point
Grass build up in BBC area	Clear BBC area of debris

TROUBLESHOOTING (cont'd)

Key-Lectric Starting System

Symptom: Starter motor does not turn over

Possible Cause	Remedy
Battery is discharged	Test battery and charger, see pages 64 and 65 (battery must be fully charged)
Ignition switch defective	Test ignition switch, see page 65
Loose or broken wire in wire harness	Test wire harness, see page 65
Brushes stuck or worn	Replace starter motor end cap

Symptom: Starter motor turns too slowly

Possible Cause	Remedy
Battery is discharged	Test battery (battery must be fully charged)
Charger or alternator not charging	Test charger and alternator, see page 66
Starter motor end cap binding	Replace starter motor end cap
Mechanical compression release malfunctioning	Test for proper operation by rope starting
Starter motor malfunctioning	Replace starter motor

Symptom: Starter motor turns but does not turn over engine

Possible Cause	Remedy
Insufficient momentum	Check for loose blade, flywheel or BBC flywheel. Also check for causes of slow starter motor speed, as this will decrease momentum
Starter pinion malfunctioning	Repair or replace pinion

Symptom: Burnt insulation on wires or burnt alternator

Possible Cause	Remedy
Short circuit in wire harness	Test wire harness, see page 65
Short circuit in alternator	Test alternator, see page 65

TROUBLESHOOTING (cont'd)

Miscellaneous

Symptom: All four tires do not touch the ground

Possible Cause	Remedy
Surface not level	Insure that surface is absolutely level
Pivot arm bent	Replace defective pivot arm
Deck warped less than 6 mm (1/4")	Elongate low pivot arm bolt hole upward
Deck warped more than 6 mm (1/4")	Replace the deck

Symptom: Thatcher does not fit correctly

Possible Cause	Remedy
Incorrect components	See Service Bulletins 45, 46

Symptom: Drain tube does not fit correctly (OHV models only)

Possible Cause	Remedy
Incorrect drain tube	Use P/N 75-9850

MAINTENANCE

TECUMSEH 2-CYCLE ENGINE

Tecumseh 2-Cycle - Servicing the Air Cleaner

Normally, clean the air cleaner after every 25 operating hours. More frequent cleaning is required when the mower is operated in dusty or dirty conditions.

CAUTION! Pull the high tension wire off the spark plug before performing adjustments or maintenance.

1. Stop the engine and pull the wire off the spark plug. See Figure 1.

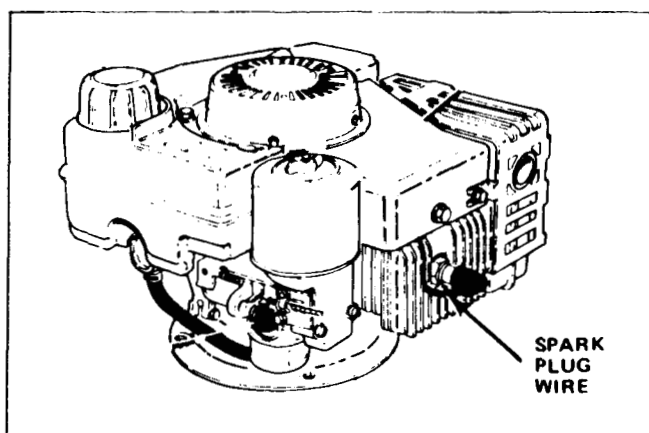


Figure 1

2. Unscrew the wing nut and remove the air cleaner cover. Slide the *foam* element off the paper cartridge. See Figure 2.

WASH the *foam* element in a solution of liquid soap and warm water. Squeeze to remove dirt, but do not twist because the foam may tear. Rinse thoroughly in clear water.

DRY by wrapping in a clean rag. Squeeze the rag and the foam element to dry.

SATURATE the element with 25 ml (5 teaspoons) of SAE 30 or 10W30 engine oil. Squeeze the element to 5 teaspoons, remove excess oil and to distribute oil thoroughly. A damp element is desirable.

3. Paper Filter - Replace annually; more frequently when the mower is operated in dusty or dirty conditions. **DO NOT ATTEMPT TO CLEAN OR OIL PAPER FILTER!**
4. Remove the nut and the paper element.

5. Clean the top side of the base and the inside of cover thoroughly. Clean the filter by tapping on a solid surface
6. Reinstall the paper filter and the nut. Tighten the nut finger tight and then turn one (1) more complete turn.

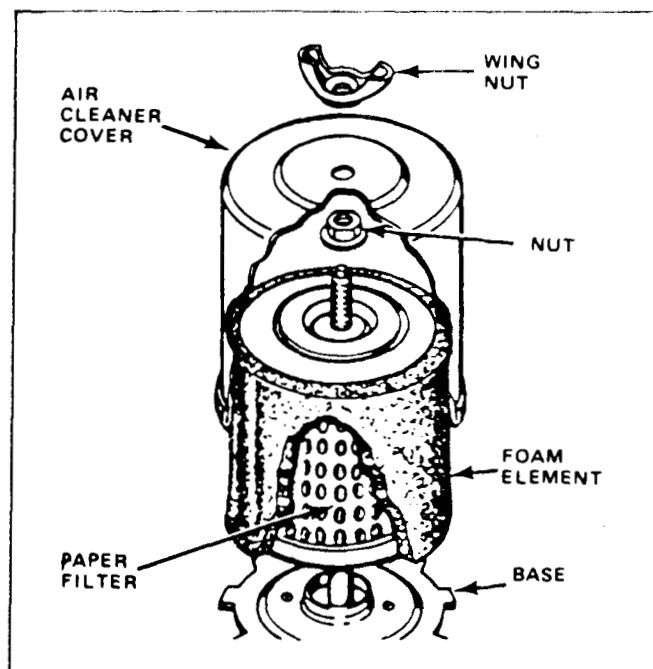


Figure 2

7. Reinstall a clean foam element onto the paper filter. Install the cover and wing nut. Tighten the wing nut.

IMPORTANT: Do not operate the engine without an air cleaner element because extreme engine wear and damage will likely result.

Tecumseh 2-Cycle - Replacing Spark Plug

Use a Champion CJ-8Y or Auto Lite 2976 spark plug or equivalent. Correct air gap is 0.762 mm (0.030"). Remove the plug after every 25 operating hours and check its condition.

1. Stop the engine and pull the wire off the spark plug. See Figure 1.
2. Clean around the spark plug and remove the plug from the cylinder head.

Tecumseh 2-Cycle - Replacing Spark Plug (cont'd)

IMPORTANT: Replace a cracked, fouled or dirty spark plug. Do not sand blast, scrape or clean electrodes because engine damage could result from grit entering the cylinder.

3. Set the air gap at .0030" (0.030"). See Figure 3. Install correctly gapped spark plug and gasket seal. Tighten the plug firmly.

Spark Plug Torque:
24.4 N•m (18 ft lb)

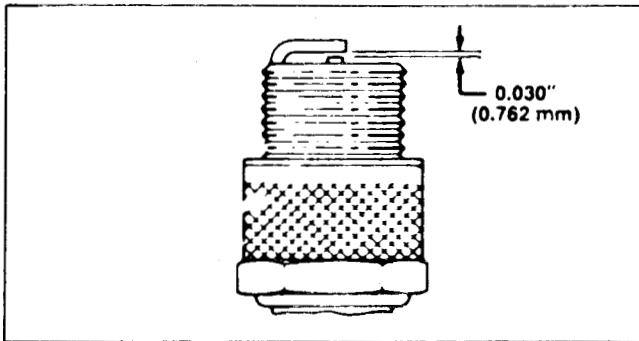


Figure 3

Tecumseh 2-Cycle - Adjusting the Throttle

Throttle control adjustment may be required if the engine does not start or stop. Whenever a new throttle control cable is installed, the throttle must be adjusted.

1. Stop the engine and pull the wire off the spark plug. See Figure 1.
2. Move the throttle control to FAST.
3. Loosen the cable clamp screw until the throttle cable slides. See Figure 4. Move the carburetor control arm as far to the left as possible. Pull the throttle cable slightly to remove any slack and tighten the cable clamp screw to lock adjustment in place.

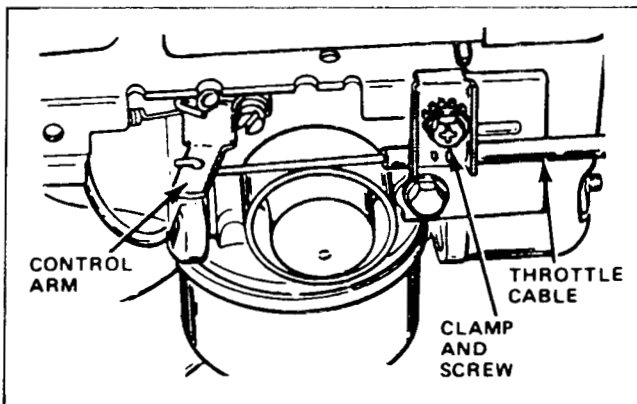


Figure 4

Tecumseh 2-Cycle - Draining Gasoline

1. Stop the engine. Pull the wire off the spark plug.
2. Squeeze the ends of the fuel line clip shown in Figure 5, and slide the clip down the fuel line. Carefully pull the fuel line off fitting and allow gasoline to flow into the drain pan.

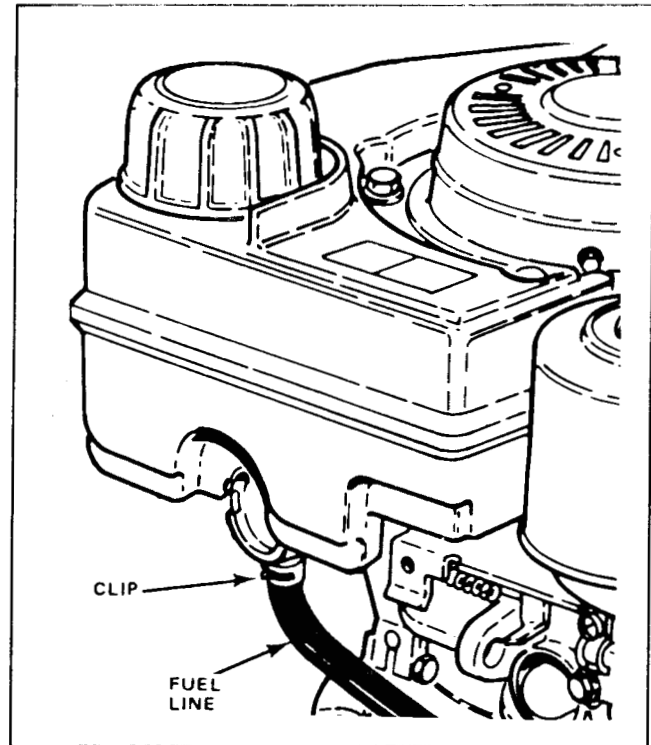


Figure 5

Tecumseh 2-Cycle - Servicing the Air Cleaner

3. After the tank is drained, install the fuel line on the fuel tank fitting and secure in place with the clip.

BRIGGS AND STRATTON QUANTUM ENGINE

Briggs & Stratton Quantum- Servicing the Air Cleaner

Normally, clean air cleaner after every 25 operating hours. More frequent cleaning is required when the mower is operated in dusty or dirty conditions.

CAUTION! Pull the wire off the spark plug before performing adjustments or maintenance.

1. Stop the engine and pull wire off spark plug. See Figure 6.

2. Remove the screw securing the air cleaner cover to the engine as shown in Figure 7. Lift off the air cleaner cover. Clean thoroughly.

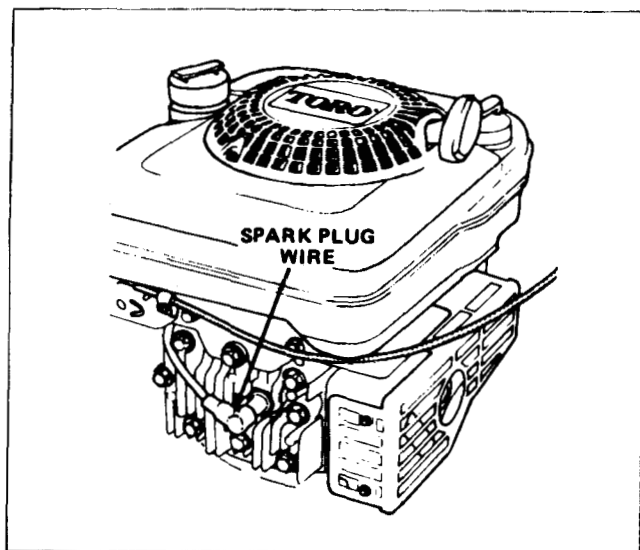


Figure 6

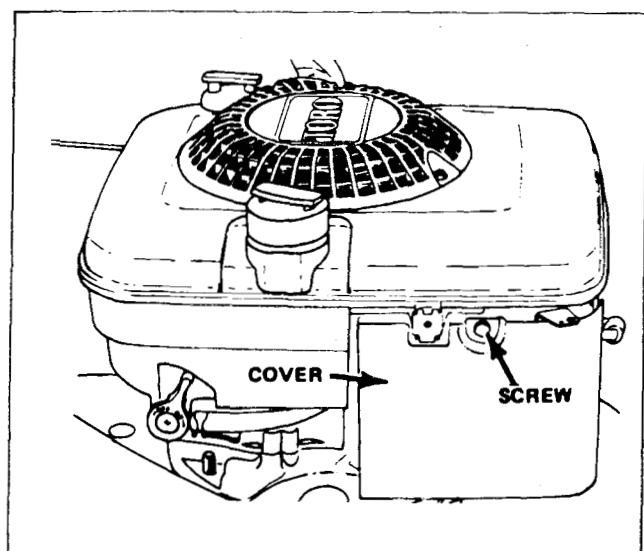


Figure 7

3. Remove the paper air filter and discard. See Figure 8.
4. Install a new paper air cleaner filter.
5. Reinstall the air cleaner cover and secure with a screw.

IMPORTANT: Do not operate the engine without air cleaner element because extreme engine wear and damage will likely result.

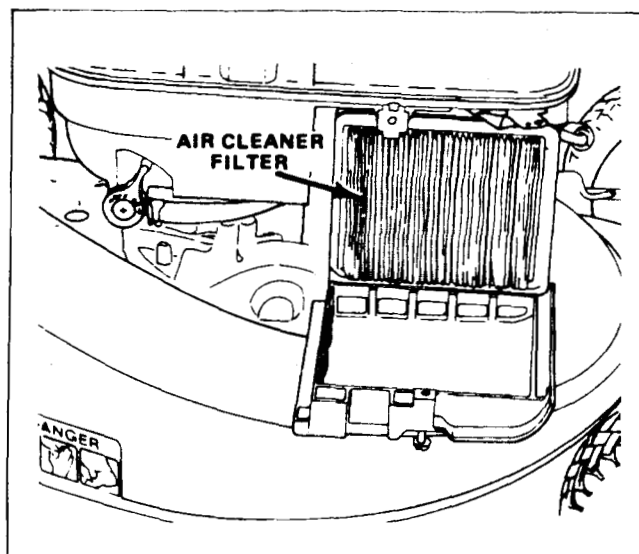


Figure 8

Briggs & Stratton Quantum- Replacing Spark Plug

Use a Champion RJ19LM or J19LM spark plug or equivalent. Correct air gap is 0.8 mm (0.032"). Remove the plug after every 25 operating hours and check its condition.

1. Stop the engine and pull the wire off the spark plug. See Figure 6.
2. Clean around the spark plug and remove the plug from the cylinder head.

IMPORTANT: Replace a cracked, fouled, or dirty spark plug. Do not sand blast, scrape, or clean electrodes because engine damage could result from grit entering the cylinder.

3. Set the air gap at .08 mm (0.032") as shown in Figure 9. Install correctly gapped spark plug and gasket seal. Tighten plug firmly.

Spark Plug Torque:
20 N•m (15 ft lbs)

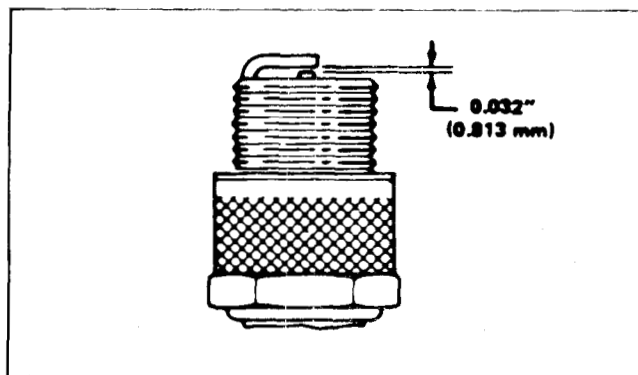


Figure 9

Briggs & Stratton Quantum- Draining Gasoline

1. Stop the engine and pull the wire off the spark plug as shown in Figure 6.

NOTE: Drain gasoline from a cold engine only.

2. Turn the fuel shut-off valve, if applicable, to the OFF position as shown in Figure 10.
3. Remove the cap from the fuel tank and use a pump-type syphon to drain the fuel into a clean gas can.

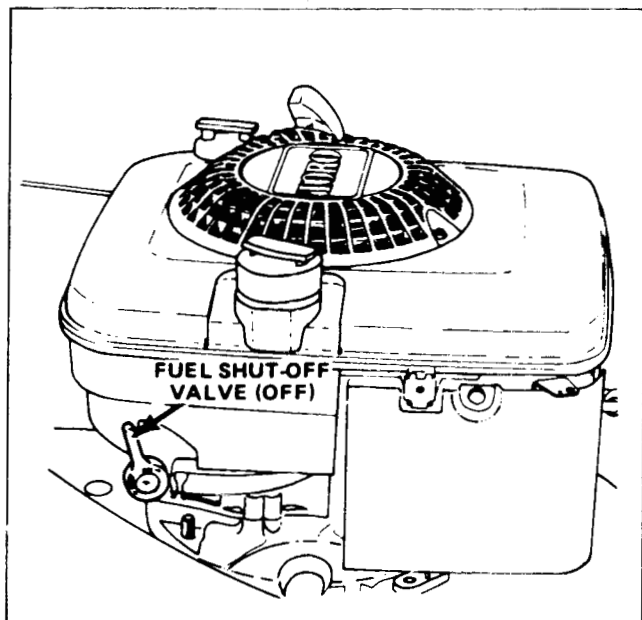


Figure 10

NOTE: This is the only procedure recommended for draining fuel.

Briggs & Stratton Quantum - Changing the Crankcase Oil

Change the oil after the first 2 operating hours and after 25 hours thereafter. Since warm oil drains better and carries more contaminants than cold, run the engine for a minute or so before draining oil.

1. Stop the engine and pull the wire off the spark plug as shown in Figure 6.
2. Remove the grass bag. Drain gasoline from the fuel tank; refer to Draining Gasoline, page 20.
3. Remove the dipstick. Tip the mower on its left side and empty all the oil into a drain pan. See Figure 11. Tip mower down and up a few times to ensure oil drains completely.

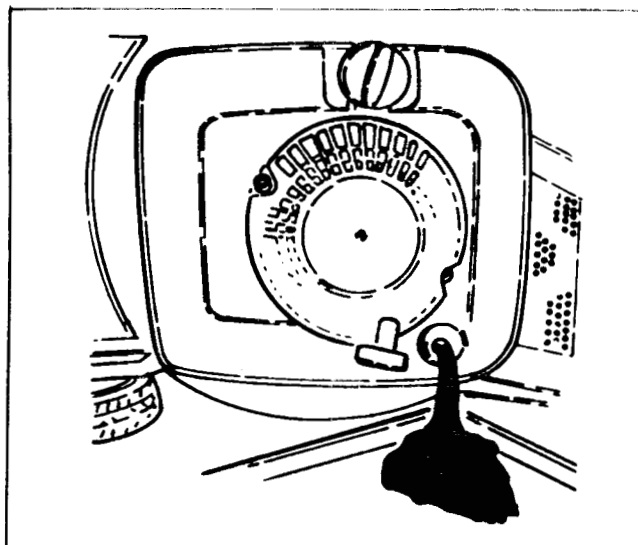


Figure 11

4. After draining, fill the engine with 410 cc (14 oz) fresh oil. Check the oil level using a dipstick. Fill to "full" mark, but do not overfill.

Briggs & Stratton Quantum- Adjusting the Throttle

Throttle control adjustment may be required if the engine does not start or stop. Whenever a new throttle control cable is installed, the throttle must be adjusted.

1. Stop the engine and pull the wire off the spark plug. See Figure 6.
2. Move the throttle control to FAST.
3. Loosen the cable clamp screw until the throttle cable slides. See Figure 12. Align the holes in the throttle lever and throttle bracket using a 3mm (.121") diameter pin. Tighten the cable clamp screw to lock the adjustment in place.

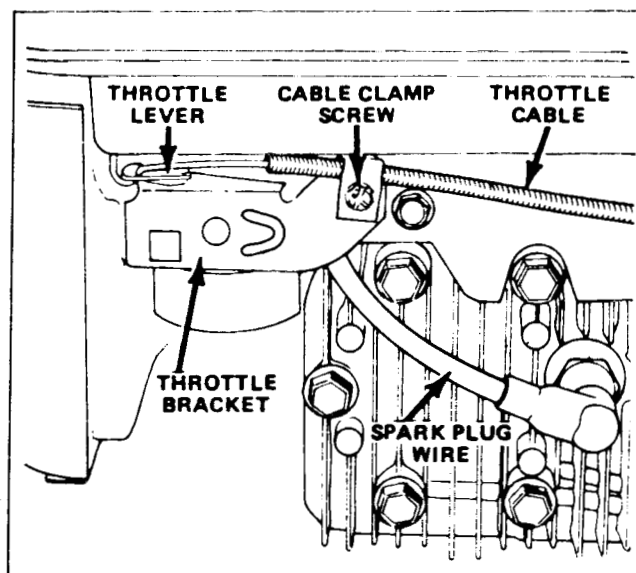


Figure 12

TORO 2-CYCLE ENGINE

TORO 2-Cycle - Servicing the Air Cleaner

Normally, clean the air cleaner foam element after every 25 operating hours. More frequent cleaning is required when the mower is operated in dusty or dirty conditions.

CAUTION! Pull wire off spark plug before performing adjustments or maintenance.

1. Stop the engine and pull the wire off the spark plug.
2. Lift tabs at top of air cleaner cover and pivot the cover down. Clean the cover thoroughly.
3. If the outside of the foam element is dirty, remove it from the air cleaner body. See Figure 13. Clean thoroughly.

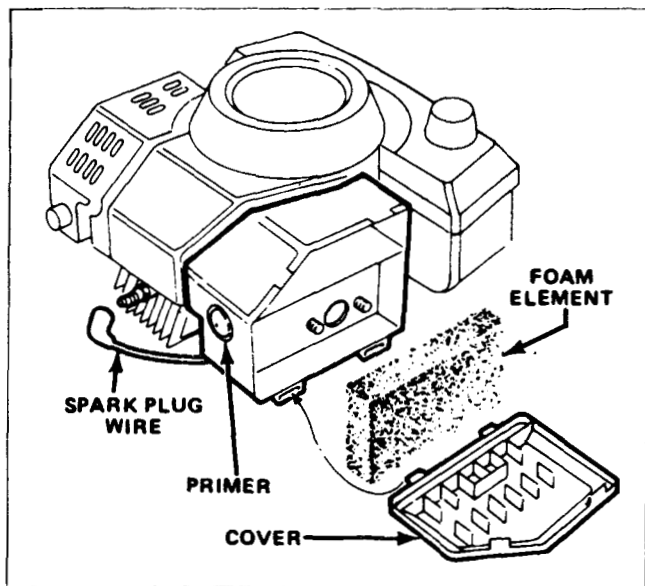


Figure 13

WASH the foam element in a solution of liquid soap and warm water. Squeeze to remove dirt, but do not twist because the foam may tear.

DRY by wrapping in a clean rag. Squeeze the rag and the foam element to dry.

SATURATE the element with 25 ml. (5 teaspoons) of SAE 30 or 10W30 engine oil. Squeeze the element to remove excess oil and to distribute the oil thoroughly. A damp element is desirable.

4. Install foam element and air cleaner cover.

IMPORTANT: Do not operate the engine without an air cleaner element because extreme engine wear and damage will likely result.

TORO 2-Cycle - Replacing the Spark Plug

Use an NGK BPMR4A spark plug or equivalent. Correct air gap is 0.81 mm (0.032"). Remove the plug after every 25 operating hours and check its condition.

1. Stop the engine and pull the wire off the spark plug. See Figure 13.
2. Clean around spark plug and remove plug from cylinder head.
3. Set air gap at 0.81 mm (0.032") as shown in Figure 14. Install correctly gapped spark plug and gasket seal. Tighten plug firmly.

Spark Plug Torque:
13.6 N•m (10 ft lbs)

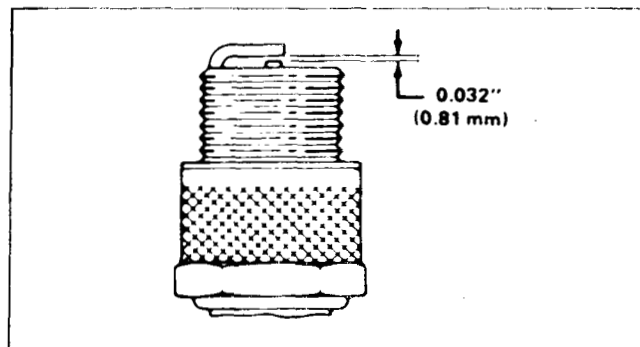


Figure 14

TORO 2-Cycle - Draining Gasoline

1. Stop the engine. Pull the wire off the spark plug.
2. Remove the cap from the fuel tank and use a pump-type syphon to drain the fuel into a clean gas can.

NOTE: This is the only procedure recommended for draining fuel.

TORO OHV ENGINE

TORO OHV - Servicing the Air Cleaner

Normally, clean air cleaner after every 25 operating hours. More frequent cleaning is required when the mower is operated in dusty or dirty conditions.

TORO OHV - Servicing the Air Cleaner (cont'd)

CAUTION! Pull the wire off the spark plug before performing adjustments or maintenance.

1. Stop the engine and pull the wire off the spark plug. Remove the key from the switch on electric start models.
2. Push in the locking tabs and lift off the air cleaner cover. Clean cover thoroughly. See Figure 15.
3. If the top of the foam element is dirty, remove it from the air cleaner body. Clean thoroughly.

WASH the foam element in a solution of liquid soap and warm water. Squeeze to remove dirt, but do not twist because the foam may tear. Rinse thoroughly in clear water.

DRY by wrapping in a clean rag. Squeeze the rag and the foam element to dry.

SATURATE the element with 25 ml. (5 teaspoons) of SAE 30 or 10W30 engine oil. Squeeze the element to remove excess oil and to distribute oil thoroughly. A damp element is desirable.

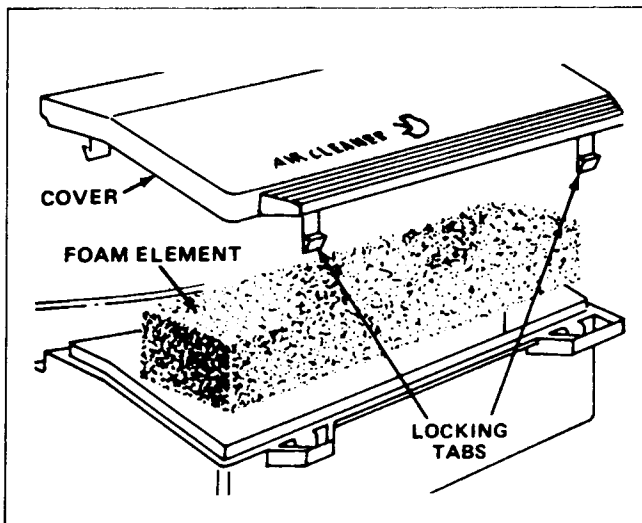


Figure 15

4. Install foam element and air cleaner cover.

IMPORTANT: Do not operate the engine without an air cleaner element because extreme engine wear and damage will likely result.

TORO OHV - Replacing the Spark Plug

Use an NGK BPR6ES spark plug or equivalent. Correct air gap is 0.813 mm (0.032"). Remove the plug after every 25 operating hours and check its condition.

1. Stop the engine and pull the wire off spark plug.
 2. Clean around the spark plug and remove the plug from cylinder head.
- IMPORTANT:** Replace a cracked, fouled, or dirty spark plug. Do not sand blast, scrape, or clean electrodes because engine damage could result from grit entering the cylinder.
3. Set air gap at 0.813 mm (0.032") as shown in Figure 16. Install a correctly gapped spark plug and gasket seal. Tighten the plug firmly.

Spark Plug Torque:
20.4 N•m (15 ft lbs)

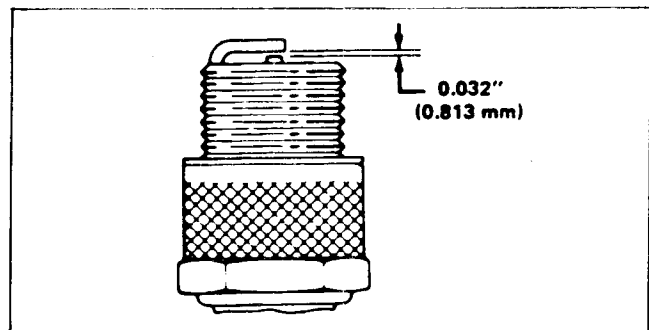


Figure 16

TORO OHV - Draining Gasoline

1. Stop the engine and pull the wire off the spark plug. Remove the key from the switch on electric start models.
2. Remove fuel tank cap and use a pump-type syphon to drain the fuel into a clean gas can.

NOTE: This is the only procedure recommended for draining fuel.

TORO OHV - Changing the Crankcase Oil

Change the oil after the first 2 operating hours and every 25 hours thereafter. Since warm oil drains better and carries more contaminants than cold, run the engine for a minute or so before draining the oil.

1. Stop the engine and pull the wire off the spark plug. Remove the key on electric start models.
2. Remove the grass bag. Drain gasoline from the fuel tank; refer to Draining Gasoline, page 22.
3. Raise the left side of the mower at least 30 cm (12"). Remove the drain plug using a 14mm wrench. Insert the oil drain tube over the drain opening. See Figure 17.

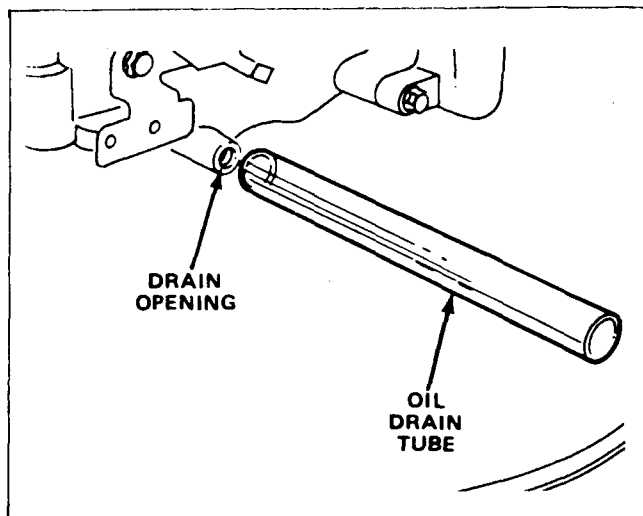


Figure 17

4. Place a drain pan at the left side of the mower. Lower the mower allowing oil to drain into the pan. Raise the right side of the mower until all the oil has flowed into the the drain pan.
5. Install the drain plug and fill the engine with 530 cc (18 oz) of fresh oil; do not overfill.

TORO OHV - Adjusting the Throttle

Throttle control adjustment may be required if the engine does not start or stop. Whenever a new throttle control cable is installed, throttle must be adjusted.

1. Stop the engine and pull the wire off the spark plug. Remove the key on electric start models.
2. Move the throttle control to FAST.
3. Loosen the cable clamp screw until throttle cable slides. Reference Figure 18. Align the holes in the throttle lever and throttle bracket. Tighten cable clamp screw to lock adjustment in place.

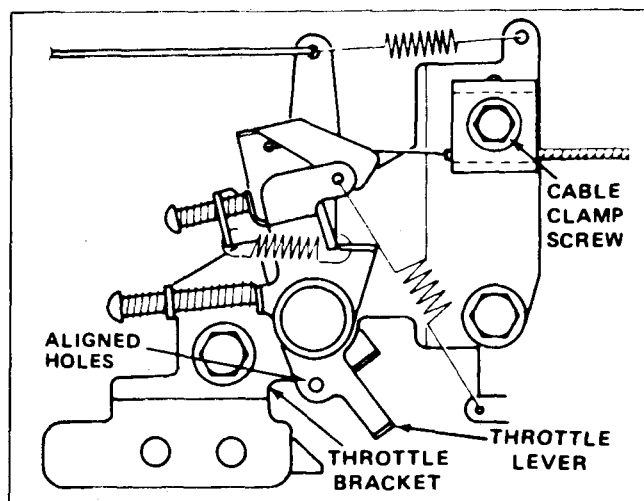


Figure 18

BLADE

BLADE - Inspecting/Removing/Sharpening the Blade

1. Stop the engine. Pull the wire off the spark plug.
 2. Drain the gasoline from the fuel tank; refer to Draining Gasoline in this section for your particular engine.
 3. Tip the mower on its side. Avoid rotating blade. Starting problems may result.
 4. *Inspecting Blade* - Carefully examine the blade for sharpness and wear, especially where flat and curved parts meet. See Figure 19. Since sand and abrasive material can wear away the metal that connects the flat and curved parts of the blade, check the blade before using the mower. If a slot or wear is noticed (see B & C, Figure 19), replace the blade
 5. *Removing The Blade* - Grasp the end of the blade using a rag or thickly padded glove. Remove the fasteners and blade. See Figure 20.
- NOTE:** For optimum performance, install a new blade before cutting season. During the year, file down small nicks to maintain the cutting edge.
6. *Sharpening Blade* - Using a file, sharpen the top side of the blade and maintain original cutting angle as shown in Figure 21. The blade will remain balanced if the same amount of material is removed from both cutting edges.

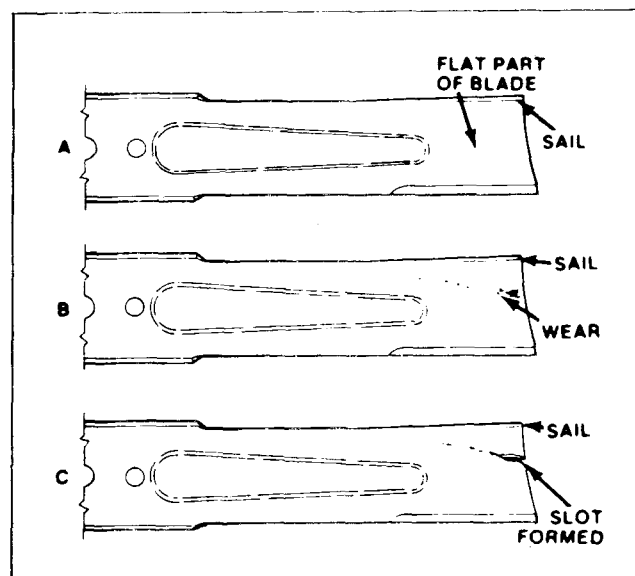


Figure 19

BLADE - Inspecting/Removing/Sharpening the Blade (cont'd)

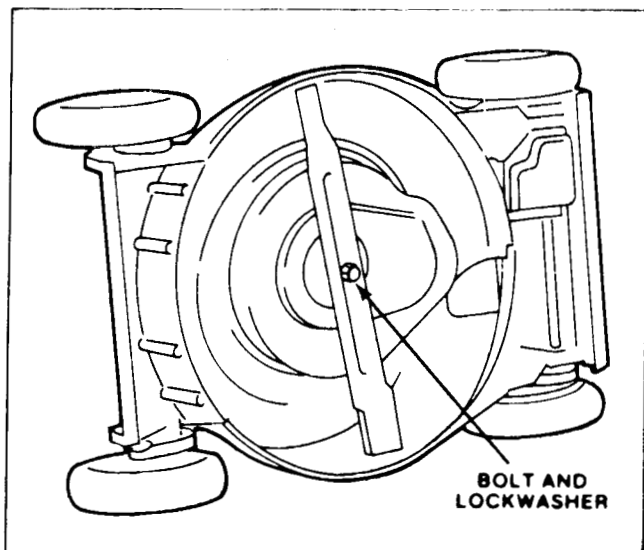


Figure 20

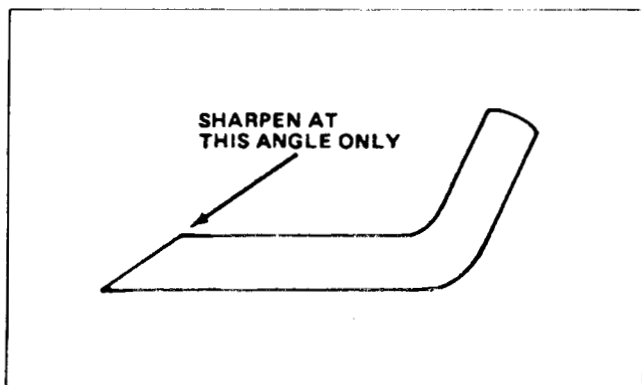


Figure 21

IMPORTANT: Check the balance of the blade by putting it on a blade balancer. An inexpensive balancer can be purchased at a hardware store. A balanced blade will stay in horizontal position and an unbalanced blade will settle to the heavy side. If a blade is not balanced, file more metal off the cutting edge on the heavy end of blade.

7. Install sharp, balanced blade with a lockwasher and blade bolt. The sail part of the blade must point toward the top of the mower housing to assure correct installation.

HOUSING

Housing - Cleaning the Mower Housing

To assure optimum performance, keep the underside of the mower housing and the inside of discharge area clean.

1. Drain gasoline from the fuel tank; refer to Draining Gasoline, this section, for your particular engine.
2. Tip the mower on its side. Avoid rotating blade because starting problems may result.

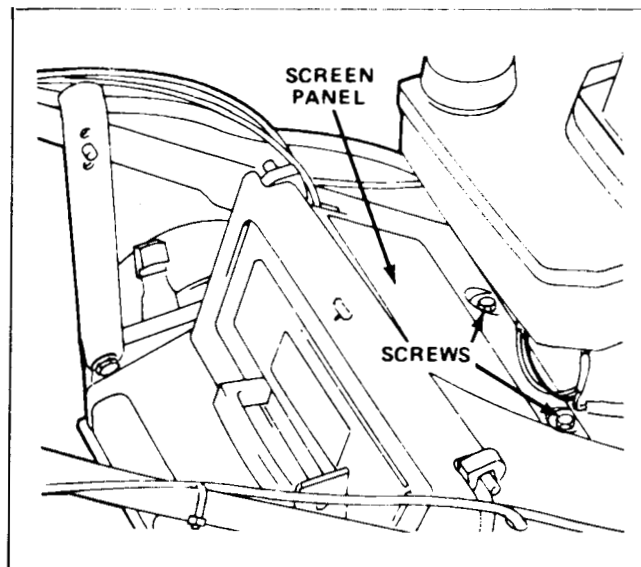


Figure 22

3. Remove dirt and grass clippings that stick to the housing by spraying it with a garden hose. Scrape out the remaining debris with hardwood scraper. Avoid burrs and sharp edges.
4. Clean discharge door and hinges of grass or debris that may impair operation of door. Use caution when cleaning door so you do not damage foam seal.

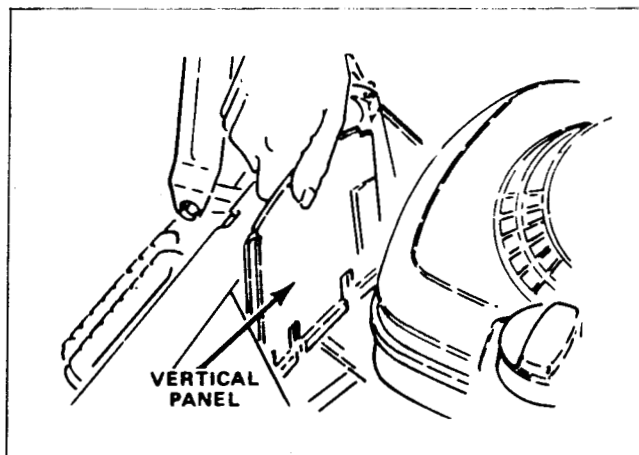


Figure 23

5. Remove the screen panel and access cover on the mower housing and clean around the gear box and blade brake mechanism on units so equipped. See Figures 22 and 23.

BATTERY

Battery - Charging, Model 26624

Although a new battery is not fully charged, a partial charge of 4 hours provides enough energy for several starts. However, a new battery must be charged for 72 continuous hours to assure full charge. Also charge battery for 72 hours when mower is stored and in the spring. During normal operation, engine alternator keeps battery charged.

1. Stop the engine and disconnect the wire harness from the battery terminal. See Figure 24.
2. If desired, battery can be removed by sliding it out of the mounting slots. However, removal is not required if the mower can be positioned near an electrical outlet.
3. Connect TORO electro charger to battery and plug into 120 VAC power outlet. After charging battery for the specified time, unplug the charger and disconnect it from battery.
4. Connect the wiring harness to the battery terminal.

IMPORTANT: Only the TORO electro charger is recommended because other chargers could damage the battery. Always use charger indoors
Battery - Charging, Model 26624 (cont'd)

and charge battery at room temperature 21°C (+70°F) whenever possible. Do not charge a battery longer than 72 hours because damage could result.

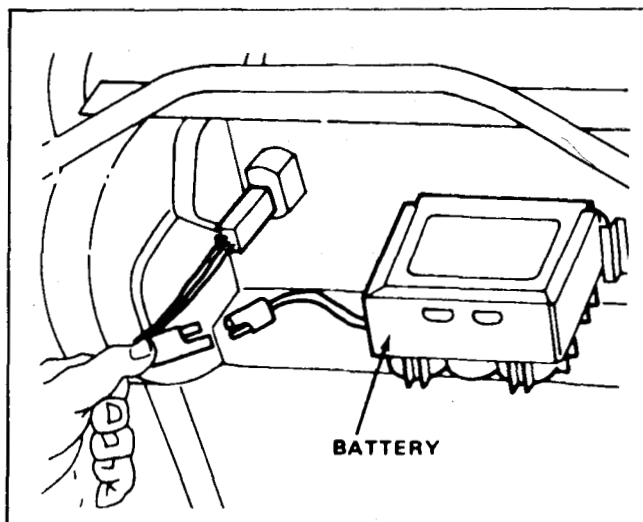


Figure 24

WHEELS

After every 25 operating hours or when the season ends, front and rear wheels must be lubricated.

1. Apply 2 or 3 drops of light oil on the inside and outside of all wheel bolts. Spin wheels to distribute oil into bushings. Wipe up excess oil.

ZONE START BRAKE

Zone Start Brake - Adjusting Blade Brake

Whenever a new blade brake cable or brake clutch belt is installed, an adjustment is required.

1. Stop the engine and pull the wire off the spark plug.
2. **Check Adjustment** - (See Figure 25.) Move the control bar toward the handle until slack in the wire is removed. Gap between brake lever and handle must be 3-5 mm (1/8" - 3/16").
3. **Cable Conduit Adjustment** - Loosen the nut on cable bracket. Insert a 3-5 mm (1/8" - 3/16") object between brake lever and handle. Pull down on the cable conduit until all slack is removed from wire. Then tighten the nut.

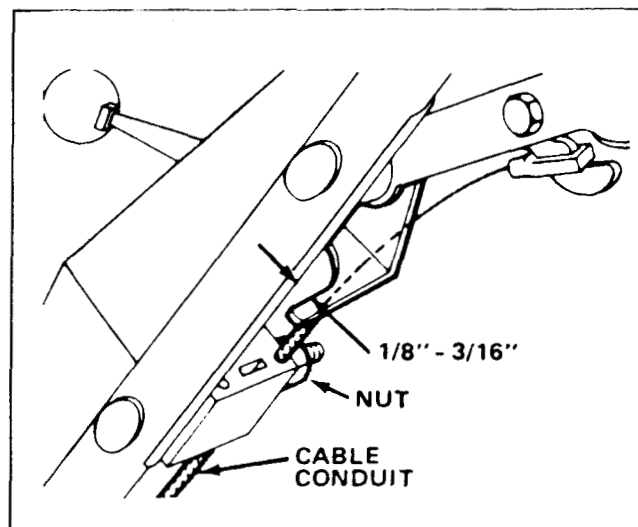


Figure 25

BBC

BBC - Adjusting the Blade Brake

1. Stop the engine. Pull the wire off the spark plug.

BBC - Adjusting the Blade Brake (cont'd)

2. Remove the two screws securing the screen panel to the top of the mower housing as shown in Figure 22. Remove the panel.
3. Move the control bar down and lift up against the handle. With the control bar against the handle, measure the spring length (L) at the front of the spring as shown in Figure 26.

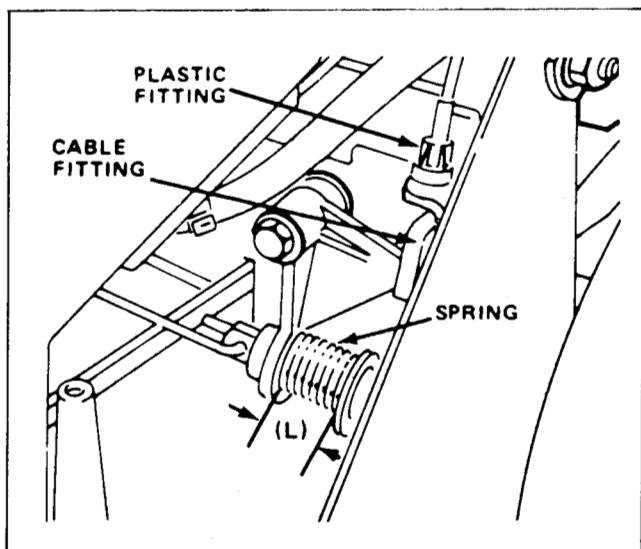


Figure 26

4. If the spring dimension is greater than 32 mm (1-1/4") an adjustment is needed.
5. To adjust, loosen the bottom jam nut on the blade brake cable as shown in Figure 27. Adjust the top jam nut until spring dimension is as near as possible to nut; not less than 25 mm (1"). See note below.

NOTE: Adjusting the top jam nut too high can cause the cable end to crush the plastic fitting when the control bar is moved up against the handle. If the spring cannot be adjusted to less than 32 mm (1-1/4") before the cable end contacts the plastic fitting, the clutch belt is worn out and should be replaced. After replacing the belt, adjust the cable per the above procedure.

NOTE: 1990 and newer models are equipped with finger tip adjusters that do not require tools. Use the same adjustment criteria on these cables.

6. Tighten bottom jam nut to lock the adjustment.

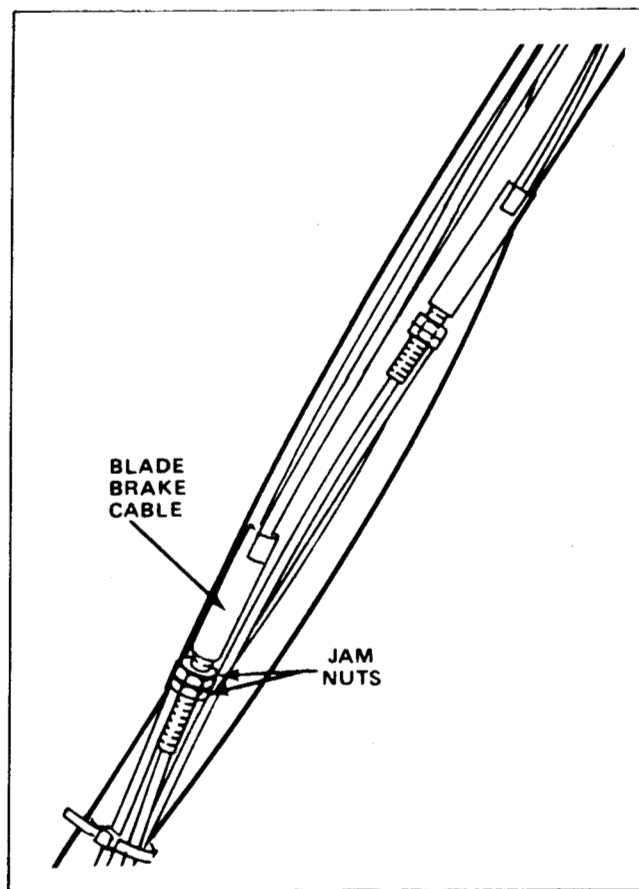


Figure 27

BBC - Check Control Bar Operation

The control bar should be checked periodically, at the beginning of each mowing season as a minimum, to assure the Blade Brake Clutch (BBC) system is operating properly.

1. Start the engine.
2. Push the control bar as shown to the lowest position. See Figure 28. This "latches" the mechanism prior to engaging the blade.
3. Lift the control bar to the normal "blade engaged" position, about 50 mm (2") below the handle. The "fan" noise and bag inflation indicate that the mower blade is engaged and rotating.
4. Release the control bar. A "bang" should be heard and the blade should stop within three seconds. If the blade does not stop within three seconds when the control bar is released, refer to BBC section for service information.

If your unit stops within the required three seconds, the BBC system is operating properly. However, to detect the BBC system deterioration

before it affects normal operation, proceed to Step 5.

5. Start the engine if not already running.
6. Push the control bar down to its lowest position, latching the mechanism. See Figure 28.

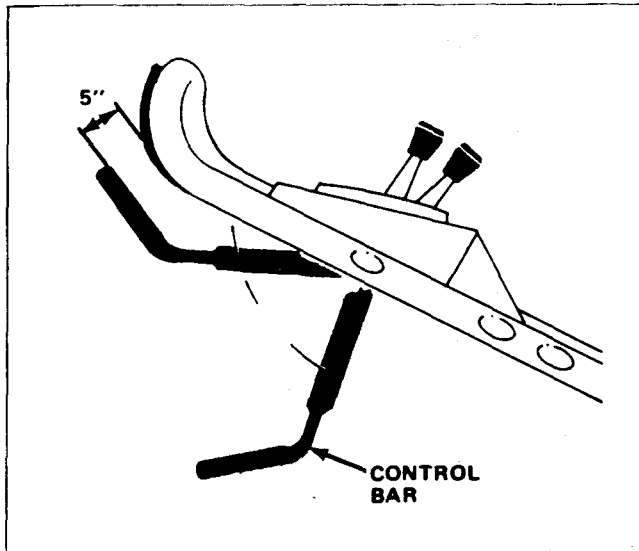


Figure 28

7. Slowly lift the control bar to a point where the bag just begins to inflate (about 5" below the handle). This indicates that the mower blade is engaged and has begun to rotate.

NOTE: This intermediate position is not the "natural" operating position of the control bar. However, it has proven to be useful in early detection of latent BBC sticking which could create an unsafe condition later in the life of the mower.

8. Release the control bar.

NOTE: If a "bang" is heard and the bag immediately deflates, the control bar had been raised too far. Repeat steps 5, 6, and 7, but do not raise the handle as high as the last time.

If the control bar "hangs up" and the blade does not stop quickly, you should stop the blade before shutting the engine off. This can be done by raising the control bar to the normal operating position and releasing it.

SELF-PROPEL SYSTEM

Self-Propel System - Lubrication

1. Move the rear wheel height-of-cut levers to the "C" setting. Wipe grease fittings with a clean rag

as shown in Figure 29. Install grease gun onto the fitting and gently apply one or two pumps of No. 2 multi-purpose lithium-base grease.

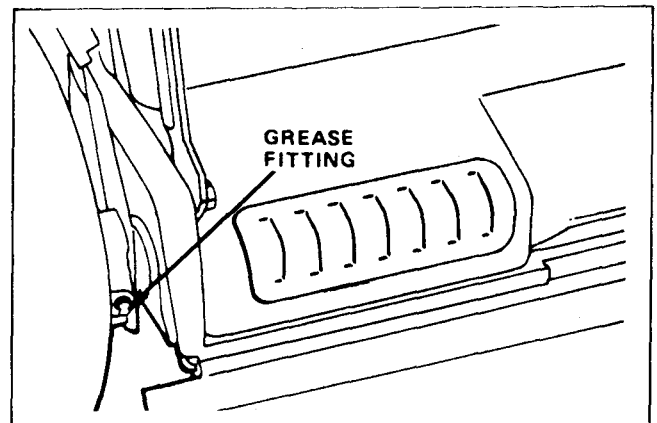


Figure 29

Self-Propel System - Adjusting Wheel Drive

If the mower does not self-propel or creeps forward when the drive is not engaged, then adjustment to the wheel traction control cable is necessary.

1. Stop the engine. Pull the wire off the spark plug.
2. Loosen bottom jam nut on the wheel traction cable as shown in Figure 30.

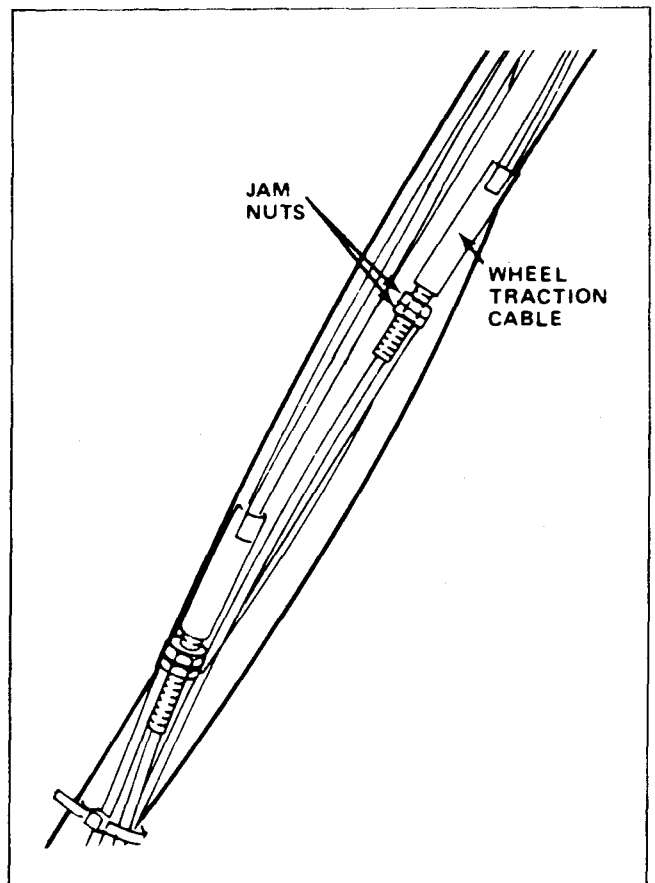


Figure 30

Self-Propel System - Adjusting Wheel Drive

NOTE: '90 and newer units will have finger tip adjustment just below the control panel

3. Lift the control bar until some resistance is felt. Control bar should be 38 mm (1-1/2") from handle when properly adjusted. See Figure 31.
4. Move the top jam nut up to increase the clearance between the control bar and the handle. Move the top jam nut down to decrease the clearance between the control bar and the handle.

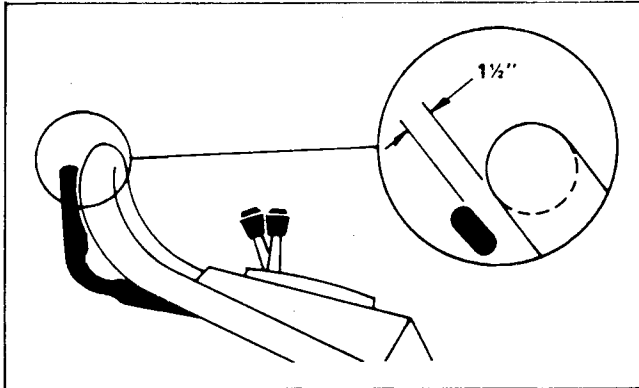


Figure 31

5. Repeat steps 3 and 4 until properly adjusted.
6. Tighten the bottom jam nut to lock in the adjustment.

Self-Propel System - Neutral Adjustment

Whenever a new ground speed control cable is installed or if the mower drives when ground speed control is in "N", an adjustment is required.

1. Stop the engine and remove the grass bag.
2. Remove access cover from the rear of the mower housing. See Figure 32.

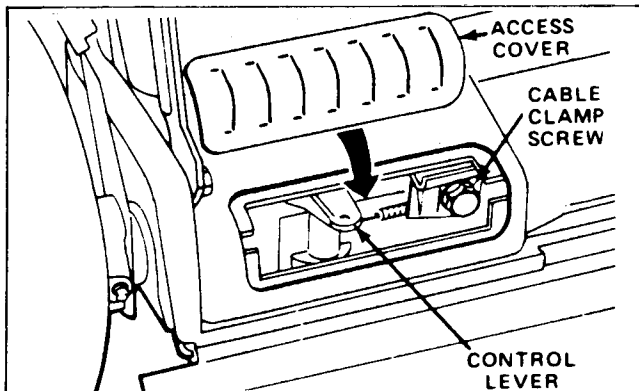


Figure 32

3. Move the ground speed control to "N".
4. **Adjustment** - Refer to Figure 32. Loosen the cable clamp screw until cable conduit slides. Push the shift lever toward the cable clamp screw. Push the cable sheath to the right to remove the slack and tighten the clamp screw.
5. Reinstall access cover and grass bag.

STORAGE

Storage - Preparation

1. For long term storage, it is recommended that gasoline be drained from the fuel tank; refer to **Draining Gasoline**, this section, for your particular engine. After fuel is drained, start the engine and let it idle until all fuel is consumed and engine stops. If gasoline is not drained, gum-like varnish deposits will form and cause poor engine operation, or even starting problems.
 2. Drain the oil; refer to **Changing Crankcase Oil**, this section, for your particular engine. After oil is drained, do not fill crankcase with oil until the following steps (3 through 11) are completed.
 3. Remove the spark plug and pour 30 ml (2 tablespoons) of SAE 30 or 10W30 oil into the hole in the cylinder. Pull starter rope slowly to coat the inside of cylinder. Install spark plug and tighten. **DO NOT INSTALL THE WIRE ON THE SPARK PLUG.**
- Spark Plug Torque:
20.4 N•m (15 ft lbs)
4. Clean the mower housing; refer to **Housing - Cleaning Mower Housing**, page 24.
 5. Clean BBC screen covers if so equipped.
 6. Check condition of blade; refer to **Inspecting/Removing/Sharpening Blade**, page 23.
 7. Tighten all nuts, bolts and screws.
 8. Clean dirt and chaff from cylinder, cylinder head fins, and blower housing. Also remove grass clippings, dirt, and grime from external parts of the engine, shrouding, and top of mower housing.

9. Clean the air cleaner; refer to Servicing Air Cleaner, this section, for your particular engine.
10. Lubricate the wheels; refer to Wheels, page 25, and Self-Propel System - Lubrication, page 27.
11. Touch up all rusted or chipped paint surfaces. Toro Re-Kote paint is available from an Authorized TORO Service Dealer.
12. Fill the crankcase with oil; refer to Changing Crankcase Oil, this section, for your particular engine.
13. Charge battery for 72 hours (model 26624); refer to Battery - Charging, page 25.
14. Store the mower in a clean, dry place. Cover the mower to keep it clean and protected.

SECTION 1 FRONT SUSPENSION

Front Suspension - Operation

Since the introduction of this model in 1988, there have been a number of different front suspension configurations which have different parts used. However, the basic design has remained the same. The wheels rotate on a shoulder bolt. The wheel and tire assembly is supported by oil impregnated bushings which are permanently lubricated, although occasional oiling will increase service life.

The wheel bolts are fastened to pivot arms. The pivot arms pivot on a shoulder bolt to allow changes in height-of-cut. Height-of-cut is determined by the spring arm detent that slips into various slots molded into the housing. These slots are marked and allow adjustment from 25 to 75 mm in 13 mm increments (1" to 3" in 1/2" increments).

Front Suspension - Disassembly

Four different front suspension configurations have been used. See Figure 33.

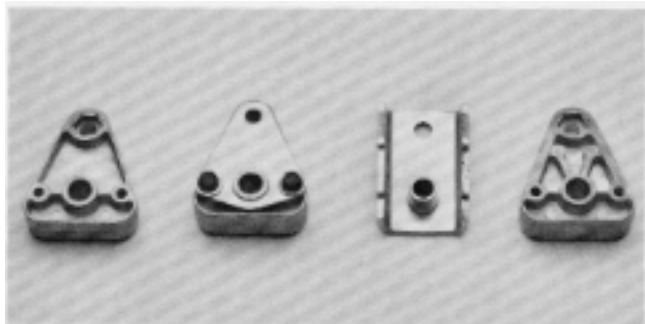


Figure 33

1. Remove the shoulder bolt securing the wheel to the pivot arm. Remove the wheel and tire assembly along with the shoulder bolt and the nylon locknut.
2. Remove the shoulder bolt securing the pivot arm to the housing and remove the pivot and spring arm assembly, complete with washers and fasteners.
3. Remove the spring arm from the pivot arm. In some cases it will be secured with a socket head machine screw. In other cases, the spring arm will be retained with detents.

NOTE: If the pivot arm you are working on resembles pivot arm "B" above, it can be further disassembled by removing the steel plate. However, these plates and pivot arm assemblies are not available separately and have been

superceded by the system denoted by "D" in Figure 35.

4. The knob can be removed from the spring arm by pressing on the detent through the hole in the knob. It is not glued on.

Front Suspension - Assembly

See Figures 34 and 35.

1. Assemble the spring arm and knob so that the detent on the spring arm falls in the hole on the knob.

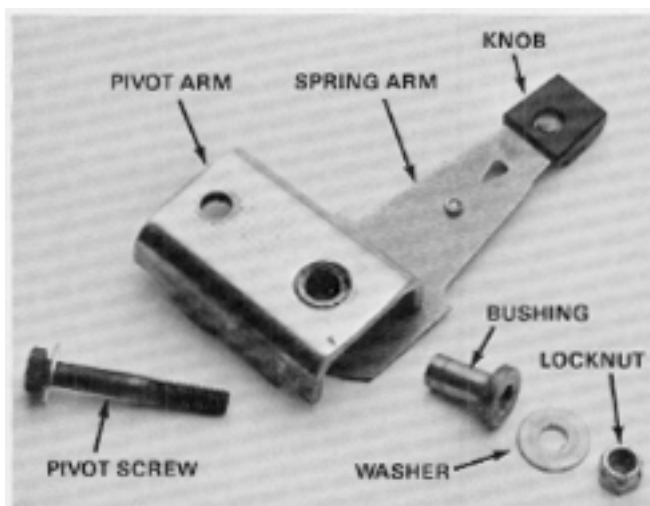


Figure 34

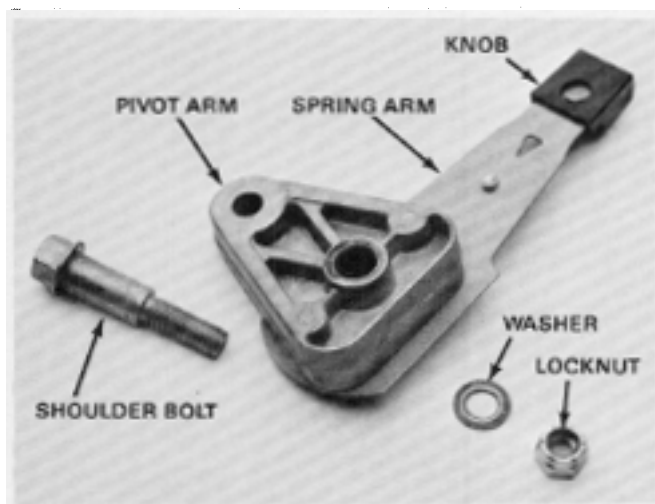


Figure 35

2. Assemble the pivot arm and spring arm so that the concave portion of the knob faces the deck. See the appropriate figure for pivot arm orient-

tation. If the pivot arm is cast aluminum, secure the spring arm with the socket head machine screw.

3. Install the spring arm and pivot arm assembly onto the deck using the shoulder bolt and nylon locknut. Don't forget the spacer that fits between the deck and the pivot arm. Torque the pivot arm bolt. See Figure 36.

Pivot Arm Bolt Torque:
17-28 N•m (150 to 250 in lbs)

NOTE: It is not necessary to lubricate the pivot arm bolt.

4. Move the pivot arm to the highest height-of-cut and slip the locknut, nylon side toward the housing, into the recess provided in the pivot arm. Then secure the wheel entire assembly with

the shoulder bolt and nylon locknut. Be sure to lubricate the wheel bolt with 2 or 3 drops of light oil. Wipe up any excess oil.

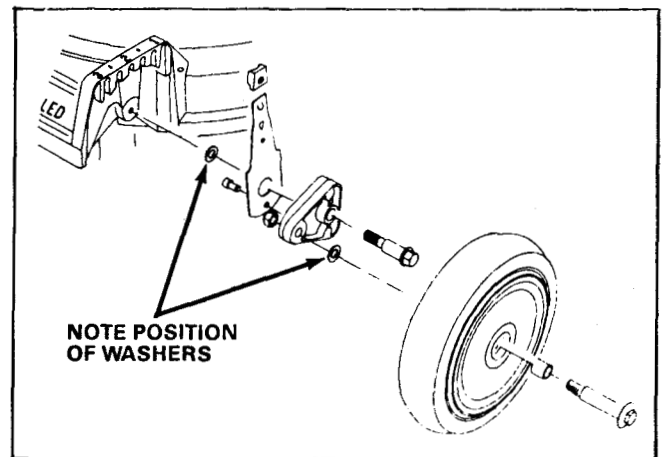


Figure 36

SECTION 2 REAR SUSPENSION (HP Models Only)

Hand Push Rear Suspension - Operation

The rear suspension used in hand push versions of the Vacu-Power mower serves two purposes: One, it supports the wheels, and two, it allows the height-of-cut to be changed.

You will note many similarities between the hand push system and the self propel system. This was intended to maximize commonality between the machines.

The wheel and tire assembly ride on shoulder bolts that are fastened into the pivot arms. See Figure 37.

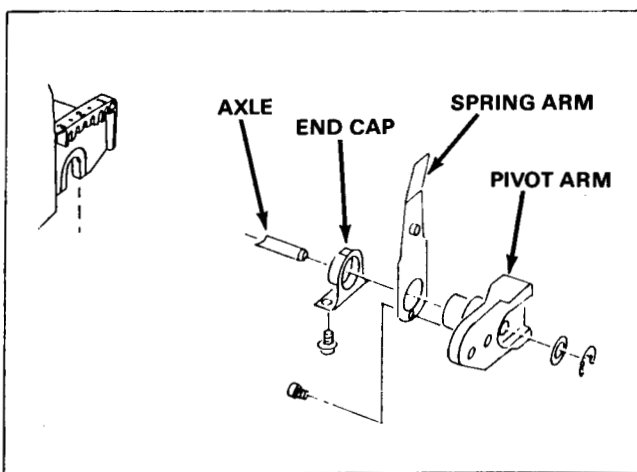


Figure 37

Wheels and tires are not individually replaceable, although they ride on oil impregnated bushings which can be replaced. These bushings are permanently lubricated. However, a few drops of oil at 50 hour intervals will increase service life.

The pivot arms are supported by end caps. They are retained inside the end caps by an axle that spans the entire width of the deck. A washer and an E-clip keep the pivot arms from coming off the end of the axle. This arrangement allows the pivot arms to pivot.

Changing height-of-cut is accomplished by bending the spring arm which is rigidly fastened to the pivot arm by means of a socket head capscrew. Recesses in the deck and a rivet in the center of the pivot arm provide a means of retaining the desired height-of-cut. The recesses provided allow the height-of-cut to be changed from 25 to 75 mm in 13 mm increments (1" to 3" in 1/2" increments).

Hand Push Rear Suspension - Disassembly

If rear suspension service is necessary, it will most often be easiest to remove the whole assembly and then perform the service.

1. Remove the spark plug wire to prevent accidental starting.
2. Drain the gasoline from the unit.
3. Remove the four flanged head capscrews securing the end caps and safety shield to the deck. Remove the safety shield assembly and the hand push rear suspension assembly.
4. Remove the shoulder bolt that secures the wheel and tire assembly to the pivot arm and remove the wheel, washer and nylon locknut.
5. Remove the E-clips from each end of the axle.
6. Pull the pivot arms, spring arm assembly and the end caps from the axle.
7. Remove the spring arms from the pivot arms by removing the socket head capscrews.

If required, the spring arm can be further disassembled by removing the knob. Press on the tab inside the hole in the knob and pull off vertically.

NOTE: The spring arm uses a rivet to retain it in a desired height-of-cut. These rivets are not replaceable separately.

8. Inspect all parts for wear and/or damage and replace as necessary.

Hand Push Rear Suspension - Assembly

1. If necessary, reassemble the spring arms by installing a knob on top of the spring arm. Make sure that the tab on the top of the spring arm rises at least 1.5 mm (.060") above the spring arm. Install the knob so that the concave part of the knob and the concave part of the rivet are on opposite sides. See Figure 38.
2. Secure the spring arm to the pivot arm with a socket head capscrew.
3. Slide an end cap onto each end of the axle as shown in Figure 37. Slide the spring arm and pivot arm assembly onto each side of the axle, spring arm first.

Slide a flat washer onto each end of the output shaft then secure the assembly with an E-clip on each end.
4. Install the assembly into the mower housing using only the two front flanged head capscrews.

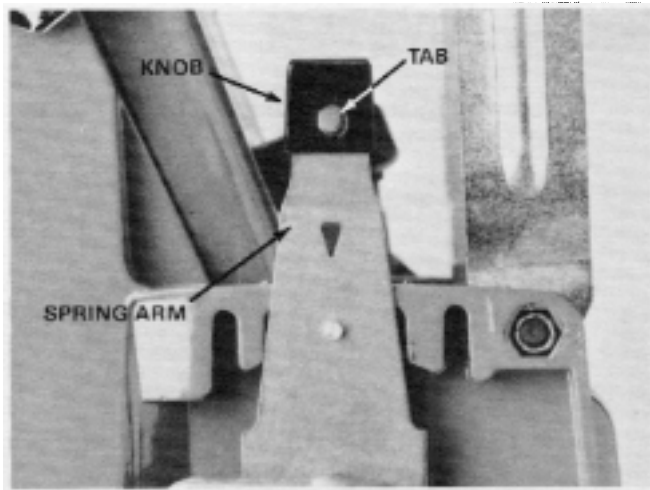


Figure 38

5. Position the safety shield components as shown in Figure 39, and secure the safety shield and end caps with the two flanged head capscrews. Torque all end cap capscrews.

End Cap Capscrew Torque:
25 N•m (225 in lbs)

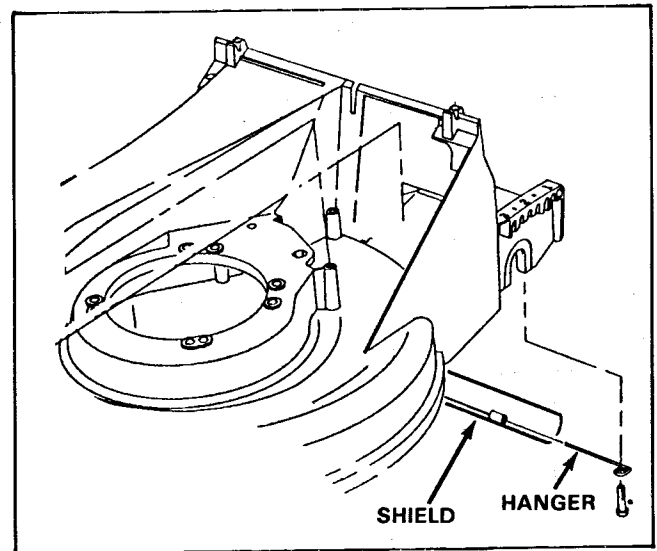


Figure 39

6. Install the wheel and tire assembly onto the pivot arm using a shoulder bolt and nylon locknut. Don't forget the washer that goes between the wheel and the pivot arm.
7. Check for free operation of the pivot arm.

SECTION 3 SELF-PROPEL SYSTEM

GEAR SELECTION CONTROL

Gear Selection Control - Operation

The TORO Vacu-Power mower is equipped with a 3-speed transmission. The gear selection control allows the operator to select one of the three speeds or neutral by moving a lever on the control panel. The gear selection control is made up of 3 components: the controlling cable, the cable clamp, and the input lever on top of the transmission. The transmission uses a sliding key arrangement for gear selection.

On '88 and '89 Vacu-Power mowers there is no detent inside the gear box. Rather, the detent is in the gear selection control in the control panel. If alignment between detents on the control panel and the gears inside the transmission is a problem, make sure that the cable is adjusted properly. If a problem still exists, consult Service Bulletin 43 for further information.

Gear Selection Control - Removal

1. Place the gear selection control in the neutral position.
2. Snip the cable ties securing the gear selection control cable to the handle to allow greater movement of the self-propel cable.
3. Raise and support the rear of the mower approximately 30 cm (12") off the ground. Remove the transmission access cover by pressing from underneath. See Figure 40.

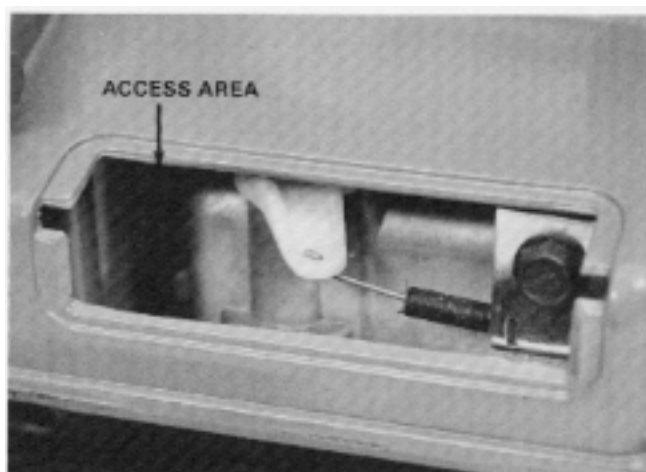


Figure 40

4. Remove the two flanged head self-tapping screws holding the left end cap to the housing. This will allow the rear axle to move slightly,

thereby providing clearance for removal of the input lever. See Figure 41.



Figure 41

5. Loosen the cable clamp fastener until the self-propel control cable is free and clear.
6. Remove the cotter pin securing the input lever to the transmission and then remove the input lever.
7. Bend the control panel tab slightly to provide clearance for removal of the self-propel control. See Figure 42.



Figure 42

8. Push the gear selection cable control up and out of the control panel.
9. Remove the control and cable from the unit.

Gear Selection Control - Installation

When installing a new control, be sure to use original TORO parts to insure proper operation and safety.

1. Bend the control panel tab forward to provide a positive lock when the control is inserted. See Figure 42 above.

2. Insert the control cable through the control panel from the top then snap the control into the rectangular hole on the right side of the control panel. Make sure that it snaps fully into place and that the control cable is pointing forward.
3. Slide the gear selection control cable about 30 cm (12") into the hole next to the right handle locknut. See Figure 43.

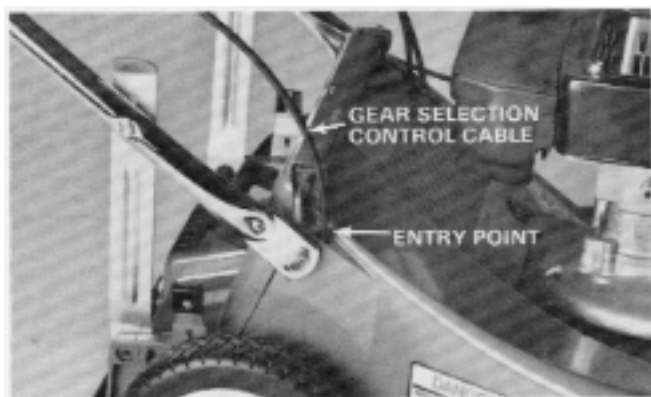


Figure 43

4. Turn the unit on its side and bring the gear selection control cable into the proper position making sure that it is routed *between* the deck and the output shaft as shown in Figure 44.



Figure 44

NOTE: Be careful not to bend or damage the cable during installation or shifting difficulties will result.

5. Slip the end of the gear selection cable into the shift lever.
6. Pull the gear case away from the housing slightly and install the shift lever onto the shifter fork at the rear of the transmission and secure with a new cotter pin.
7. Install the two self-tapping flanged head capscrews that secure the safety shield and the end caps to the housing.

8. Secure the gear selection control cable to the handle using two black cable ties. Make sure that they are not positioned too close to the housing or control panel. This will prevent kinking of the cable.
9. Adjust the gear selection cable as described below.

Gear Selection Control - Adjustment

Whenever a new ground speed control cable is installed or if the mower drives when the ground speed control is in neutral, an adjustment is required.

NOTE: '90 and newer cables are not adjustable at the transmission.

1. Stop the engine and remove the grass bag.
2. Remove access cover from the rear of the mower housing (push) from underneath. See Figure 45.

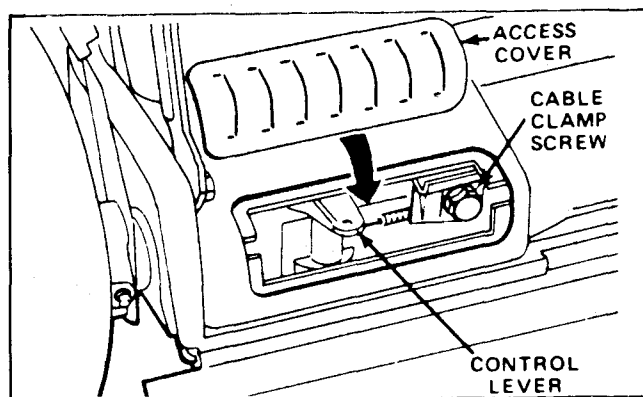


Figure 45

3. Move the ground speed control to neutral.
4. Loosen the cable clamp screw until the control cable slides but does not fall from the clamp. Push the shift lever toward the cable clamp screw then push on the cable sheath toward the right to remove slack. This action places both the transmission and the control in neutral. Tighten the clamp screw. See Figure 46.



Figure 46

Gear Selection Control - Adjustment (cont'd)

5. Reinstall access cover by pressing from the outside.
6. Test to insure proper operation.

TRACTION CONTROL

Traction Control - Operation

A belt transfers power from the engine to the transmission. The tension on this belt determines whether the unit will drive or not. Tensioning is accomplished by tilting the transmission rearward.

The operator controls this by means of the black control bar at the top of the handle. When the operator brings the control bar up to the handle, a cable is tightened and causes the transmission to rock backwards. When the operator releases the control bar, the transmission is allowed to tilt forward which loosens the belt. A belt guide at the engine and another on top of the transmission insure that the belt adequately releases the pulleys. This provides positive control.

Adjustment of the control bar is accomplished by means of a jam and locknuts arrangement on the traction cable on '88 and '89 units. '90 and newer units use a fingertip adjustment near the control bar.

Traction Control Cable - Removal

1. Disconnect the spark plug lead from the spark plug to prevent accidental starting.
2. Remove the two flanged head self-tapping screws securing the screen panel to the housing and remove the screen panel. See Figure 47.

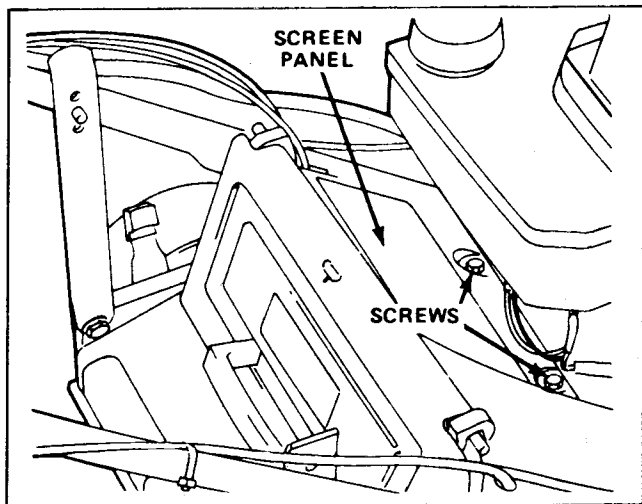


Figure 47

3. Remove the black plastic transmission cover from the transmission area by pulling straight up and out.
4. Squeeze the "ears" at the end of the cable sheath and pull the cable out vertically. See Figure 48.



Figure 48

5. Tip the unit on its side and remove the end of the cable from the transmission belt guide.
6. Stand the unit upright then bend the control panel tab out of the way. Drive the throttle control out of the left-hand side of the control panel with a rubber mallet.
7. Put a piece of tape on the outside of the left handle to keep the two special carriage bolts in place when working on the BBC control box.
8. Remove the three self-tapping screws from the right side of the BBC control box cover. See Figure 49.

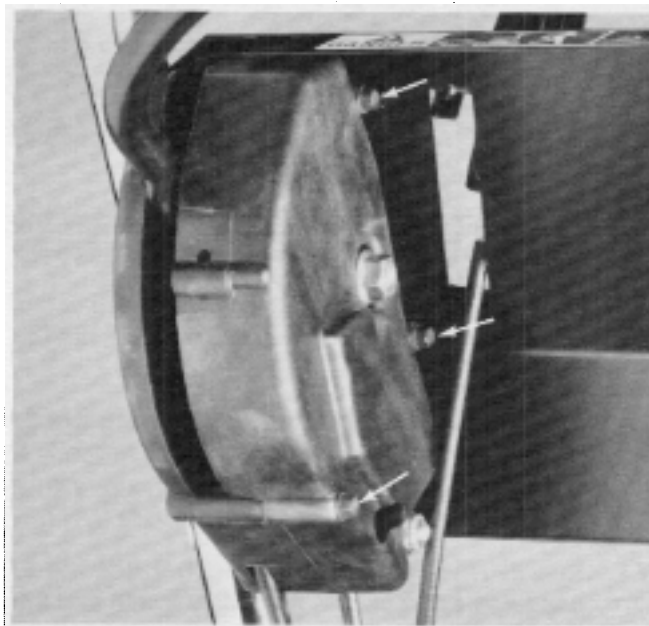


Figure 49

9. Remove the two nylon locknuts securing the right hand BBC cover to the BBC control box and remove the right hand control box half.
10. Carefully pull the traction control cable from the traction control lever in the BBC control box and remove the cable. Remove the cable tie securing the cables to the handle only if necessary.

Traction Control Cable - Installation

1. Slip the new traction control cable into the traction lever inside the BBC control box (if so equipped).
2. Make sure that all BBC or zone start components are still in place (consult Handle Assembly section, page 67, if necessary) then install the right-hand BBC case half and secure with the flanged and the regular nylon locknuts.
NOTE: The flanged nylon locknut fits on the rear carriage bolt.
3. Install the three flanged head screws to fully secure the BBC case halves.
4. Bend the control panel tab forward slightly to provide complete engagement with the control when put in place. Snap the throttle control in place.
5. Route the traction control cable through the existing tie strap (or if necessary, install a new one) being sure that the tie strap does not kink or damage any cables.
6. Route the traction control cable on the outside of the handle and handle latch and down to the transmission belt guide. Insert the end of the cable into the belt guide as shown in Figure 50.

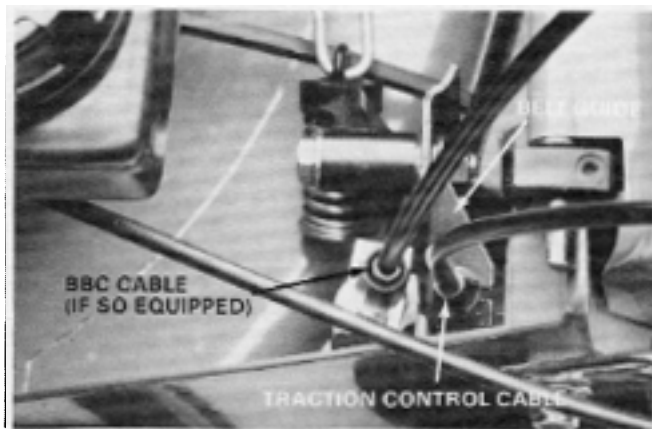


Figure 50

7. Pull the cable tight, causing the transmission to rock back, then insert the end of the sheath into the cable support bracket from the top.

8. Line up the black plastic transmission cover with the guides on the deck and the cable support bracket and slide into place.

NOTE: It may be necessary to reach under the deck and tilt the transmission back slightly to get it to drop into place.

9. Install the screen panel by slipping the traction cable and the BBC cable, if so equipped, into the slot provided. Make sure that the top of the screen panel slips below the lip at the top of the housing. Secure with the two self-tapping flanged head capscrews.
10. Check adjustment of the traction control cable and adjust if necessary as described below.

Traction Control Cable - Adjustment

The traction control cable is properly adjusted when all slack is removed from the cable and the control bar is at 3.8 cm (1-1/2") from the handle. (You can tell when all slack is removed from the traction cable by feeling for slight resistance as the control bar is raised and also by watching for slight movement of the black traction cable sheath.)

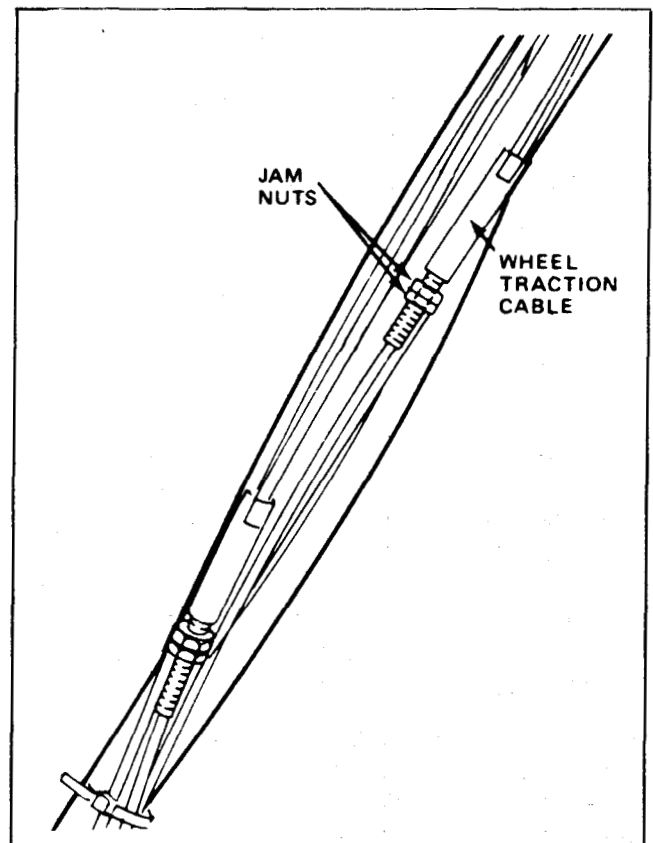


Figure 51

1. If adjustment is required, loosen the two jam nuts on the traction control cable. (If in doubt which

Traction Control Cable - Adjustment (cont'd)

cable is the traction control, squeeze the control bar toward the handle and note which cable sheath moves.) See Figure 51.

2. Move the jam nuts either up or down until you feel slight resistance when the control bar is 40 mm (1-1/2)" from the handle.

NOTE: Make sure that the two halves of the traction control cable sheath are properly mated when performing this adjustment.

NOTE: 1990 and newer units will have "fingertip adjustable" cables that do not require tools for adjustment. See Figure 52.

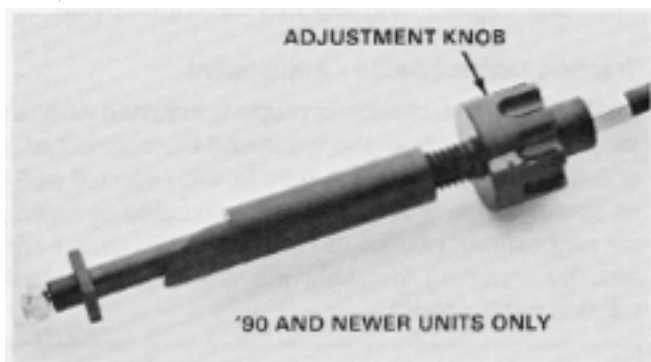


Figure 52

3. Once proper adjustment is attained, tighten the jam nuts by rotating in opposite directions.
4. Test for proper operation and repeat adjustment if necessary.

REAR HEIGHT-OF-CUT SYSTEM (HOC) AND WHEEL PINION CLUTCH (WPC)

Rear HOC and WPC - Operation

Rear Height-Of-Cut System: The rear height-of-cut system is similar to the front height-of-cut system. By fastening the wheel to pivoting brackets called pivot arms, the height-of-cut can be changed from 25 to 75 mm in 13 mm increments (1" to 3" in 1/2" increments). The spring arms hold the pivot arms in their desired position through the use of a small rivet which drops into recesses in the housing.

The rear height-of-cut system is a bit more complex in that not only must the wheels pivot, but they must also drive. This is accomplished by running the output shaft from the transmission through the pivot point on the pivot arms. The pinion at the end of the output shaft drives the wheel gear which is permanently affixed to the wheel. Because the output shaft passes through the pivot point on the pivot arm, mating of the two gears

is not affected by changing the height-of-cut. See Figure 53.

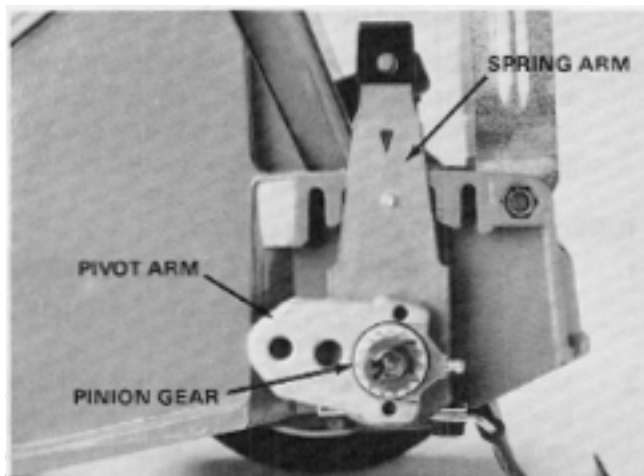


Figure 53

Wheel Pinion Clutch: The wheel pinion clutch has a three-fold purpose. One, when the transmission is engaged, it causes the pinions to move with the output shaft and drives the wheels. Two, it provides differential action to allow easy turning and excellent maneuverability. Three, it disengages the wheel pinions from the output shaft when the operator is not squeezing the handle. This allows the wheels to turn backwards without turning the gears inside the transmission and provides pullback forces similar to those found on a hand-push version.

Figure 54 shows a breakdown of the wheel pinion clutch system. The letters in the illustration refer to the explanations of each component function below.

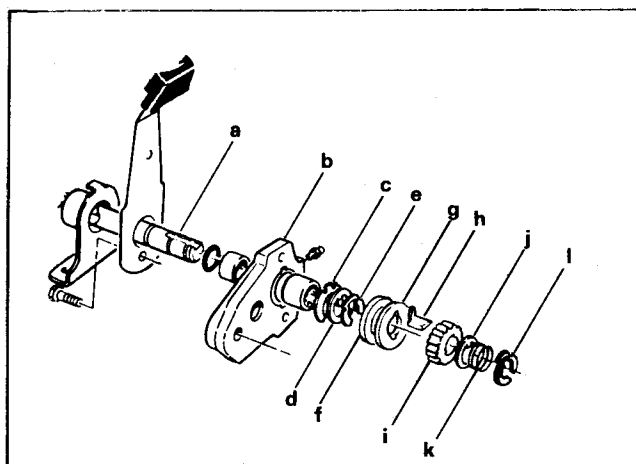


Figure 54

- a. Output Shaft - turns when the operator squeezes the handle to provide power to the wheels.
- b. Pivot Arm - provides support for the output shaft with a bushing and a needle bearing. It can be rotated in the end cap to change height-of-cut.

- c. **Externally Tabbed Thrust Washer** - fits in corresponding recesses on the pivot arm to protect pivot arm from premature wear.
- d. **Internally Tabbed Thrust Washer** - internal tab fits in the keyway on the output shaft. This washer rotates with the output shaft and protects outboard clutch components from wear.
- e. **Special Retaining Clip** - fits in a groove on the output shaft to retain the pivot arm and spring arm. (This is not an E-clip!) The tab at the center of the clip is extended and fits in the keyway of the output shaft to prevent rotation. If an E-clip is substituted, premature failure of the wheel pinion clutch system will result.
- f. **Friction Ring** - fits in a circular groove in the pivot arm and works with the clutch washer to actuate the key. It does not rotate.
- g. **Clutch Washer** - is affixed to the output shaft by means of the key so it turns with the output shaft. It is also allowed to rotate slightly with respect to the output shaft. This slight back and forth rotation actuates the wheel pinion key. Friction between the clutch washer and friction ring causes the clutch washer to lag the output shaft slightly once it is engaged. That slight rotation is all that is necessary to raise the wheel pinion key and engage the pinion.
- h. **Wheel Pinion Key** - causes wheel pinion to turn with output shaft when up. Allows the wheel pinion to "free-wheel" when down. Clutch washer brings key up. Wheel pinion turning forward "wipes" key down.
- i. **Wheel Pinion** - positively engages the wheel gear at all times. Engagement with the output shaft is controlled by the wheel pinion key. The wheel pinion is a powered metal part and is symmetrical so that it can be put on either way and still function properly.
- j. **Internally Tabbed Thrust Washer** - turns with the output shaft to prevent wear problems between the spring and the wheel pinion.
- k. **Compression Spring** - provides the light, constant, inward force necessary for proper clutch washer and friction ring engagement.
- l. **Special Retaining Clip** - fits in the outer groove on the output shaft to retain the outer wheel pinion clutch components (note that this is not an E-clip!). The extended tab at the center of the clip fits into the keyway to prevent rotation with

respect to the output shaft. Substituting an E-clip will result in reduced wheel pinion clutch life.

The wheel pinion clutch is a durable system, however it is extremely important that it be maintained as per the instructions in the operator's manual, which is greasing every 25 hours with one or two pumps of grease. Greasing regularly will prevent contaminants from damaging or wearing the system.

Rear HOC and WPC - Disassembly

The rear height-of-cut system and the wheel pinion clutch can be serviced with the transmission in or out of the unit. For information on removing the transmission from the unit, see Transmission - Removal, page 42.

1. Disconnect the spark plug lead from the spark plug to prevent accidental starting.
2. Remove the shoulder bolt securing the wheel and tire assembly to the pivot arm and remove the wheel and tire assembly complete with shoulder bolt, spacers, wheel cover and nylon locknut.
3. Remove the special retaining clip at the end of the output shaft and pull off the following six wheel pinion clutch components:
 - Spring
 - Internally Tabbed Thrust Washer
 - Wheel Pinion
 - Wheel Pinion Key
 - Clutch Washer
 - Friction Ring
4. Remove the inner special retaining clip from the output shaft and remove the following components:
 - Internally Tabbed Thrust Washer
 - Externally Tabbed Thrust Washer
 - Pivot Arm and Spring Arm Assembly
 - End Cap (if desired)
5. Check all components at this time for damage and wear. Pay particular attention to the grooves at the end of the output shaft, the bearing surfaces on the output shaft and the wheel pinion clutch components. Replace parts as necessary.
6. Check the innermost groove on the output shaft which is located 5.7 cm (2-1/4") in from the end of the shaft) making sure that the O-ring seal is present and in tact. This seal is important to keep grease in and contaminants out. Replace if necessary. See Figure 55.

Rear HOC and WPC - Disassembly (cont'd)

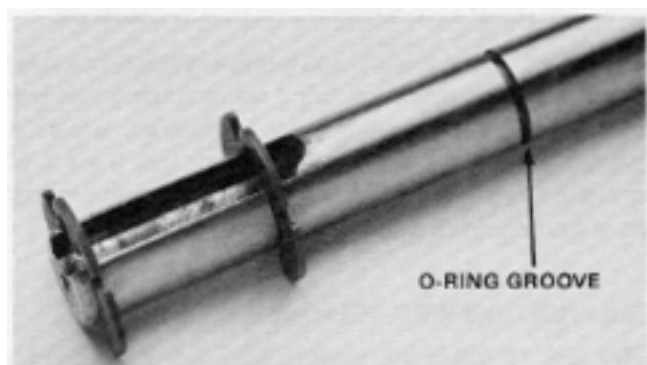


Figure 55

7. If further disassembly of the pivot arm is required, remove the spring arm.
8. Press the needle bearing and the oil impregnated bushing from the pivot arm using an arbor press.
9. Removal of the grease fitting is not recommended because it is pressed in. However, if damaged or lost, we suggest tapping and installing a threaded grease fitting.
10. If the spring arm knob requires replacement, push in on the detent tab, then pull the knob straight off.

NOTE: The detent rivet is not replaceable separately.

Rear HOC and WPC - Assembly

1. If the grease fitting in the pivot arm has been damaged or lost, tap and replace with a threaded fitting.
2. Pack the caged needle bearing with grease then press into the outside of the pivot arm until it is flush with the groove that houses the externally tabbed thrust washer.
3. Press the oil impregnated bushing into the boss on the pivot arm until it is flush with the face of the boss. See Figure 56.
4. If spring arm disassembly was required, install the knob making sure that the detent is pressed out about 1.5 mm (.060"). Install the spring arm knob so that the concave side of the knob and the convex side of the rivet align.
5. Assemble the spring arm and pivot arm as shown in Figure 58.
6. To increase service life, make sure all parts are clean prior to assembly and coated with new grease.

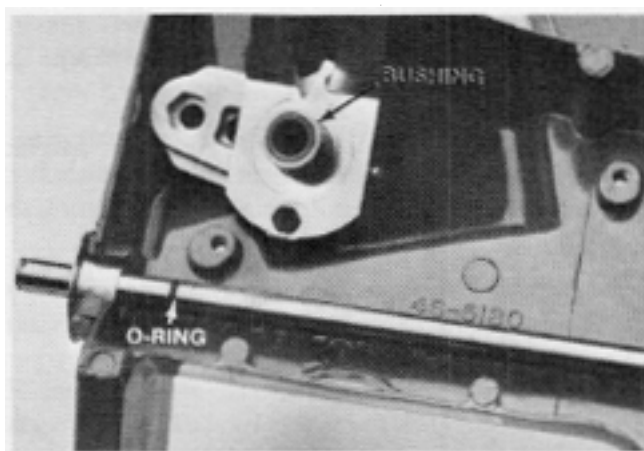


Figure 56

7. If removed, install new O-rings in the innermost groove 5.7 cm (2-1/4") in from end on each end, making sure that it is fully seated in the groove. See Figure 58.
8. Slip the end cap onto the output shaft but do not fasten at this time.
9. Slide the pivot arm and spring arm assembly onto the output shaft, boss first.
NOTE: The convex side of the spring arm rivet and the concave side of the knob on the spring arm should both be facing the housing.
10. Slide the externally tabbed thrust washer and the internally tabbed thrust washer onto the output shaft. (Make sure that the tab on the internally tabbed thrust washer follows the contour of the keyway.) Secure with the special retaining clip, making sure that the center tab fits properly into the keyway. This will prevent rotation of the clip on the output shaft.
11. Place the friction ring into the groove on the pivot arm, flat side out.
12. Slide the clutch washer onto the shaft so that the recesses for the key are facing out.
13. Place the wheel pinion key in the groove on the output shaft with the leg toward the clutch washer.

NOTE: There is a left and a right wheel pinion key. You are using the correct key if when placed in the groove, the top of the key is flat and the straight portion of the leg is perpendicular to the shaft.

Before assembling further, rotate the clutch washer back and forth slightly, making sure that the key actuates properly. See Figure 57.

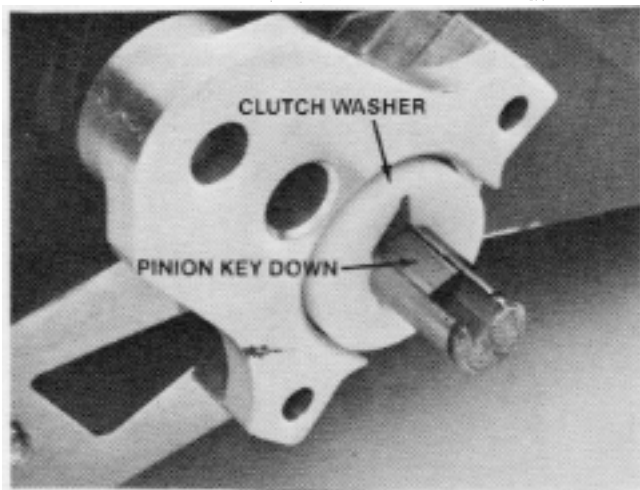


Figure 57

14. Place the wheel pinion onto the output shaft. It is symmetrical and can be put on either way.
15. Install the internally tabbed thrust washer onto the output shaft making sure that the contours of the tab follow the contours of the keyway.
16. Slip the spring onto the end of the output shaft and secure with the special retaining clip. Again, make sure that the center tab fits properly into the keyway to prevent rotation of the clip. See Figure 58.

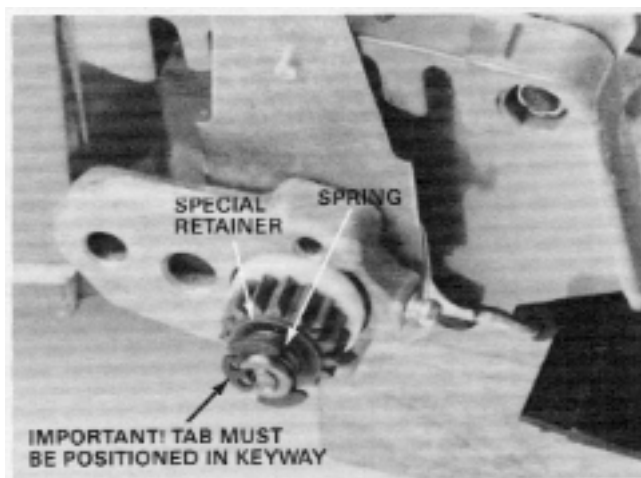


Figure 58

17. Slip the wheel, the original number of spacers, and the wheel cover onto the shoulder bolt and secure to the pivot arm using the nylon locknut.
18. Grease with a No. 2 type lithium-based grease. As a rule, use two pumps to insure that you do not overgrease. Be sure to grease after every 25 hours of use to insure maximum service life.

TRANSMISSION

Transmission - Operation

Power from the engine is transferred to the wheels by means of a belt and a three speed transmission. The belt and transmission are easiest to understand when broken down into smaller systems.

Input System: Power is transferred from the engine to the transmission via a belt. The self-propel pulley at the engine is keyed to the crankshaft. The self-propelled pulley on top of the transmission is supported by a ball bearing and drives a pinion gear inside the transmission. Tensioning of the belt is accomplished by rocking the transmission. When the operator squeezes the control bar toward the handle, a cable is tightened which tilts the transmission backward and tensions the belt. When the control bar is released, gravity rocks the transmission forward to loosen the belt.

Belt guides at the engine pulley and atop the transmission insure disengagement by forcing the belt to loop around the pulleys. See Figure 59.

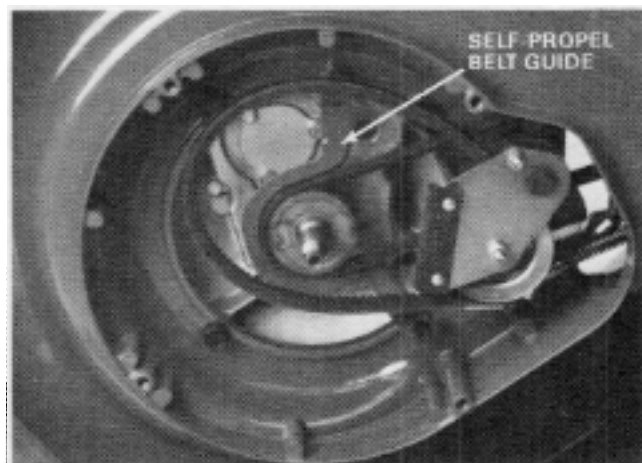


Figure 59

Speed Reduction System: Speed reduction is accomplished by two sets of gears—one set on the intermediate shaft and the other set on the output shaft. The gears on the intermediate shaft are powdered metal and ride on a hexagonal shaft supported on each end by oil impregnated bushings. These gears are driven by the pinion at the bottom of the input shaft. The driven bevel gear turns the shaft so that all three gears on the intermediate shaft have the same rotational velocity. See Figure 60.

There are also three gears on the output shaft, however, these three gears rotate freely on the gear sleeve. The gear sleeve is coupled to the output shaft

Transmission - Operation (cont'd)

with a roll pin so the gear sleeve always rotates with the output shaft. The gear selection system determines which one of these three gears will be coupled with the gear sleeve and the output shaft. This determines the final drive ratio. For more information on final speeds at various throttle settings, see Figure 61.

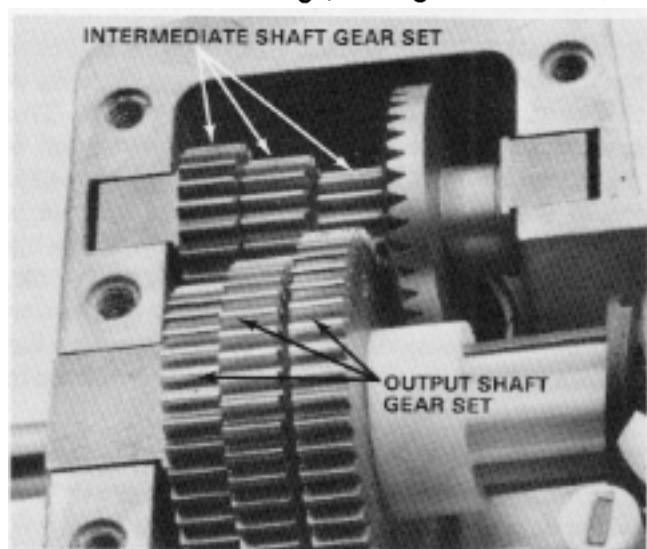


Figure 60

Gear Selection System: Gear selection is determined by moving sliding shift keys in a sleeve that is fixed to the output shaft. These keys engage one of the three gears that rotate on the gear sleeve. Once the key engages one of the gears, that gear will rotate at the same speed as the output shaft. This determines the final drive ratio, shown in Figure 61.

Gear	Ground Speed @ 3000 RPM	Ground Speed @ 2000 RPM
1	1.8 mph	1.2 mph
2	2.7 mph	1.8 mph
3	3.8 mph	2.5 mph

Figure 61

The shift keys are trapped on one end by the shift collar. Movement of the shift fork positions the shift collar and shift key. The shift fork is supported, both top and bottom, by nylon bushings for smooth operation and long wear. See Figure 62.

The operator controls movement of the shift fork by means of the gear selection control and cable. For more information on this, see Gear Selection Control, page 34.

NOTE: There are no detents in or on the transmission on 1988 and 1989 Vacu-Power mowers.

General Information: The upper gear case half is cast aluminum. The lower transmission cover is made of stamped steel and the gears are powdered metal.

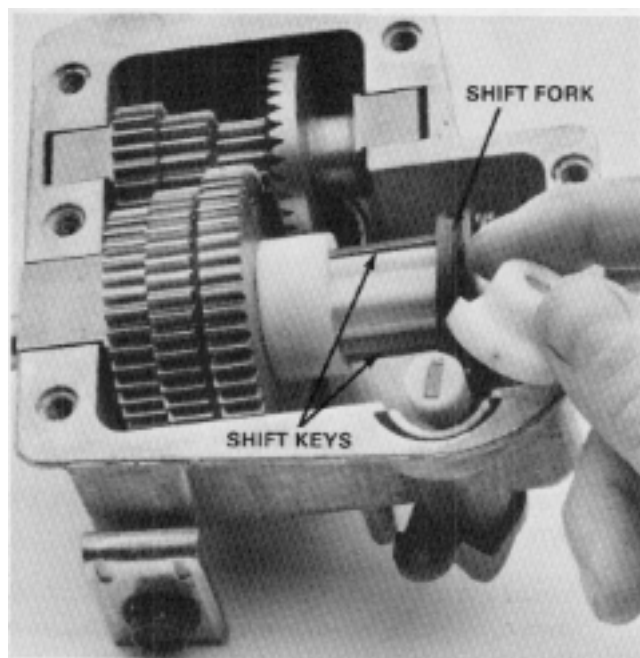


Figure 62

Output shaft and intermediate shaft construction is of steel and both are supported by oil impregnated powdered metal bushings.

Lubrication is provided by 177 cc (6 oz) of No. 2 lithium-based grease.

Transmission - Removal

Complete transmission removal on the Vacu-Power mower is quite easy and is recommended for most self-propel system repairs.

1. Remove the spark plug lead from the engine to prevent accidental starting.
2. Place the ground speed selector in neutral. This will make it easier to remove the speed selection cable later.
3. Remove the two flanged head self-tapping screws securing the screen panel to the housing and remove the panel. See Figure 63.
4. Remove the black plastic transmission cover from the top rear of the housing.
5. Remove the two flanged head self-tapping screws securing the belt cover to the top of the transmission. Pull the cable from belt guide and remove the belt guide.

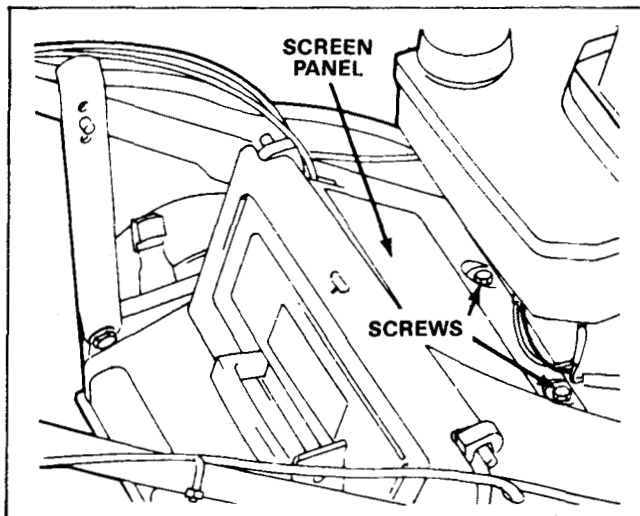


Figure 63

6. Remove the transmission access cover from the rear of the housing by pressing from underneath.
7. Loosen the gear selection control cable clamp screw until the cable comes free. Do not attempt to remove the gear selection cable from the control arm at this time.
8. Turn the mower onto its right side and remove the four flanged head self-tapping screws securing the end caps to the housing. Do not remove the transmission at this time. See Figure 64.

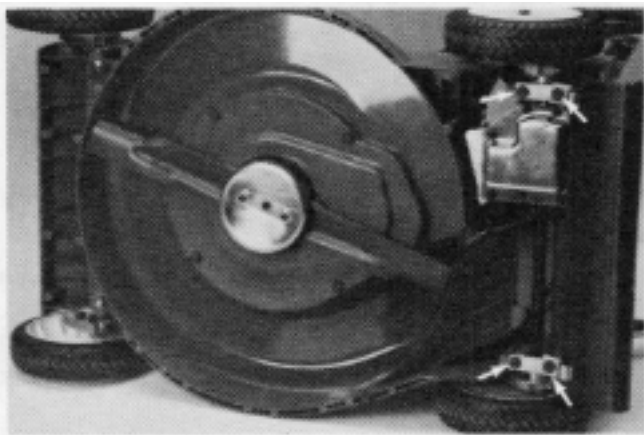


Figure 64

9. Slowly pull the transmission from the housing being very careful not to damage the gear selection cable. Once clear of the housing, rotate the assembly until the cable can be safely removed.

Transmission - Disassembly

Most repairs to this "Series 2" transmission can be accomplished without removing the pivot arm

assembly from the output shaft. Only if components on the output shaft require replacement will pivot arm removal be necessary.

1. Remove the six flanged head self-tapping screws securing the transmission cover to the transmission case and remove the cover. See Figure 65.

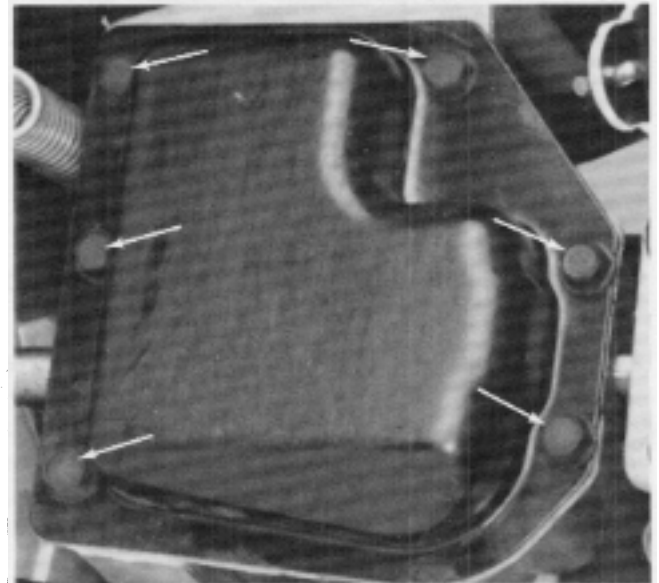


Figure 65

2. Before disassembling further, check for proper operation of the input system, the gear reduction system and gear selection system. For more information on this, see Transmission - Operation, page 41.
3. Removal of the input shaft and pulley assembly can be difficult because the input pinion will have a tendency to turn as the pulley nut is loosened. Address this situation by using an impact wrench or by removing the 20 and 25 tooth gears from the intermediate shaft and then putting the intermediate shaft assembly back onto the transmission. The hexagonal intermediate shaft can then be held with a 7/16" end wrench while the pulley nut is loosened.

NOTE: Using a cut-away transmission cover to hold the intermediate shaft in place may facilitate pulley nut removal. See Figure 66.

4. Remove the intermediate shaft from the transmission and clean. Inspect all gears for cracks and/or broken teeth. Inspect the bushings for excessive wear. Replace any parts necessary. Be careful not to lose the two spacers that fit between the bevel gear and the bushing.

Transmission - Disassembly (cont'd)

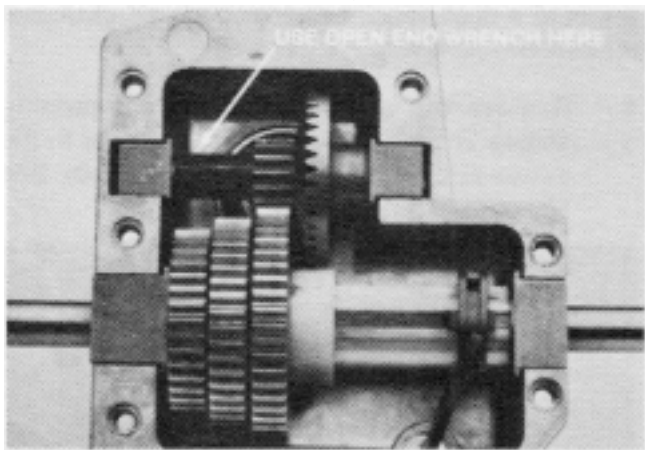


Figure 66

6. Remove the cotter pin from the top of the shift fork and remove the shift lever.
7. Carefully pull the output shaft from the transmission case, clean, and inspect all components for wear or damage. Check the input shaft ball bearing for roughness or excessive drag and replace any parts necessary. If ball bearing replacement is required, press the ball bearing out using an arbor press.

8. If service of any of the output shaft gears or the gear selection system is required, remove the left pivot arm as described under Rear Height-of-Cut System and Wheel Pinion Clutch - Disassembly, page 39.

NOTE: It is possible to replace the shift keys and spring clip without removing the pivot arm if the roll pin securing the gear sleeve to the output shaft is first driven out. However, it is not recommended since inspection of the inside of the output gears is not possible.

9. Pull the output shaft bushing, the spacer, the shift collar, the shift keys and spring clip, and the shift key sleeve from the output shaft.
10. Remove the three output shaft gears from the output shaft.
11. Drive out the roll pin securing the gear sleeve to the output shaft and remove the gear sleeve and remaining output shaft bushing. Inspect all parts for wear and damage and replace if necessary.

Transmission - Assembly

The "Series 2" transmission uses No. 2 lithium-based grease as a lubricant. When assembling, be sure to coat all moving components with grease to insure proper lubrication.

Output Shaft Assembly:

1. Slide the output bushing onto the output shaft, flanged side last.
2. Slide the gear sleeve onto the output shaft, tabs last and secure with a new roll pin.
3. Paint a light coat of lithium-based grease on the output shaft under the output bushing, on the gear sleeve, and on the three output shaft gears. Slide the three output shaft gears onto the gear sleeve, notched sides last.
4. Slide the nylon shift key sleeve onto the output shaft, large end first. Make sure that it engages the tabs on the gear sleeve.
5. Coat the shift key sleeve with grease and prepare the shift keys, shift collar, and spring clip for assembly as shown in Figure 67.

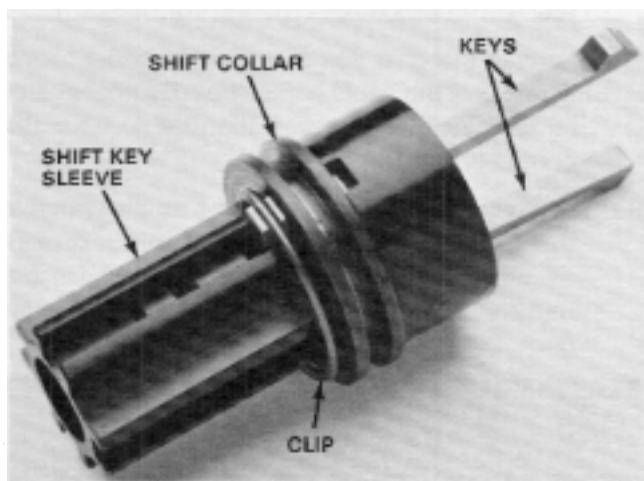


Figure 67

6. Slide the shift key assembly into the shift key sleeve until the shift collar bottoms out.
7. Complete the output shaft assembly by sliding a spacer washer and the other output bushing, flanged side first, onto the output shaft. Don't forget to coat these components with a light coat of grease. See Figure 68.

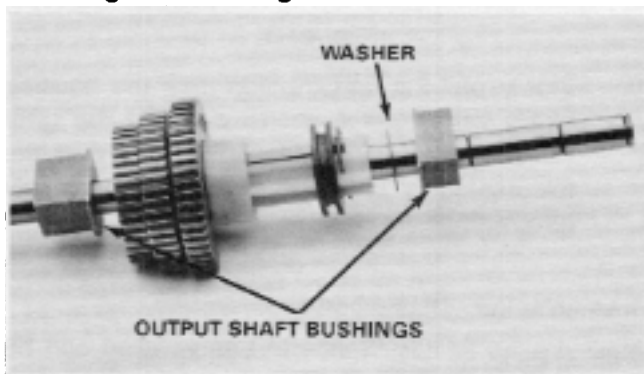


Figure 68

8. If the left pivot arm was removed for servicing, reassemble now as described under Rear Height-of-Cut System and Wheel Pinion Clutch - Assembly, page 40.

Input Shaft Assembly:

1. If the input bearing had been removed, press a new one into the gearcase using an arbor press. Press only on the outer race or bearing damage may result.
2. Slide the input shaft and pinion through the ball bearing and top with the spacer and two pulley halves as shown in Figure 69. Secure with a flat washer and a nylon locknut.

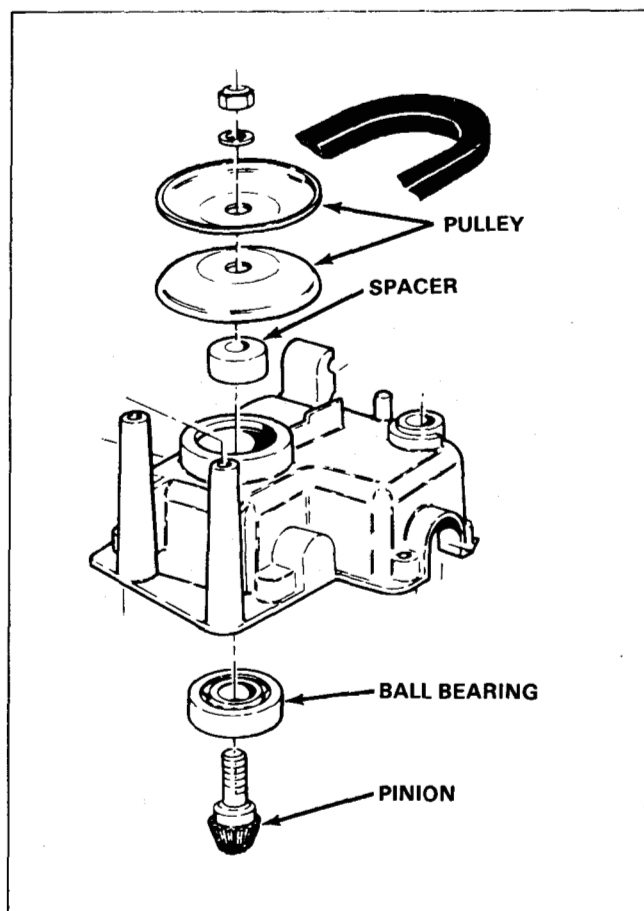


Figure 69

3. Tighten the input pulley nut by using an impact wrench or by using the cutaway gearcase half and end wrench method described in step 3, under Transmission - Disassembly, page 43.
4. Slip the shift fork into the slot on the shift collar and place the shift fork and output shaft assembly into the transmission.

NOTE: The long end of the shift fork shaft should go through the hole in the gearcase. Make sure

that the output bushings are trapped in the proper locations. Note that the larger output bushing goes on the longer end of the shaft and the shorter output bushing goes on the shorter end of shaft.

5. Slide the yoke bushing onto the lower end of the shift fork then secure the shift fork with the white nylon shift fork retainer. See Figure 70.

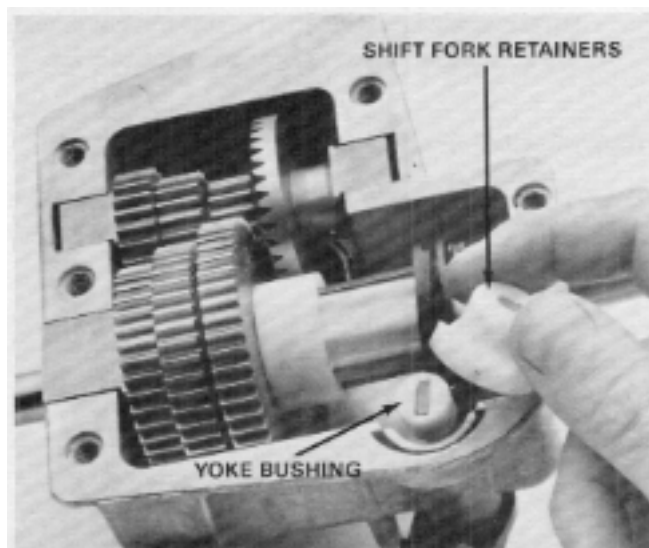


Figure 70

Intermediate Shaft Assembly:

NOTE: Before assembling, be sure that you have coated the intermediate shaft with a No. 2 lithium-based grease.

1. Slip an intermediate shaft bushing onto the left end of the intermediate shaft, flanged end first. See Figure 71.

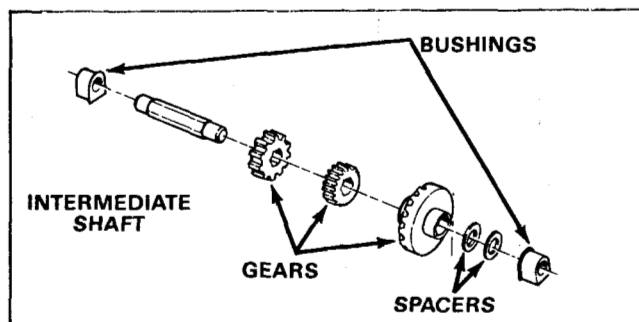


Figure 71

2. Slide the intermediate shaft gears onto the intermediate shaft in this order:
 - 25-tooth gear
 - 20-tooth gear
 - 15-tooth gear

Transmission - Assembly (cont'd)

3. Slide a spacer washer onto the intermediate shaft next to the bevel gear and follow with an intermediate shaft bushing, flanged side first.
4. Drop the intermediate shaft into the gearcase, making sure that all gears engage properly.
5. Fill the gear case with 177 cc (6 oz) of No. 2 lithium-based grease, then install the cover with the six flanged head self-tapping capscrews.

Transmission - Installation

1. Slip the gear selection cable into the shift fork shift lever through the bottom as shown in Figure 72.

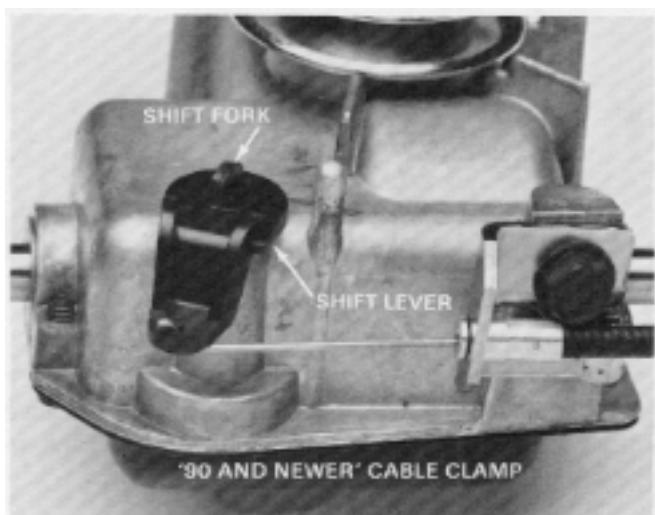


Figure 72

2. Bring the transmission assembly into position underneath the deck, making sure that the end caps are on the outside of the housing. Before securing, install the shift fork control arm onto the shift fork and secure with the cotter pin. Place the transmission and pivot arm assembly into the deck.
3. Loosely install the two front end cap fasteners.

4. Slip the two rear end cap fasteners through the safety shield guide wires then install. Tighten all four end cap fasteners. See Figure 73.

End Cap Fastener Torque:
26 N•m (225 in lbs)

5. Slip the traction belt into position on the transmission pulley. Make sure that it does not bind on any of the bosses.
6. Slip the end of the traction cable into the belt guide bracket from the outside then install the belt guide bracket onto the top of the transmission, making sure that the traction belt is inside the guide.

Belt Guide Fastener Torque:
15 N•m (130 in lbs)

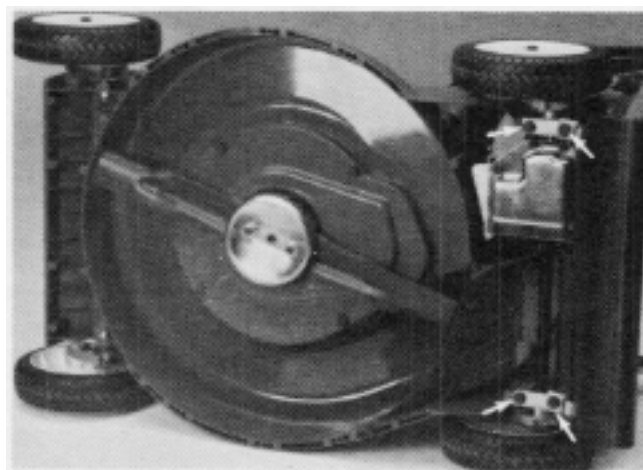


Figure 73

7. Slip the black plastic transmission cover into place making sure that the belt falls in the appropriate grooves. Install the upper BBC cover with the two flanged head self-tapping capscrews. Make sure that the top edge is trapped underneath the lip of the housing.
8. Adjust the gear selection cable as described under Gear Selection Control - Adjustment, page 35.

SECTION 4 BLADE BRAKE AND CLUTCH (BBC) SYSTEM

Introduction

In 1982 the federal government mandated that all consumer walk behind mowers with a cut of 63.5 cm (25") or less be equipped with safety devices. There are two primary criteria which these safety devices must meet.

1. A two step operation must be performed in order to get the blade turning.
2. The blade must come to a stop within 3 seconds of the operator leaving the operator's position.

One of the ways The Toro Company met these requirements was with the Blade Brake and Clutch or BBC System. This system uses a clutch on the engine crankshaft so that the blade can freewheel on the crankshaft. It also uses a brake to stop the blade within 3 seconds of when the operator releases the control bar. This system has the advantage of allowing the operator to stop the blade without stopping the engine.

The BBC system is somewhat complex, and will therefore be broken down into 4 subsections:

- BBC Control Box
- BBC Bellcrank System
- BBC Deck Mechanism
- BBC Cable

BBC CONTROL BOX

BBC Control Box - Operation

The BBC control mechanism's purpose is to actuate the deck mechanism. It does this by tensioning and loosening the BBC cable. While this sounds simple enough, keep in mind that the control mechanism must also meet the federal government's "2-step" blade engagement procedure, and on many models must also control traction.

First, let's take a look at normal operation of the BBC control box. See Figure 74.

The normal or "at rest" position of the control bar is indicated by the number 1 in the previous figure. In order to engage the blade, the operator must first "cock" the control bar down to position 2, then raise the control bar to position 3.

Notice that position 3 is approximately 12 cm (5") below the handle. This distance between position 3 and the handle is reserved for engagement of the transmission on those models equipped with the self propel. On units without self-propel the control bar can be lifted to

the handle without affecting operation of the BBC system.

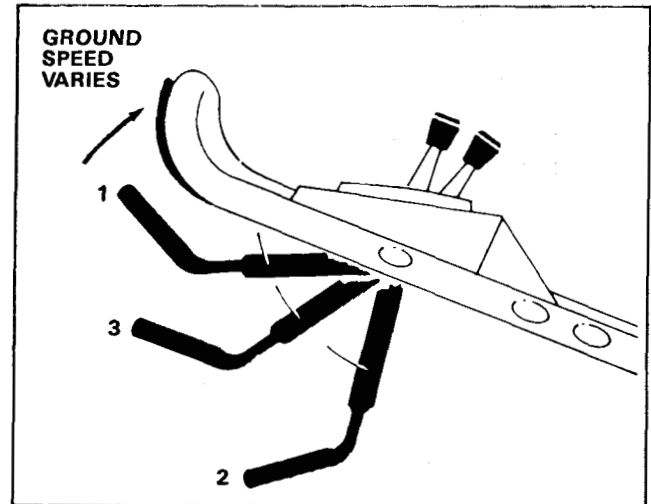


Figure 74

After engagement of the blade, release of the control bar causes it to drop to the number 1 position which disengages the blade and, on self-propel models, the transmission.

Next, let's take a look inside the control box at the various components and identify their function. See Figure 75 and the corresponding explanations that follow.

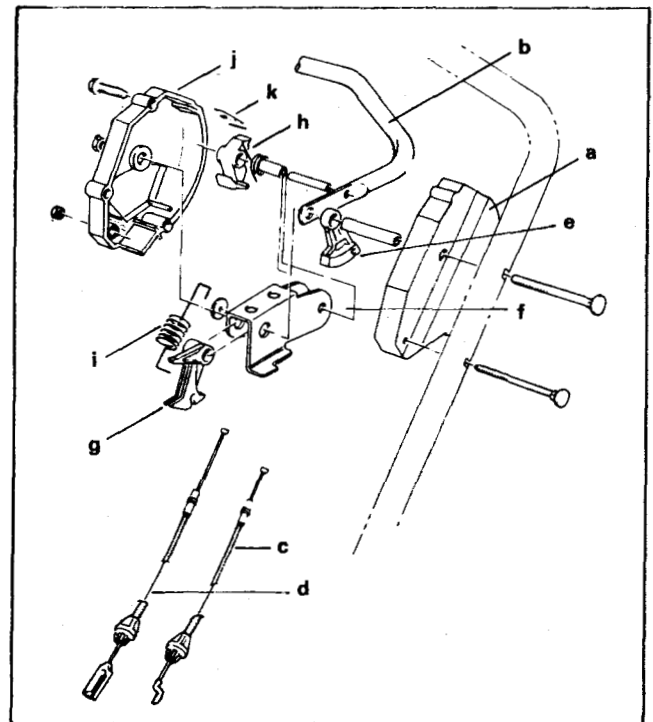


Figure 75

BBC Control Box - Operation (cont'd)

- a. **Left Control Housing:** Serves as cover for BBC control mechanism. Also houses ends of traction and BBC cables.
- b. **Control Bar:** Pivots on upper shoulder bolt. Transfers operator inputs to control box components.
- c. **Traction Cable:** Engages transmission by transferring inputs from the control box. Transmission is engaged when cable is tightened; disengaged when cable is loosened.
- d. **BBC Cable:** Transfers inputs from the control box to the BBC deck mechanism.
- e. **Traction Lever:** Provides input to the traction cable since the end of the traction cable is retained in it. Also pivots on the upper shoulder bolt, however it is not directly connected to the control bar.
- f. **Rocker Arm:** Pivots on the upper carriage bolt. It is affixed solidly to the control arm by means of the roll pin. Houses both the control hook and cable lever. Also provides slot and stop for buckling spring.
- g. **BBC Cable Lever:** Controls tensioning and loosening of the BBC cable since the end of the BBC cable is retained by it. Pivots freely on the upper carriage bolt. Movement is controlled by the control hook.
- h. **Control Hook and Spring:** Pivots on the roll pin and is spring loaded in the counterclockwise direction by the torsion spring. The control hook "grabs" the cable lever when the control bar is cocked and releases the cable lever when the control bar is dropped.
- i. **Buckling Spring:** Sole purpose is to hold the control bar in the middle position when at rest. The spring is flexed or "buckled" when the control bar is operated. It rides in a slot on the rocker arm to prevent it from applying force to the control bar when the control bar is at its lowest or uppermost positions.
- j. **Right Control Housing:** Serves as other half of control box cover. Houses leaf spring.
- k. **Leaf Spring:** Releases control hook as control bar drops to "at rest" position. Because of orientation, it allows the control hook to slip by as the control bar is raised.

Finally, let's take a look at how these components interact to provide control to the BBC deck mechanism. Notice in Figure 76 the position of the traction cable lever and the BBC cable lever. Since this is the "at rest" position, both the BBC and the transmission are disengaged. When the control bar is in this position, it is the buckling spring that supports it. Notice that the buckling spring is not flexed and is at the left end of the slot in the rocker arm.

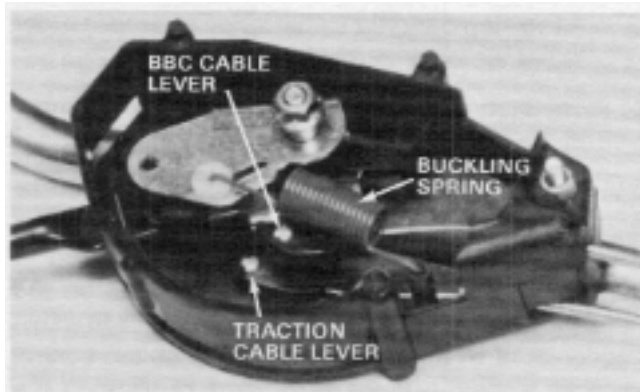


Figure 76

When the control bar is cocked to its lowest position as in Figure 77, a number of events take place. The buckling spring is flexed and moves from the left end of the rocker arm slot to the right end. The other event takes place inside the rocker arm. This spring loaded control hook slides over the cable lever and grasps it so that when the lever is raised, the BBC cable will come with it.

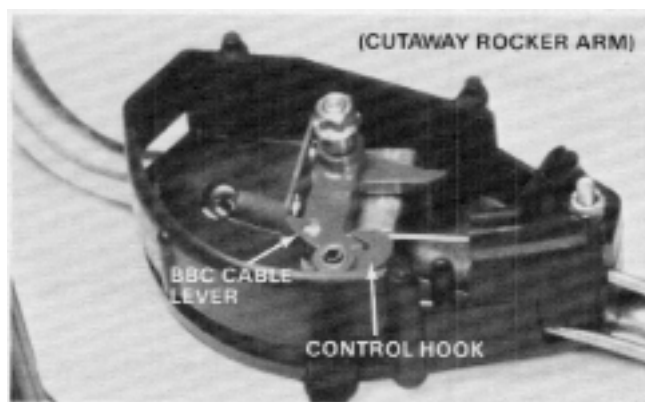


Figure 77

When the control bar is raised to a point 12.7 cm (5") below the handle, the BBC cable has been tightened enough to engage the blade. See Figure 78. Raising the control bar also straightens the buckling spring. Also important is the function of the leaf spring. As the control bar is raised, the left tip of the control hook slips by the leaf spring without tripping release of the cable lever.

If the control bar is raised so that it touches the handle, it will cause the traction lever to move slightly and engage the transmission.

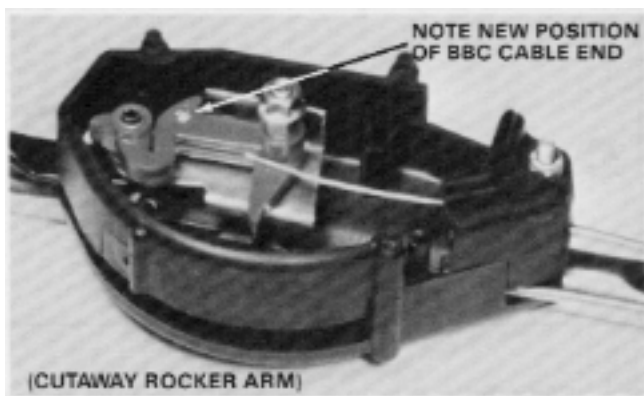


Figure 78

Finally, when the control bar is released, the tip of the control hook catches on the leaf spring causing it to rotate. This releases the BBC cable lever, thereby causing the BBC to clutch and brake the blade. See Figure 79.



Figure 79

BBC Control Box - Disassembly

NOTE: When servicing the BBC control box, be careful not to disassemble the unit any further than necessary as it will then become difficult to troubleshoot. Instead, remove the right housing half, then operate the control box while watching for proper function of internal components. See Step 5 below for more information.

1. Place a piece of duct tape over the heads of the carriage bolts passing through the handle and the BBC control box. This will prevent them from falling out later during troubleshooting.
2. Bend the locking tab securing the throttle control to the control panel then tap the throttle control out using a rubber mallet.
3. Remove the 3 flanged head screws retaining the 2 control box halves.

4. Carefully remove the 2 nylon locknuts retaining the control box to the handle and remove the right control box half. Be careful not to dislodge any internal components.
5. Operate the control bar in its normal manner to determine if any of the components inside the control box are malfunctioning.

CAUTION! Wear gloves and eye protection when operating an open control box as the buckling spring could fly out.

NOTE: The cable ends and end of the spring are not retained once the right cover is removed. Be sure to use one the two methods below to retain them.

The first and quickest method is to manually hold the ends of the cable and the end of the buckling spring while operating the control bar. However, with the right case half removed, the leaf spring is no longer in place and you will not be able to observe release of the BBC cable lever.

A better method is to make a special cut-away version of the right control box housing half as shown in Figure 80. When this cut-away version is installed, all components will function normally. Notice the cutaway cover and how it houses the leaf spring. This will aid in diagnosis.

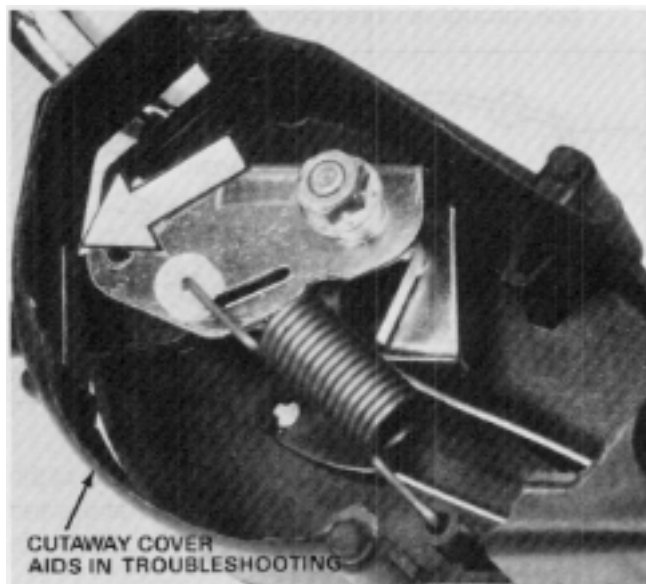


Figure 80

6. If further disassembly is required, remove the buckling spring and washer from the rocker arm assembly.
7. Remove the BBC cable from the BBC cable lever and the left-hand control box half.

BBC Control Box - Disassembly (cont'd)

8. Remove the rocker arm as an assembly, complete with cable lever and control hook.
9. Remove the cable lever from the rocker arm assembly.
10. Press the roll pin from the rocker arm and remove the control hook and torsion spring.
11. Remove the traction cable from the traction lever and the left-hand control housing.
12. Pull the tape from the outside of the handle and remove the upper carriage bolt and the cable lever and spacer with it.
13. Remove the lower carriage bolt and remove the left control housing.
14. Inspect all parts for wear and/or damage and replace as required.

BBC Control Box - Assembly

1. Slip the lower carriage bolt through the handle then slide the left control housing onto it.
2. Slip the end of the traction cable into the traction lever then place the control housing, traction lever, and the control bar into position as shown in Figure 81. Once in position, slide the carriage bolt through all three components.

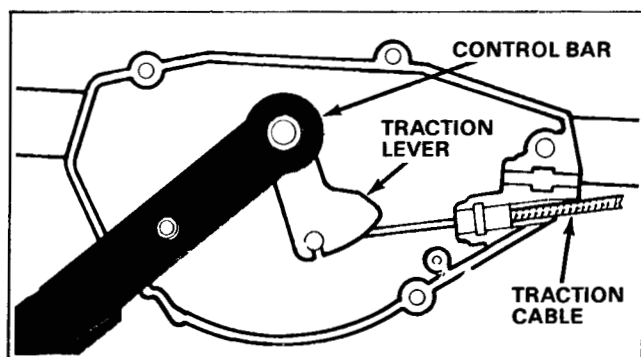


Figure 81

3. Place a piece of duct tape over the heads of the carriage bolts that slide through the handle and the left control box housing. This will aid in assembly.
4. Slide the sleeve onto the upper carriage bolt making sure that it passes through the control bar, the traction lever and the left control housing.
5. Position the control hook and torsion spring in the rocker arm as shown in Figure 82. Secure with the roll pin making sure that the roll pin is flush with the side indicated in the Figure. Also

loosely install the BBC cable lever as indicated. When correctly installed, the control hook and the cable lever will be engaged.

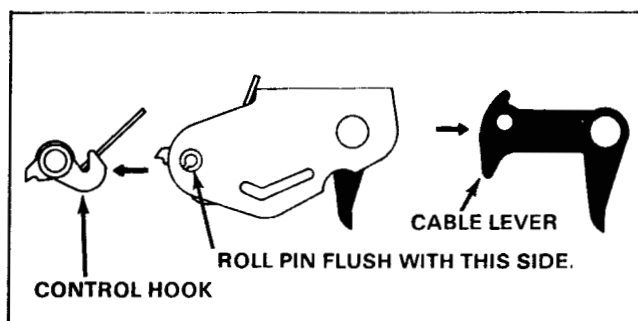


Figure 82

6. Slide the rocker arm assembly over the upper carriage bolt and sleeve making sure that the sleeve passes through the cable lever. Also make sure that the roll pin passes through the hole in the control bar.
7. Release the BBC cable lever from the control hook and install the BBC cable into the cable lever. See Figure 83.

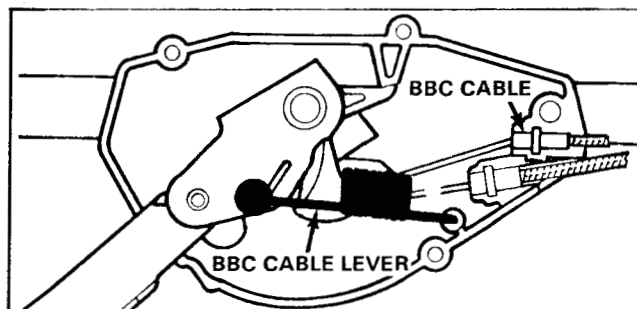


Figure 83

8. Slip the white nylon washer onto the J end of the buckling spring. The slotted side of the washer should face away from the end of the spring. Slip the spring into position in the rocker arm and the left control housing as shown in Figure 84.

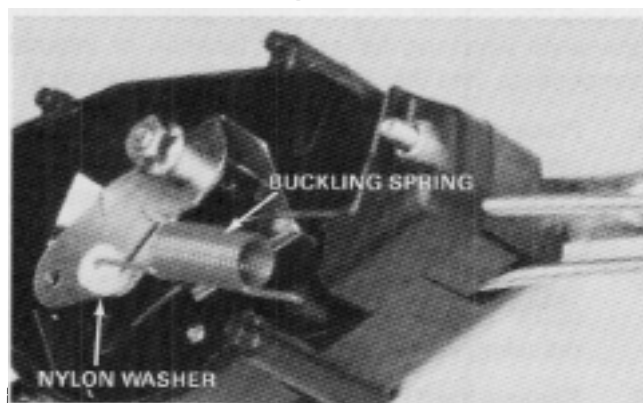


Figure 84

9. Assemble the right control housing by installing the leaf spring and pin to retain the leaf spring. See Figure 85.

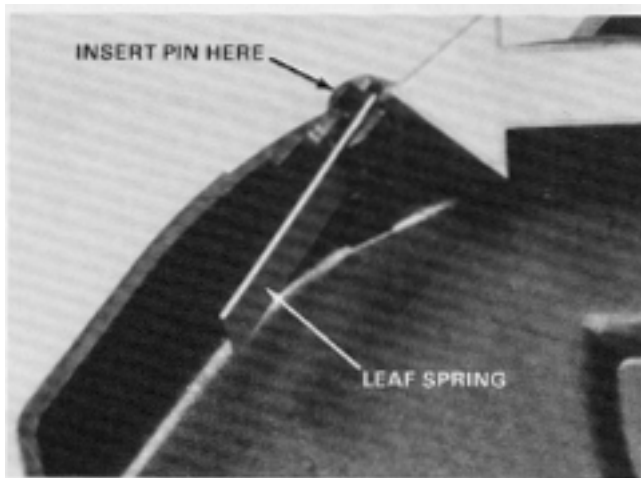


Figure 85

10. Before installing the right control housing, check to make sure that both cable sheath ends are fully seated in their slots in the left housing. Also make sure that the sleeve passes through all components including the left control housing. Finally, make sure that the roll pin passes through the rocker arm and control bar.

Install the right control housing and secure with the 2 nylon locknuts.

11. Install the 3 flanged head screws that retain the two control box halves.
12. Check for proper operation of the entire BBC system. Correct as required.
13. Bend the throttle control locking tab forward to provide positive lock with the throttle control and install the throttle control.
14. Adjust the BBC cable as described under BBC - Adjusting the Blade Brake, page 26.
15. Adjust the traction cable if you are working on a self-propel model as described under Drive Control Cable - Adjustment, page 37.

BBC BELLCRANK SYSTEM

BBC Bellcrank System - Operation

The bellcrank system shown in Figure 86, performs two important functions. It changes the direction of control input and also regulates the force applied to the blade brake assembly.

The directional change is accomplished by means of a bellcrank. The bellcrank rides on a nylon bushing and is attached to the cable support bracket.

Regulation of the force applied to the brake plate assembly is accomplished by means of the "over-tension" spring. The control link, which provides the actual input to the brake plate assembly, is not attached directly to the bellcrank, but rather through a compression spring. This spring insures that the same force is applied to the blade brake assembly each time the blade is engaged. It also helps reduce shock loads.

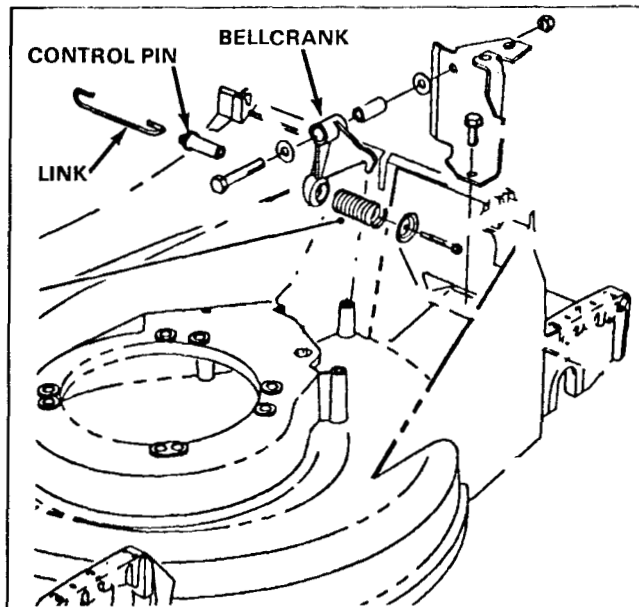


Figure 86

NOTE: This spring is the primary indicator of proper BBC adjustment. It should measure 25.4 ± 1.5 mm ($1 \pm 1/16$ ") with the blade engaged, when properly adjusted. If spring measures more than 32 mm ($1-1/4$ "), correct by moving the jam nuts on the turn buckle arrangement midway up the control cable.

BBC Bellcrank System - Disassembly

1. Remove the flanged head self-tapping capscrews securing the upper BBC cover to the housing and remove the upper BBC cover.
2. Pull the black plastic transmission cover up to remove it from the housing. See Figure 87.
3. Remove the shoulder bolt and flanged nut securing the bellcrank to the control cable bracket. Once loose, remove the bellcrank assembly complete with control link and remove from the unit. See Figure 88.
4. Remove the bushing from inside the bellcrank.

BBC Bellcrank System - Disassembly (cont'd)

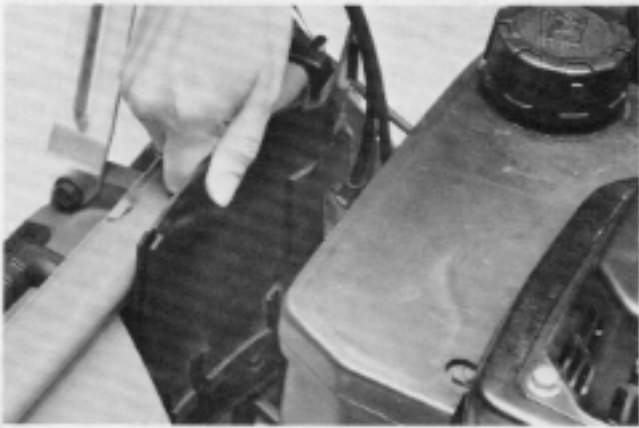


Figure 87



Figure 88

5. Using the control link to hold the control pin, remove the flanged head screw from the control pin.

CAUTION! Always wear safety goggles and gloves when disassembling items under spring tension or compression.

6. Remove the control link from the control pin.
7. Inspect all parts for wear and damage and replace as necessary.

BBC Bellcrank System - Assembly

1. Insert the control pin into the recessed area on the bellcrank.
2. Place the spring onto the control pin. Place the spring retainer onto the spring and insert the screw into the control pin. Using the control link to prevent rotation of the control pin, tighten the flanged head screw until the retainer bottoms out on the control pin. See Figure 89.

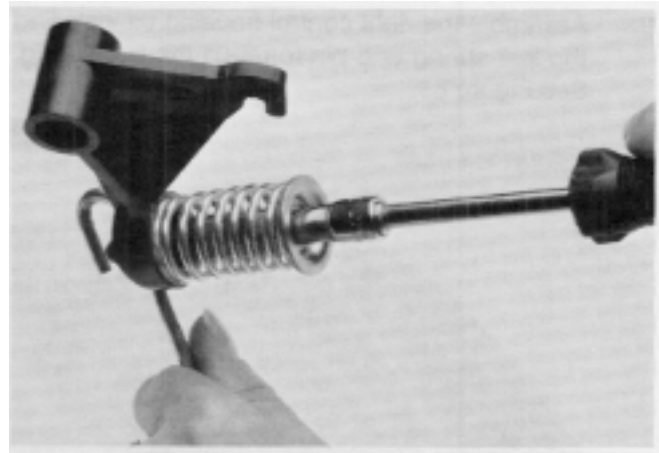


Figure 89

4. Note the orientation of the control link in Figure 90. Make sure that it is installed correctly into the bellcrank.



Figure 90

5. Slide a flat washer and a bushing onto the carriage bolt and slide into the front side of the bellcrank as shown in the figure above. Complete reassembly of the bellcrank system by sliding another flat washer onto the carriage bolt.

NOTE: Lubrication of the bushing is not recommended.

6. Hook the end of the control link into the brake plate lever, then slip the BBC control cable onto the bellcrank. Finally, slip the carriage bolt through the hole in the control cable bracket and secure with the flanged nut.

NOTE: The serrations in the flanged nut must fully seat on the control cable bracket.

7. Check adjustment of the BBC cable as described under BBC Adjusting the Blade Brake, page 26.
 8. Slide the black plastic transmission cover into place making sure that the belt slides into the grooves provided. Some contact between the belt and the cover may be evident.
- NOTE:** It may be necessary to push the transmission back slightly to get the transmission cover to slide in completely.
9. Place the upper BBC cover into position on the housing and secure with the two self-tapping flanged head capscrews.
 10. Check for proper operation of all controls, especially the BBC, and adjust as necessary.

BBC UNDER DECK COMPONENTS

BBC Under Deck Components - Operation

Brake Plate Assembly: The brake plate assembly (see Figure 91) consists of the brake plate, the brake pad, brake plate hub, brake plate lever, a bushing, seal and the idler pulley. See Figure 91. The brake plate has two important functions.

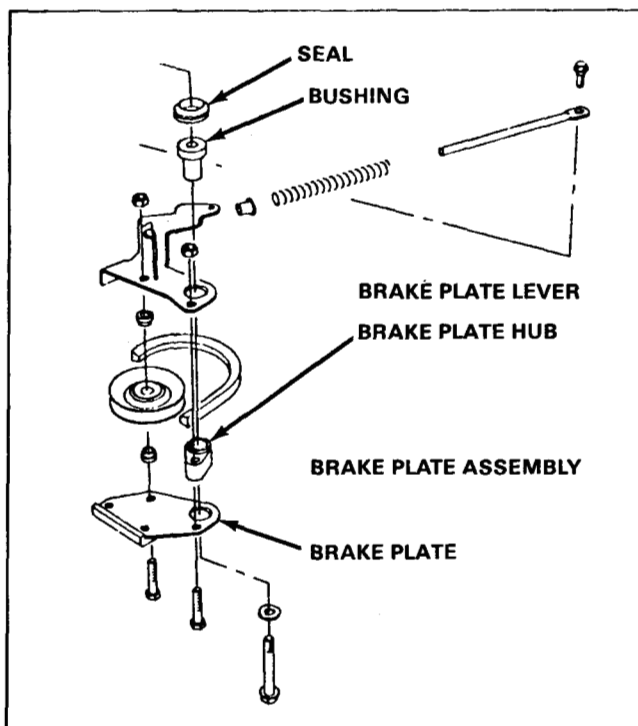


Figure 91

First, it controls tensioning and loosening of the BBC belt by pivoting on the brake plate bushing. This controls engagement and disengagement of the blade. It is spring loaded by the brake plate spring

assembly in the disengaged position.

Secondly, it provides the breaking action necessary to stop the blade within three seconds of release of the control bar. (The three second time frame is mandated by federal law.) When in the disengaged position, the brake pad that is affixed to the brake plate touches the brake drum.

Because of the orientation of the pivot point, the brake pad, and the brake drum, this type brake is termed "self-energizing". It is named as such because when the brake drum is rotating in its normal direction, the brake pad and brake drum are actually wedged together which produces more friction and a lower stopping time. This is desirable because it greatly reduces the input force required.

Brake Plate Spring Assembly: The brake plate spring assembly spring loads the brake plate assembly so that the belt is in the disengaged position and the brake pad is spring loaded into the brake drum. The assembly consists of a rod which slides through a slot in the brake plate in a spring. The rod is attached to the deck housing and the spring provides the force necessary for braking action. Note that there is no retainer securing the rod to the brake plate.

Split Sheave Pulley and Blade Assembly: The split sheave pulley design used on the VP mower provides the clutching action that allows the engine to keep running while the blade is stopped.

In this split sheave pulley type clutch, there are 4 primary parts involved, the crankshaft or rotating spindle, the upper pulley sheave, the lower pulley sheave and a bearing block. See Figure 92.

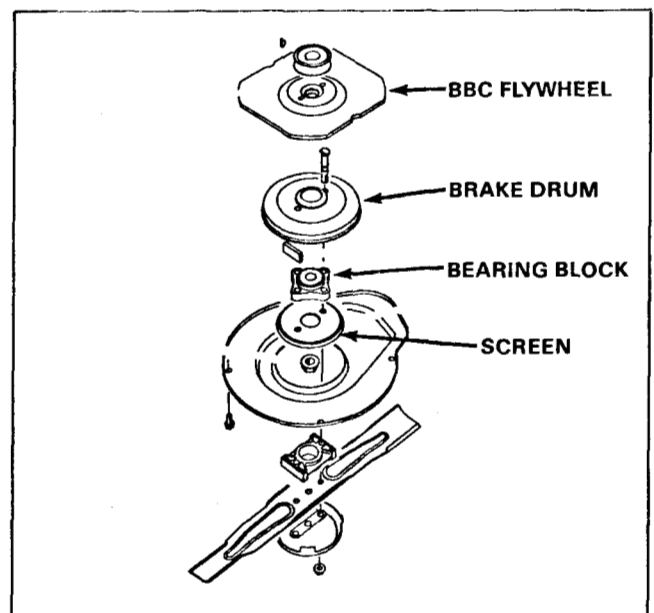


Figure 92

BBC Under Deck Components - Operation (cont'd)

The upper pulley sheave is secured to the rotating shaft. It will always turn with the crankshaft.

The lower pulley sheave is mounted on a bearing which spins freely on the crankshaft, thus the two sheaves are both mounted on the crankshaft, yet can spin freely with respect to one another. However, once a belt is properly tensioned in the groove created, the two sheaves spin as one.

Getting more specific, the upper sheave of the pulley is the BBC flywheel, and the lower sheave and bearing block are the bearing block and brake drum. The BBC belt fits in between these two components. The belt is tensioned by the brake plate assembly. Some things to note regarding the VP BBC system is that the BBC flywheel uses a taper fit to secure it to the crankshaft. It is that taper fit which keeps it from rotating on the crankshaft once the crankshaft nut is tight. The small tabs on the self-propel pulley do not assist in this function. (They are provided only to allow tightening and loosening of the crankshaft nut with hand tools.)

The brake drum bearing block, screen, blade spacer, blade and anti-scalp cup all rotate as an assembly. Their orientation can be clearly seen in the Figure 95. Note the vibration dampeners, two of which are used on the BBC brake drum. These dampeners help reduce the screeching sound when the brake is applied, due to the bell shaped brake drum.

BBC Cover and Screen: The BBC cover and screen are two important components that keep dirt and debris out of the BBC mechanism. The screen (see Figure 92) is installed, sharp edge down, to allow air to be drawn in through the screen panel on top of the deck and down underneath the deck. This venting improves the airflow underneath the deck thereby improving quality of cut and bagging performance. Be sure to clean the screen on occasion, especially if quality of cut or bagging performance has degraded.

Before troubleshooting the BBC deck mechanism, be sure that it is adjusted properly. See BBC - Adjustment, page XX.

BBC Under Deck Components - Disassembly

1. Stop the engine and disconnect the spark plug lead to prevent accidental starting.
2. Remove the 2 flanged nylon locknuts securing the blade to the bearing block and remove the anti-scalp cup, the blade, the blade spacer, and the lower BBC screen. See Figure 93.

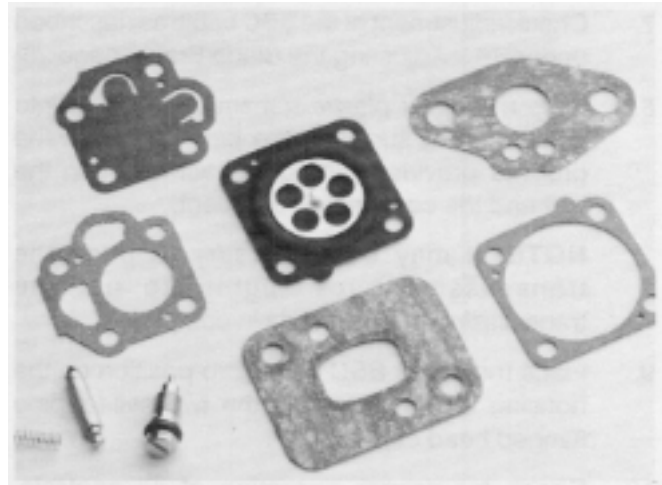


Figure 93

3. Remove the 4 flanged head self-tapping screws securing the lower BBC cover to the housing, and remove the lower BBC cover.
4. Before disassembling further, check to make sure that the BBC components are functioning normally. Make sure that the brake and brake drum fully disengage when the control bar is cocked, then raised. Make sure that the BBC flywheel and the brake drum rotate together when the control bar is raised. Make sure that the belt loosens properly when the control bar is lowered. Repair or replace parts as required.
5. If further disassembly is required, begin by removing the crankshaft nut.

NOTE: Be careful not to damage the bearing seal when removing this nut, or premature bearing failure could result.

6. Pivot the brake plate counterclockwise slightly and remove the bearing block and brake drum from the crankshaft.
7. Again, pivot the brake plate counterclockwise and remove the BBC flywheel.
8. **BBC Belt or Idler Pulley Replacement:** If the BBC belt or idler pulley requires replacement, it can be done without removal of the brake plate. Remove the idler pulley capscrew and nylon locknut then pull the belt and pulley from the brake plate as an assembly.

NOTE: The powdered metal hubs of the pulley are replaceable, however, the bearing inside the idler pulley is not replaceable separately.

9. If the brake pad has reached its service life or if the brake plate has been damaged, remove the other capscrew securing the brake plate to the

brake plate hub and lever and remove the brake plate assembly. The brake pad is not replaceable separately. Instead, use a complete brake plate assembly.

10. If necessary, remove the flanged head capscrew securing the brake lever and hub to the housing.

CAUTION! The brake plate lever is under some spring loading. Heavy gloves and eye protection are recommended when removing the brake plate lever.

NOTE: Do not use an air wrench on the brake lever self-tapping screw as thread damage to the housing may result.

11. Remove the brake plate and hub assembly from the housing and disassemble the seal, or oil impregnated bushing, the hub, self-tapping capscrew and washer from the brake lever. Be careful not to lose the plastic bushing which fits on the end of the brake spring rod. See Figure 94.

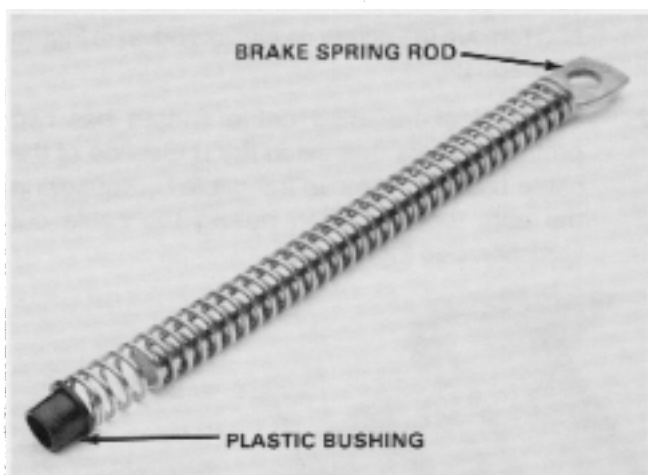


Figure 94

12. Complete disassembly of the brake plate by removing the brake plate screws and the bearing block.
13. Remove the two bearings from the bearing block by pressing the bearings out on an arbor press. Press only on the outer race to prevent bearing damage (use an appropriately sized arbor or a 28 mm (1-1/8") socket).
14. Inspect all parts for damage and/or wear and replace as necessary.

BBC Under Deck Components - Assembly

1. Check to make sure that the brake plate seal is in good condition, then stretch onto the brake plate bushing. See Figure 95.

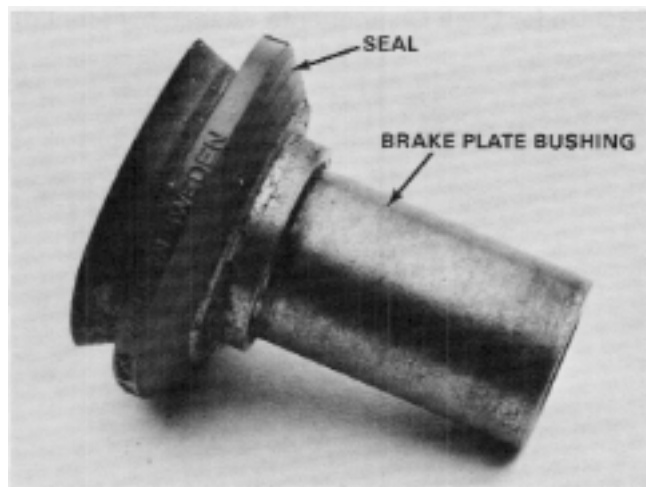


Figure 95

2. Hook the control link in the slot on the brake lever. Place the spring and the bushing onto the brake rod then slip the bushing and brake rod through the hole provided in the brake lever. Finally, install the bushing hub and flanged head self-tapping screw with washer through the brake lever.

Brake Plate Capscrew Torque: 25.5 N•m (225 in lbs)
--

NOTE: If the self-tapping screw strips the threads in the housing, do not helicoil, rather, place a hexnut in the recess provided in the top side of the deck.

3. Loosely secure the brake plate, complete with brake pad to the brake lever and brake hub as shown in Figure 96. Note that the carriage bolt should go through the brake plate first. Secure with a nylon locknut but do not tighten at this time. This will allow proper alignment of the idler pulley later.
4. Install an idler hub into each side of the idler pulley bearing, then slip the belt onto the idler pulley. Slip the entire assembly between the brake plate and brake lever. Secure with the carriage bolt and nylon locknut as shown in Figure 96.
5. Tighten both idler pulley carriage bolts. Make sure that the idler pulley spins freely.

Idler Pulley Bolt Torque: 11.33 N•m (100 in lbs)
--

6. Install the BBC flywheel onto the crankshaft, making certain that the slots in the BBC flywheel align with the tabs on the bottom of the self-propel pulley.

BBC Under Deck Components - Assembly (cont'd)



Figure 96

NOTE: If the crankshaft nut is tightened with these tabs misaligned, the boss at the bottom of the keyway on the self-propel pulley will break and the self-propel pulley will be free to slide up and down on the crankshaft. This can result in premature belt wear and belt jumping.

7. Press the bearings into the bearing block, using an arbor press. Press only on the outer race, otherwise bearing damage will result (use an appropriately sized arbor or a 28 mm (1-1/8") socket to press the bearing into the block).
8. Make sure that the anti-vibration pads are in place on the brake drum and assemble the brake drum bearing block and BBC screws onto the crankshaft as shown in Figure 97. Secure with the crankshaft nut.

Crankshaft Nut Torque:
78.8 N•m (58 ft lbs)

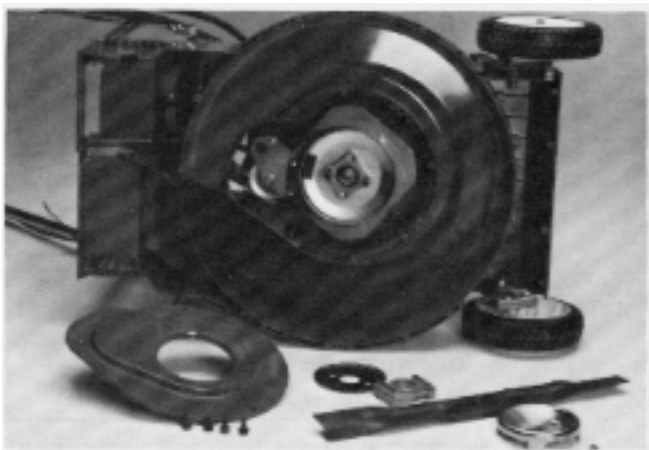


Figure 97

NOTE: Make sure that the BBC screws are properly aligned before tightening the crankshaft nut.

9. Install the BBC cover with the four flanged head self-tapping screws.
10. Install the BBC screen, the blade spacer, the blade and the anti-scalp disk onto the BBC screws and secure with the two flanged nylon locknuts. Torque to 3.80 kg m (330 in. lbs.).

Blade Locknut Torque
37 N•m (330 in lbs)

11. Complete BBC service by checking BBC and self-propel controls, making sure that all are functioning normally. Adjust as necessary.

BBC CABLE

BBC Cable - Removal

1. Remove the two flanged head self-tapping screws securing the screen panel to the housing and remove the screen panel as shown in Figure 22, page 24.
2. The end of the BBC cable sheath has two protruding ears that catch the underside of the cable bracket. Remove the cable by squeezing the ears together, then pulling the cable out vertically. See Figure 98.

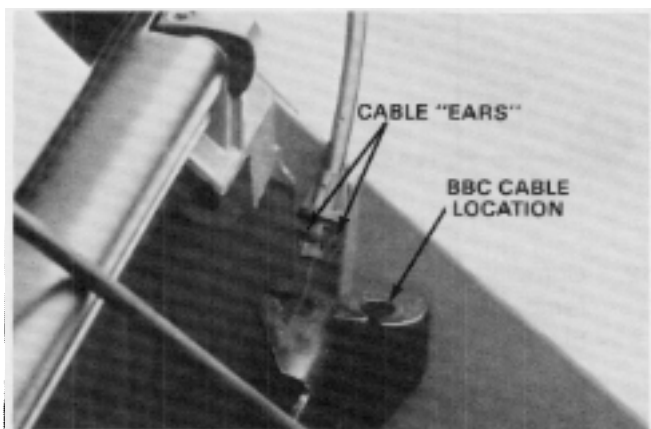


Figure 98

3. Bend the throttle control locking tab back slightly and tap the throttle control from the control panel with a rubber mallet. See Figure 51, page XX. Place a piece of duct tape over the heads of the handle and the BBC control box. This will prevent control box components from falling out of the handle during disassembly.

4. Remove the three flanged head screws securing the control box halves.
5. Remove the two nylon locknuts securing the control box to the handle and carefully remove the right control housing half.
6. Slip the end of the BBC cable from the cable lever and remove the cable. See Figure 99.

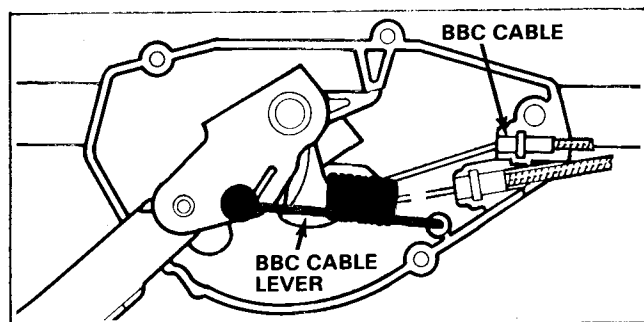


Figure 99

BBC Cable - Installation

1. Slide a new BBC cable into the BBC cable lever then install the end of the cable sheath in recess provided in the left control housing half. See Figure 99.
2. Before installing the right control housing half, make sure that the traction and BBC ends are completely seated in their recesses. Also make sure that the sleeve on the upper carriage bolt passes completely through the BBC control box components to the handle. Finally, make sure that the roll pin in the rocker arm passes through the hole in the control bar. Install the right control housing half. Secure with two nylon locknuts.

NOTE: The flanged locknut fits on the upper carriage bolt.

3. Install the three flanged head screws securing the control box halves.
4. Bend the throttle control locking tab forward so that it will provide positive engagement with the throttle control. Install the throttle control.
5. Hook the lower end of the BBC cable onto the bellcrank then slip the cable through the slot in the cable bracket. Push the end of the cable sheath into the cable support bracket as shown in Figure 100.
6. Before installing the screen panel, adjust the BBC cable as described under BBC Cable - Adjustment, which follows.

BBC Cable - Adjustment

1. Remove the two flanged head self-tapping screws securing the screen panel to the housing and remove the screen panel.

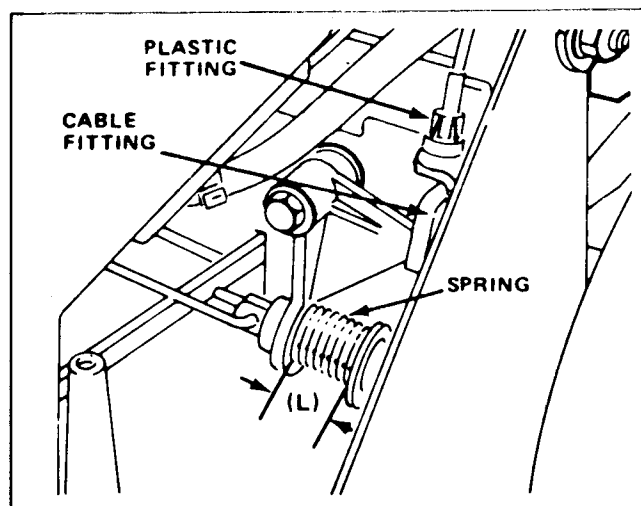


Figure 100

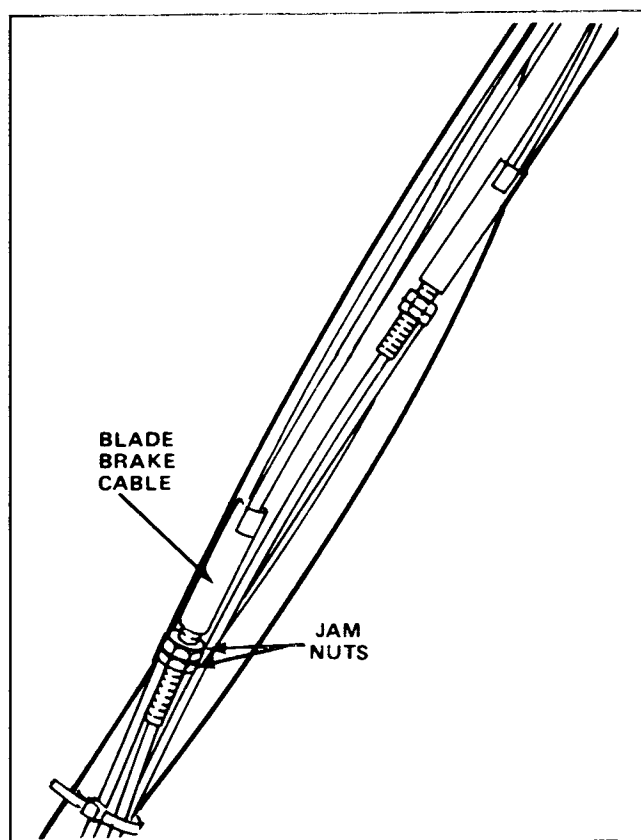


Figure 101

2. With the engine off and the spark plug wire disconnected, cock and lift the control bar to engage the blade. Tape the control bar to the handle with the blade engaged, then measure the length of the over-travel spring. See Figure

BBC Cable - Adjustment

100. When adjusted properly it should measure 25.4 ± 1.5 mm ($1" \pm 1/16"$). If it does, skip ahead to step 5. Otherwise proceed with adjustment in the following step.

3. Loosen the two jam nuts in the middle of the BBC cable as shown in Figure 101. Rotate the nuts up to make the spring smaller or down to make the spring longer. Continue adjustment until the over-travel spring measures 25.4 ± 1.5 mm ($1" \pm 1/16"$)

NOTE: On 1990 and newer BBC cables use a finger tip adjustment at the gearbox end.

4. Tighten the jam nuts by turning them in opposite directions.
5. Remove the tape from the handle and disengage the blade.
6. Install the screen panel with the two flanged head self-tapping screws. Make sure that the top edge of the screen panel is under the lip at the top of the housing.

SECTION 5 ZONE START BRAKES

Introduction

In 1982 the federal government mandated that all consumer walk behind mowers with a cut of 63.5 cm (25") or less be equipped with safety devices. There are two primary criteria which these devices must meet:

1. A two step operation must be performed in order to get the blade turning.
2. The blade must come to a stop within three seconds of the operator leaving the operator's position.

One of the ways The Toro Company met these requirements was with the "zone start system". This system utilizes a kill switch and brake which stops the engine when the operator releases the control bar. The two step blade engagement criteria is met by requiring the operator to first raise the control bar, and second, pull the recoil rope from the operator's position. See Figure 102. Notice that the end of the recoil rope is up near the operator's position just ahead of the control bar. This allows the operator to start and operate the unit without ever leaving the operator's position.

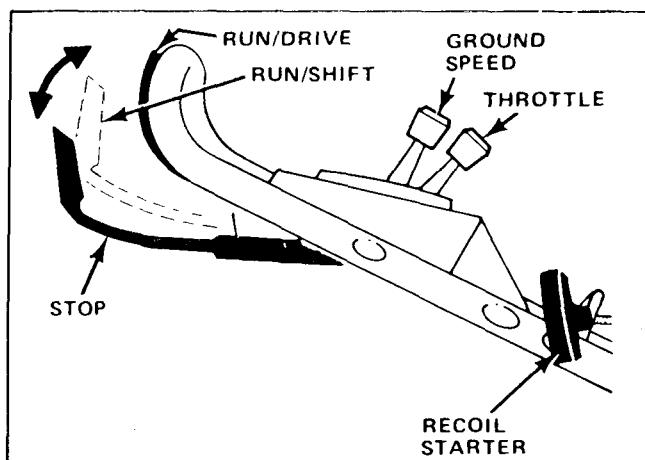


Figure 102

The Toro Company uses two different zone start systems. The one used on the Tecumseh 2-cycle engine uses a push button-type switch and a plunger-type flywheel brake mechanism. The other uses a spring steel kill switch and a pivoting type brake mechanism. This style zone start brake is used on Toro overhead valve and 2-cycle engines.

The plunger style brake will be discussed first and the later part of this section will be devoted to the pivoting style zone start brake.

PLUNGER STYLE ZONE START BRAKE

Plunger Style Zone Start Brake - Operation

There are four key components that comprise the plunger type zone start brake: the control bar, the brake cable, the kill switch and the brake. See Figure 103.

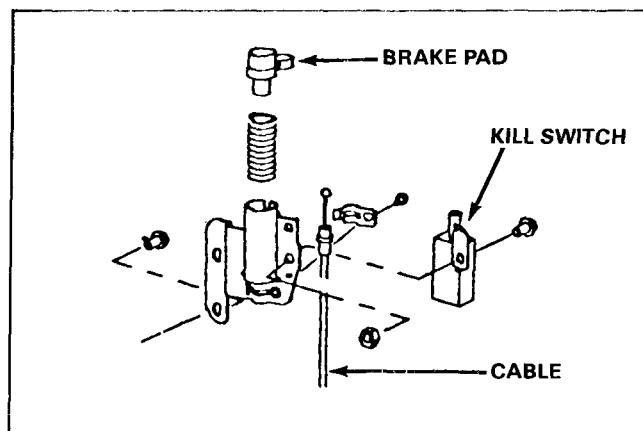


Figure 103

The control bar is the source of operator input. When the control bar is lifted past a point 10 cm (4") below the handle, the engine will run, and the brake is not in contact with the flywheel. When the control bar is released, the ignition coil is grounded and the brake is engaged.

The brake cable transfers control inputs from the operator down to the brake and kill switch on the engine. The cable is adjustable only at the upper end. There is no cable adjustment at the engine end. See Figure 104.

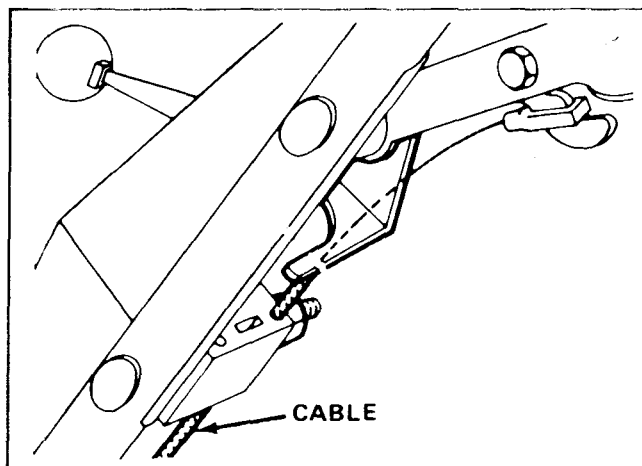


Figure 104

Plunger Style Zone Start Brake - Operation (cont'd)

The kill switch is a two position push button-type switch that is closed when the control bar is more than 10 cm (4") below the handle and open when it is closer than 10 cm (4"). The body of the switch is grounded to the engine while the terminal on the switch is connected to the ignition coil kill wire. When the switch is open, the coil will produce spark. When closed, the ignition coil is grounded and spark is inhibited. The switch is actuated by a small arm coming from the brake disk.

The brake mechanism is simply a bracket, a spring and a brake disk. When the control bar is near the handle, the spring is compressed and the disk is pulled away from the bottom of the flywheel. When the control bar is released, the spring forces the disk into the flywheel and helps the engine stop within the required three seconds.

Plunger Style Zone Start Brake - Disassembly

1. Remove the spark plug wire to prevent accidental starting.
2. Before removing the plunger style brake from the engine, remove any components necessary to get a clear view of the brake. Operate the brake while inspecting for proper flywheel to brake disk contact and proper operation of the switch. Repair or replace parts as necessary.
3. Remove the ignition coil kill wire from the switch and check using an ohmmeter or test light. When the control bar is down, the switch should be closed. When the control bar is 10 cm (4") below the handle the switch should move from closed to open and should remain open until the control bar is brought all the way up to the handle. If the switch does not appear to be operating correctly, check to insure that the switch body is properly grounded to the engine and that the ground wire connection is also good. Adjust positioning of the switch or replace the switch as required.
4. If further disassembly is required, remove the two self-tapping screws securing the plunger style brake to the engine.
5. Remove the kill wire from the switch and remove the switch from the brake tube.
6. Remove the cable clamp from the brake tube and disassemble the clamp, brake disk, spring, and cable from the brake tube. Repair or replace any parts necessary.

7. Brake Cable Replacement:

If brake cable replacement is required, remove the upper end of the brake cable from the cable clamp underneath the control panel. Disconnect the clevis from the control bar and remove the cable.

Plunger Style Zone Start Brake - Assembly

1. When installing a new cable, slip the clevis end over the hook on the left side of the control bar and place the sheath in the clamp on the left handle but do not tighten at this time.
2. Be sure that the "P" clamp is installed on the cable before proceeding with brake assembly. Check to insure that the clamp will lay flat when installed under the left screen panel fastener.
3. Slide the brake tube, the spring and finally the brake disk onto the brake cable. Pull the brake cable sheath down into position at the slot provided at the bottom of the brake tube and secure with the cable clamp. See Figure 103.

Cable Clamp Torque:
2.26 N•m (20 in lbs)

NOTE: The end of the cable sheath will not fit past the spring unless the upper end of the cable clamp is first loosened.

4. Slip the brake switch into position on the brake tube and secure with the capscrew and nylon locknut (locknut on the same side as the switch).

NOTE: There is no vertical adjustment on the switch. To adjust the switching point, adjust the brake cable under the control panel. See Figure 105.

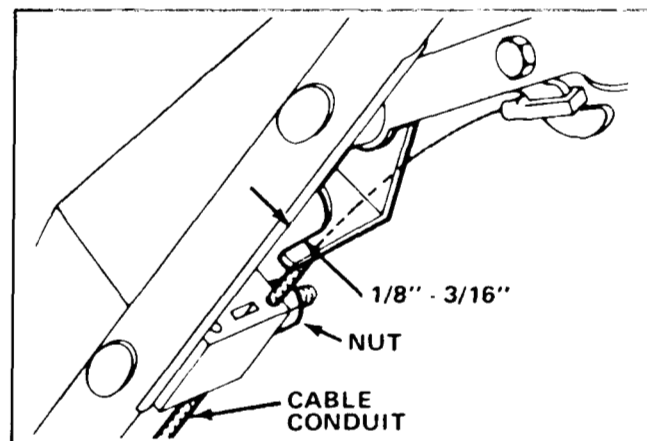


Figure 105

5. To facilitate assembly, tape the control bar to the handle.

Secure the brake assembly to the engine with two self-tapping flanged head screws. Adjust the brake tube so it is square with the flywheel and so that there is approximately 2.4 to 3.2 mm (3/32" to 1/8") clearance between the top of the brake tube and the bottom of the flywheel.

6. Once properly adjusted, tighten the two flanged head screws. Remove the tape from the control bar.

Brake Mounting Screw Torque:
11.8 N•m (105 in lbs)

7. Check again for proper adjustment of the zone start brake switch with an ohmmeter or test light. The switch should change from closed to open at a point when the control bar is 10 cm (4") below the handle. Adjust the upper end of the brake cable if necessary.
8. Slip the screen panel fastener through the P clamp and secure.

"P" Clamp Fastener Torque:
25 N•m (225 in lbs)

9. Install any engine components that were removed for brake servicing.
10. Check to insure that the brake system functions normally before returning to the customer.

Plunger Style Zone Start Brake - Adjustment

See Zone Start Brake - Adjusting Blade Brake, page 25.

PIVOTING ZONE START BRAKE SYSTEM

Pivoting Zone Start Brake System - Operation

The pivoting style zone start brake system consists of two parts. The first system stops spark production and the other stops the engine and blade.

Spark is stopped by means of a switch. The switch is closed when the control bar is in the "at rest" position. Raising the control bar opens the switch.

The switch leads are connected to the primary side of the coil and to ground. When the switch is closed, the electronic ignition module is bypassed so that it cannot interrupt primary current flow. This prevents the coil from producing the high voltage necessary for spark. When the switch is open, the ignition coil produces spark.

Stopping of the engine and blade is accomplished by means of a brake that is applied to the bottom of the ignition flywheel. The brake is spring loaded in the "braked" position when the control bar is in the "at rest" position. When the control bar is lifted, the brake is pulled away from the flywheel to allow the engine to run.

Pivoting Zone Start Brake System - Disassembly

See Figure 106.

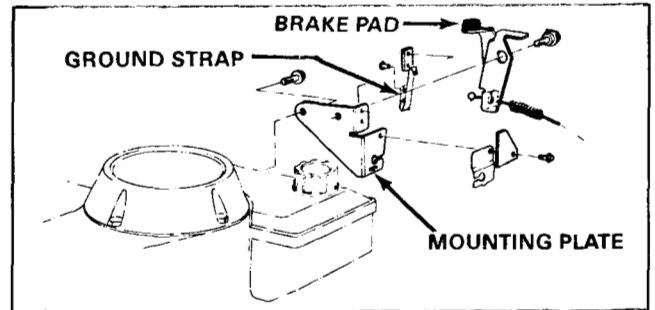


Figure 106

1. Inspect the brake pad for excessive wear and replace if necessary.

NOTE: The brake pad is not replaceable separately from the brake plate.

2. Remove the self-tapping screw securing the cable clamp to the mounting plate. Remove the cable clamp, the ground strap stop and the brake cable with spring.
3. Remove the two screws securing the mounting plate to the engine and remove the brake assembly.
4. If removal of the ground strap is required, drill out the two rivets securing it to the mounting plate and remove the strap and insulator.

Pivoting Zone Start Brake System - Assembly

1. If the ground strap has been removed, fasten it to the mounting plate as shown in Figure 107.
2. Secure the mounting plate with one self-tapping screw. Tighten to:

Mounting Plate Screw Torque:
10.4 N•m (90 in lbs)

3. Fasten the brake plate to the mounting plate and block with the shoulder screw. Make sure that the brake plate pivots freely once the screws are tightened. Tighten to:

Brake Plate Pivot Screw Torque:
10.4 N•m (90 in lbs)

Pivoting Zone Start Brake System - Assembly (cont'd)

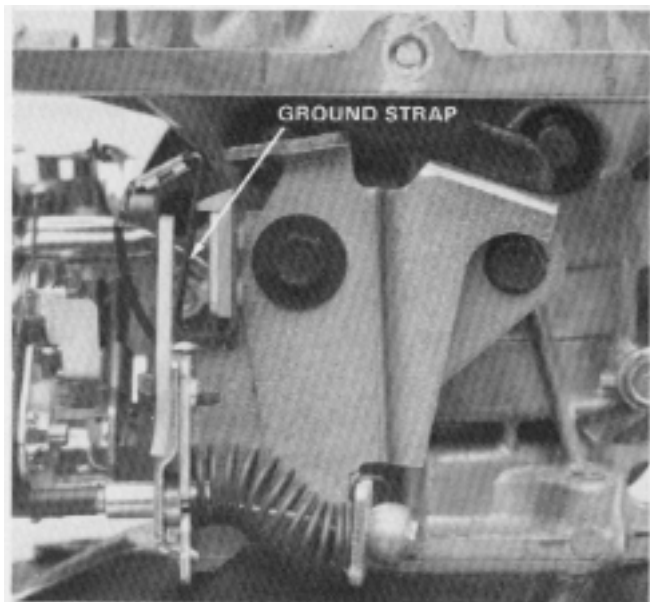


Figure 107

4. Slip the compression spring over the cable, then slip the lugged end of the cable into the slot in the brake plate. Slip the spring between the brake plate and mounting plate, then secure with the cable clamp and ground strap stop as shown in Figure 108.

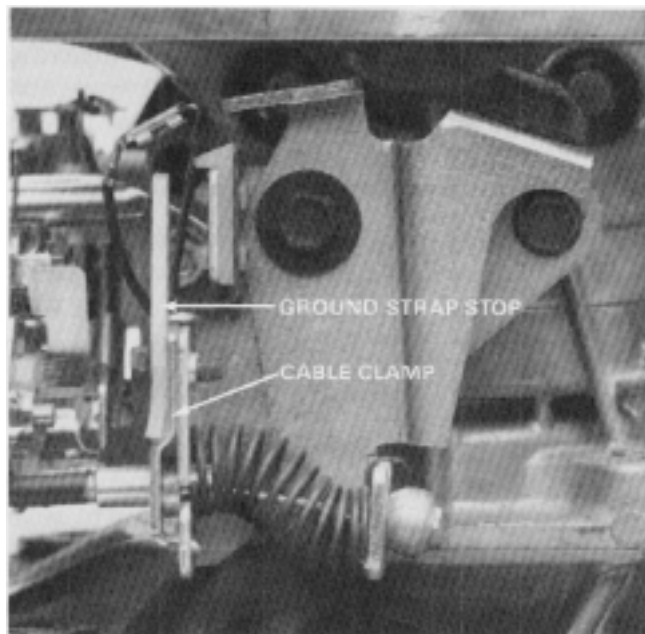


Figure 108

5. Adjust the cable as described below.

Pivoting Zone Start Brake System - Adjustment

The cable is not adjustable at the brake. See Zone Start Brake - Adjusting the Blade Brake, page 25 for cable adjustment information.

SECTION 6 ELECTRICAL SYSTEMS

IGNITION CIRCUIT

Ignition Circuit - Operation

While the ignition circuit is described in each of the applicable engine manuals, the subject will also be briefly described here since the wire harness is part of the chassis. See Figure 109.

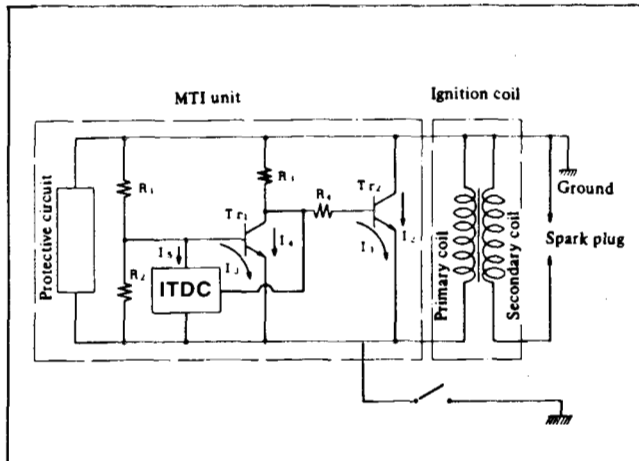


Figure 109

A magneto style ignition as shown in the figure above is based on the principle that a magnet passing by a coil of wire produces an electrical current flow in the wire. (Note: the coil of wire must form a complete circuit.)

The flywheels on Vacu-Power engines house a magnet on one side. Because the coil is mounted close to the flywheel, current flows through the primary side of the coil and through the electronic ignition module when the magnet passes by. However, the amount of current present in the primary is very small, so something must be done to "step it up".

To increase voltage, a second coil is used. This coil is called the secondary. It is different from the primary in that it is constructed of finer wire and has many more windings. The magnetic field produced by the primary tries to force current to flow in the secondary, but cannot because of the open circuit at the spark plug electrodes. While current will not flow, something important does happen. A voltage difference is produced across the electrodes. When the voltage gets high enough, an arc occurs, thereby producing spark at the plug.

Unfortunately, the components we have described so far cannot produce a voltage high enough at the plug to produce spark. To create an arc we must add one more component: the electronic ignition module.

The electronic ignition module opens the primary circuit while the magnet is passing by, thereby causing a rapid decrease in primary current flow. Opening the primary circuit is important because any change in primary current (whether an increase or a decrease) boosts the voltage in the secondary. The faster the change in primary current, the greater the increase in secondary voltage. When the electronic ignition module is functioning properly, the voltage at the spark plug electrodes becomes high enough to overcome the resistance of air, thus producing spark.

While producing spark may be somewhat difficult to understand, stopping spark is not. All Vacu-Power engines use a "kill wire" that runs to a switch. When the switch is closed, the primary coil is grounded.

Grounding does not prevent current flow in the primary. Current still flows each time the magnet passes by the coil. However, as you can see in Figure 110, the current flow bypasses the electronic ignition module which eliminates the "momentary open" in the primary circuit. With no "momentary open", high voltage cannot be produced and spark cannot occur.

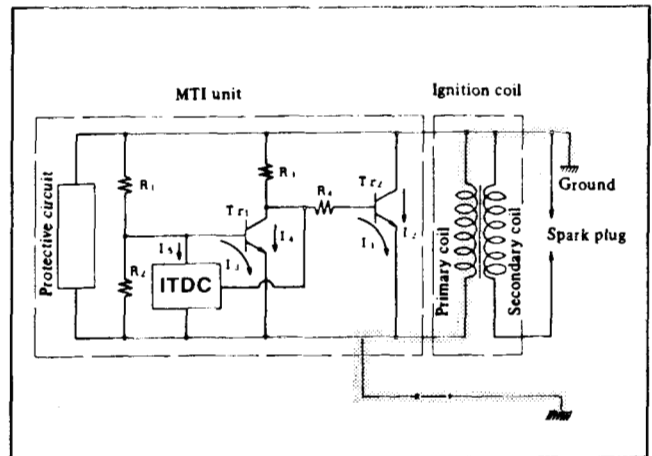


Figure 110

Ignition Circuit - Troubleshooting

For ignition system troubleshooting information, see the appropriate engine service manual for your engine.

KEY-LECTRIC® STARTING SYSTEM

Key-Letric Starting System - Operation

The Key-Letric starting system used on Vacu-Power Mowers consists of a battery, starter switch, starter motor, the alternator and the wire harness. See Figure 111.

Key-Lectric Starting System - Operation (cont'd)

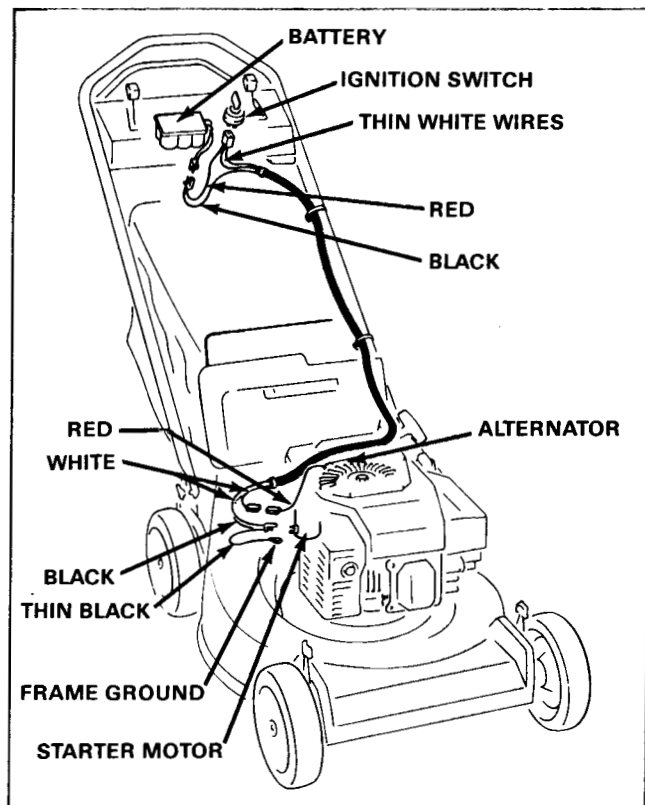


Figure 111

Battery: The battery is a six cell, lead acid, gel cell type. It's capacity is 2.5 amp hours. Maximum draw under normal starting conditions is 90 amps. Individual cells are not available as soldering or welding on the battery group is not recommended.

Starter Switch: The starter switch is closed when rotated to the "start" position. This allows current to flow through the switch and to the starter motor.

Starter Motor: The starter is a direct current, permanent magnet motor.

Alternator: The alternator's purpose is to charge the battery. It is a magneto type alternator which means that it generates electricity by passing a magnet by a coil of wire. (Note: the coil of wire must form a complete circuit.) When the magnet passes by the coil, current flow is induced by the magnetic field.

The output of the coil is approximately 125 milliamps at 14.5 volts. By itself, the alternator produces alternating current. However, in this application, a diode (one way "valve"), converts the alternating current to direct current by a process called "half wave rectification".

Half wave rectification can best be explained by means of an illustration. See Figure 112.

Normal alternating current has a wave form as shown in the figure. Notice that the voltage goes both positive

and negative. Because negative voltage would damage the battery if used for charging, the diode "removes" this portion of the wave so that it has the waveform shown in Figure 115. Notice, that although the voltage still varies up and down, it never goes negative. This arrangement allows charging of the battery.

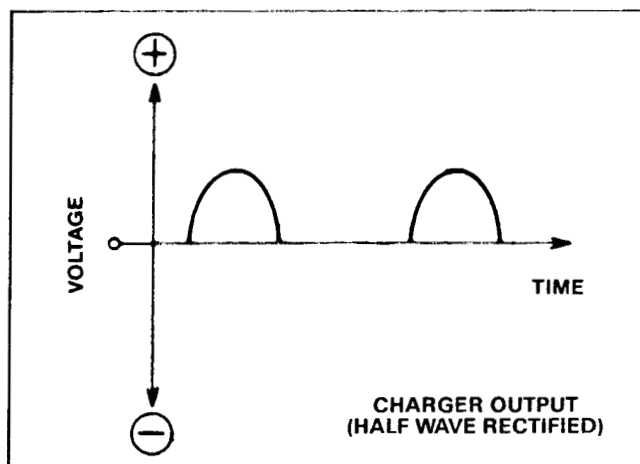


Figure 112

Charger: An auxillary charger is included with Key-Lectric Vacu-Power Mowers in case the battery discharges during storage. Using the charger allows the battery to be recharged without running the engine.

The output of the charger is 100 ma. at 14.5 volts DC. While it is called DC, it pulses in the same fashion as the alternator described above. It is important to note that if measuring the voltage of the charger with an analog (non-digital) meter, the voltage will appear low due the pulsations. A normal reading from the charger is 8.5 and 10.5 volts DC if the meter is set to read DC voltage.

Key-Lectric Starting System Operation: When the starter switch is "off", the switch is open and current cannot flow to the starter motor. However, if you look at the schematic, you will see that current can flow from the alternator to the battery. This charges the battery during mowing.

When the starter switch is closed, current flows from the battery and the alternator to energize the starter motor. The battery supplies nearly all the current since the alternator produces about 0.1 amp as compared to the 90 amps produced by the battery during starting.

Key-Lectric Starting System - Testing

Battery Testing:

Disconnect connector at battery and check battery voltage with a volt/ohmmeter (VOM) or better yet, a

Toro battery tester. Set the VOM to DC Volts. If more than one scale is available, set it to the first larger than 14 volts.

The battery should show a voltage between 12 and 14 volts. See Figures 113 and 114.

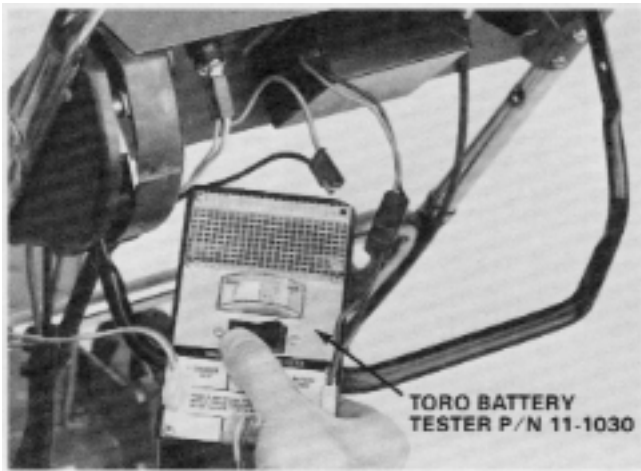


Figure 113



Figure 114

NOTE: Keep in mind that a dead battery can occur due to a number of different causes.

Ignition Switch Testing:

Pull the connector off the back of the ignition switch and test switch operation with a volt/ohmmeter (VOM) or test light. The switch should be closed (very low resistance) in the "start" position and open (very high resistance) in the "off" position. See Figure 115.

Wire Harness Testing:

Disconnect the wire harness from the ignition switch and the starter motor. Check wires A, B, and C (Figure 116) for continuity by connecting a VOM or test light to

either end of each wire. All should be continuous. If not, repair or replace the wire harness.



Figure 115

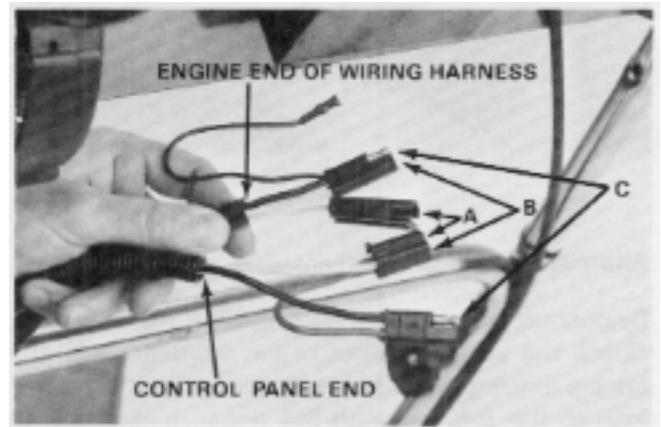


Figure 116

Check for short circuits by checking continuity between each of the wires. None should be continuous with the others unless attached to the same connector.

Finally, check each wire for continuity to ground by attaching one test lead to ground (engine block) and the other lead to one of the wires in the wire harness. There should be no continuity between the wires and ground unless the wire is a ground wire.

Starter Motor Testing:

Using a Key-Lectric starting battery that is known to be good, touch the connector directly to the connector on the starter motor. See Figure 117. The motor should turn.

If the mower doesn't turn, it is malfunctioning. Remove the end cap from the motor and check for stuck brushes or loose wires. Repair any problems found. If

Starter Motor Testing: (cont'd)

no problem is readily apparent, the cause may be a broken winding. In this case, replace the starter motor.

NOTE: Because of the orientation of the connectors, the starter motor will turn backwards when connected directly to a Key-Lectric battery.



Figure 117

Alternator Testing:

Disconnect the red wire coming from the alternator. Check the voltage output of the alternator with the engine running. Do this by connecting the positive test lead to the red wire and the negative test lead to ground (engine block). The voltage should be between 8.5 and 10.5 volts with the VOM set to DC volts. If not, use the following test for proper ground.

Check to insure that the alternator is properly grounded by testing the resistance between the alternator chassis and the engine block. See Figure 118. The resistance should be near zero. If not, remove any obstructions causing poor ground.

The alternator uses a diode to convert alternating current to direct current. Since the diode is a "one way valve", it can be checked by testing its resistance with a VOM in both directions. In one direction, its resistance should be very high, and in the other direction, the resistance should be very low.



Figure 118

Charger Testing:

Test the auxillary charger with a VOM. With the charger plugged into a receptacle that is known to be good, the voltage across the two output terminals should be between 8.5 and 10.5 volts with the VOM set on DC volts. If not, check for broken wires. If no defect can be found, replace the charger as there are no user serviceable parts inside. See Figure 119.



Figure 119

SECTION 7 HANDLE ASSEMBLY

NOTE: The handle pins (located about 20.3 cm (8") above the bottom of the handle) are replaceable and require no special tools for installation. See your parts catalog for the correct part numbers for your mower.

Handle Assembly - Removal

Removing the handle for replacement can be easily accomplished without disassembly of the BBC or Zone Start control bar mechanisms.

1. BBC Models:

Before starting, obtain one 10 cm (4") long, 1/4" bolt and one 10 cm (4") long, 5/16" bolt. These will be inserted through the BBC control box or zone start mechanisms to prevent the mechanism from coming apart during disassembly. Remove the two nylon locknuts on the right side of the BBC control box, but do not remove the two carriage bolts.

Using the 10 cm (4") long bolts obtained earlier, push the BBC control box carriage bolt out. This will retain the components inside the control box. Do the same for the other control box carriage bolt.

Zone Start Units:

Remove the nylon locknut securing the left side of the control bar to the handle, remove the cable support nut and pull both carriage bolts from the handle.

2. Remove the locknut from the right side of the control bar and pull the carriage bolt from the handle. Remove the control bar, complete with safety mechanism, from the handle.
3. Remove the four self-tapping screws securing the control panel to the handle and remove the control panel.
4. Cut the cable ties securing the cables to the handle.
5. Pull the handle latches inward to release them from the handle and lay the handle down.
6. Remove the locknuts securing the handle to the deck and remove the handle.

Handle Assembly - Installation

See Figures 120 and 121.

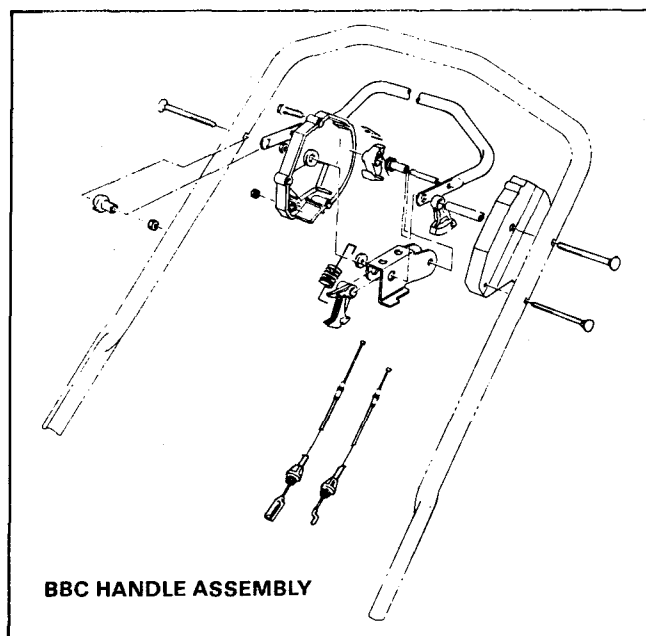


Figure 120

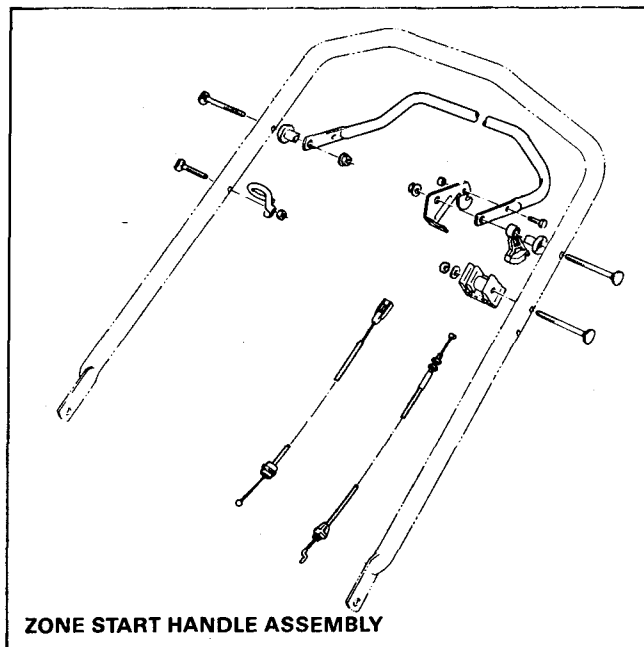


Figure 121

1. If necessary, install new handle studs into the deck.

Handle Stud Torque:
40.3 N•m (350 in lbs)

2. Slip the handle into position over the shoulder studs. Secure each side with a washer and locknut.

Handle Assembly - Installation (cont'd)

3. Bring the handle up into position and secure with the handle latches.

NOTE: The handle latches should be on the inside of the handle. For convenience, adjust to the center hole on the handle latches.

4. Install the control panel into position at the top of the handle and secure with four self-tapping screws.
5. Lift the control bar and safety control mechanism into position at the top of the handle. Secure the right side of the control bar with the handle screw, the support spacer and the locknut.

6. **BBC Models:**

With the BBC control box in its proper position and the temporary fasteners still installed through the control box, force the two left hand handle screws through the handle in the BBC control box. This will force out the temporary fasteners and will insure that no BBC control box components come loose. Secure the larger handle screw with a washer and nylon locknut and the smaller handle screw with just a locknut.

Zone Start Units:

Bring the control bar assembly into position at the top of the handle and insert the handle screws through either side of the handle. Secure with the nylon locknuts. Make sure the brake cable and the traction cable are properly positioned in the short block, then, if necessary, reinsert them into the traction lever and the control lever on the control bar. Before tightening the cable support bracket, adjust the brake and traction cable as described in the Maintenance Section.

7. Secure the cables to the handle with cable ties in the locations shown in Figure 122.

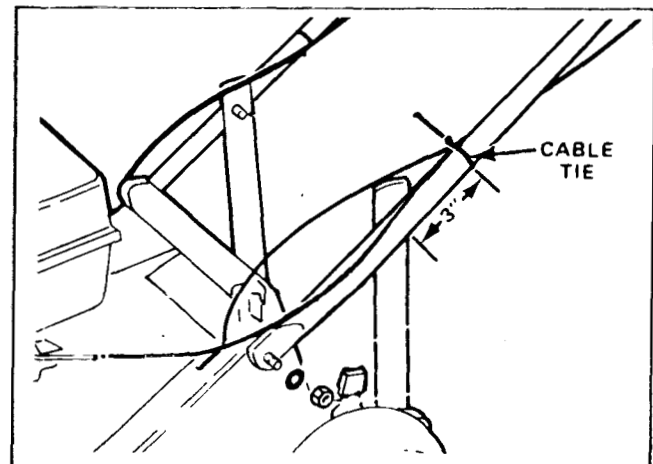


Figure 122

SECTION 8 CUTTING DECK

Cutting Deck - Operation

The Vacu-Power deck is designed to provide the ultimate in quality of cut and bagging ability. It relies on air movement to carry the grass into the bag.

Not all of the air is drawn from the sides; a considerable amount of air enters through the center of the deck. The perforated screen panel just behind the engine is the entry point. From there, the air passes through the belt opening in the deck, through another screen (BBC units only) and finally down to the cutting chamber area. On self-propelled models, there is a plate that covers the transmission to help prevent grass from packing around it. See Figure 123.

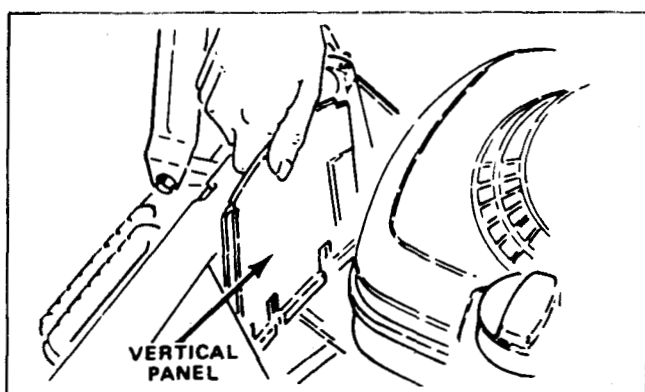


Figure 123

It is important to keep the screens and air passages clear of debris to allow free airflow. If the screens are obstructed, the quality of cut will degrade.

Cutting Deck - Adjustments

IMPORTANT: The following two adjustments can be time consuming and should *only* be performed if blade position affects safety or quality of cut.

There are two critical dimensions that also affect quality of cut: blade position and blade tip clearance. A description of each is provided below.

Blade Position refers to the vertical position of the blade at the tip with respect to the bottom lip of the deck. See Figure 124.

The specification for blade height with respect to the bottom lip of the deck is given below.

<u>Area</u>	<u>Blade Position</u>
@ Front	Flush with housing bottom
@ Rear	$6.4 \pm 1.5 \text{ mm } (.250 \pm .060")$
@ Sides	Even with opposite side within $1.5 \text{ mm } (.060")$

If the blade is too high, quality of cut will degrade. If the blade is too low, operator safety may become a concern.

If the blade is too low at any point within the housing, the engine should be shimmed to bring it within the specification. Shim the engine using shim washers between the engine and the deck as shown in Figure 125.

Always use Loctite® on engine fasteners when reinstalling. Recheck blade position after engine mounting screws are tightened to the proper torque.

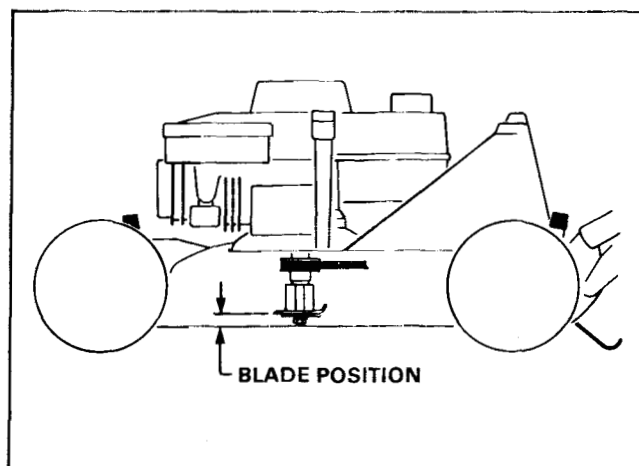


Figure 124

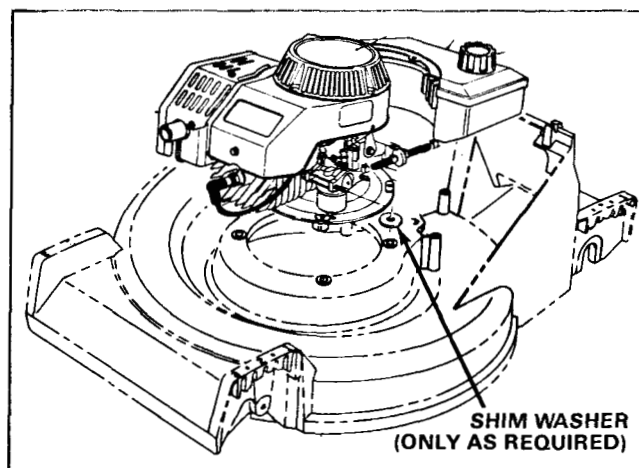


Figure 125

CAUTION! Do not shim the engine more than 1.5 mm (.060"). If the dimension is still out of specification after shimming, deck replacement may be required.

If the height of the blade is too high within the housing, the engine mounting pads on the cutting deck can be lowered slightly. Using a caliper, measure the original height of the mounting pad. Using a mill or file, remove

Cutting Deck - Adjustments (cont'd)

an amount of material from the pad equivalent to 20% of the movement necessary at the blade tip. Check the mounting pad height occasionally to make certain you are not removing too much material. Be sure the mounting pad is flat when complete. Recheck the blade tip clearance to insure it is within specification after adjusting the engine mounting pads. Always use Loctite® when re-installing engine mounting bolts.

Blade Tip to Housing Clearance is the distance between the end of the blade and the side of the deck (and the discharge ramp). See Figure 127. If this distance is too close, the blade tip may contact the side of the deck. If the clearance is too great, clumps or streaks of grass clippings may result. It is also possible that the bag will not fill completely since the deck will lose some of its vacuum around the circumference of the deck.

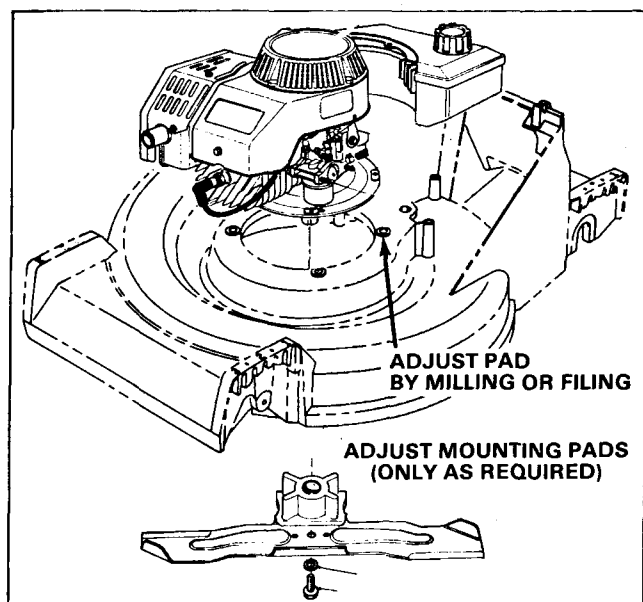


Figure 126

CAUTION! Do not adjust the engine mounting pad more than 1.5 mm (.060"). If the dimension is still out of specification after adjusting the engine mounting pad, deck replacement may be required.

The specification for blade to tip housing clearance is given below.

Blade Tip Clearance
 $4.3 \pm 2 \text{ mm } (.170 \pm .080")$

If the clearance is not greater than 2.3 mm (.090") around the circumference of the deck, loosen the engine bolts, center the engine, then retighten the bolts. Recheck to be sure that the blade to tip clearance is now within the specification.

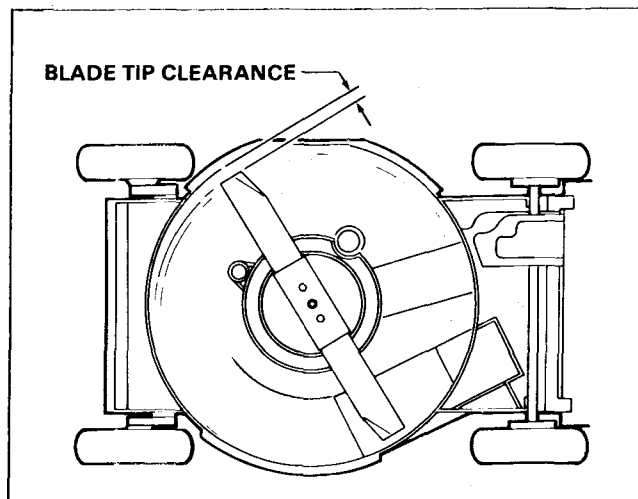


Figure 127

If after centering the engine the clearance is still not consistent around the circumference, the deck may be warped do to manufacture, "squeeze" type forklifts, or operator abuse. Check with the Toro Consumer Service Department if blade tip to deck clearance is still out of specification.

NOTE: The distance from the blade tip to the discharge ramp can have a significant effect on quality of cut. For best performance, adjust the ramp as close to the blade tip as possible but not less than 2.3 mm (.090").

Cutting Deck - Repair

If a foreign object is picked up by the blade, the deck may be damaged. Small cracks may be repaired by welding. If cracks are large, or if pieces are missing, the deck should be replaced.

CAUTION! Because the deck is aluminum, it is imperative that only a welder experienced in aluminum welding be used. If not, damage to the deck or compromised structural integrity may result.

A #380 aluminum welding rod used in conjunction with an inert gas type welder is recommended.

SECTION 9 GRASS BAG AND DISCHARGE DOOR

GRASS BAG

Grass Bag - Construction

The bag used on Toro Vacu-Power units consists of two pieces, the bag frame and the bag. See Figure 128.

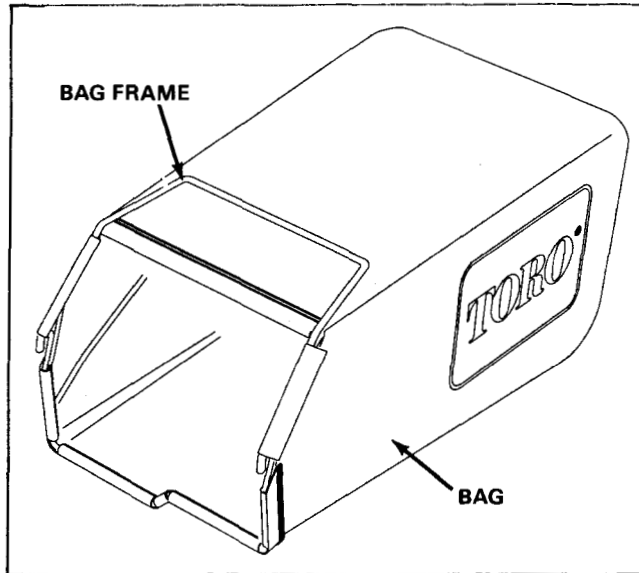


Figure 128

The bag frame is one piece. It is important that the bag frame fits properly in the area of the deck to prevent objects from flying out. If deformed, replacement is recommended. However, welding is an acceptable fix provided it does not compromise the integrity of the fit between the bag and the bag door.

The bag material is polyester with an open type weave that allows it to "breathe". Washing the bag periodically is recommended to help maintain good airflow through the bag. The left side and back of the bag (where most objects are thrown) are doubled material. The bag is fastened to the bag frame by means of plastic molding that is sewn to the bag. These plastic pieces are not available separately.

CAUTION: The bags that Toro uses meet stringent requirements by ANSI, the American National Standards Institute. To insure quality and safety, do not use substitutes.

Grass Bag Assembly - Disassembly

1. Remove the bag by prying the plastic molding off the frame.
2. Carefully inspect the bag inside and out to insure its integrity.

Grass Bag Assembly - Assembly

1. Slip the bag frame into the bag. Make sure that the Toro logos are up and that the plastic molding aligns properly with the front of the frame. Make sure that the handle is on the outside of the bag.
2. Gradually work the molding over the bag frame until it is fully seated.
3. Place the bag assembly onto the mower and check for leaks around the bag front. Correct as necessary.

DISCHARGE DOOR

Discharge Door - Operation

See Figure 129.

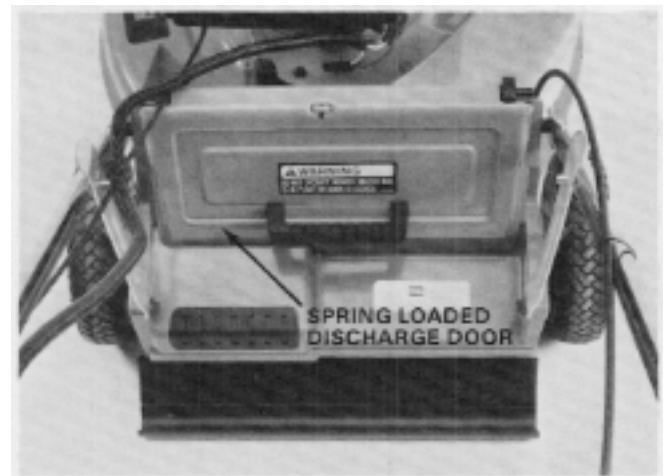


Figure 129

CAUTION! The bag door is an important component as it helps protect the operator from thrown objects. Always make sure that the door is closed or the chute is installed before mowing. Never operate the mower if the door is damaged or malfunctioning.

CAUTION! Never open the door while the engine is running.

The bag door has a number of purposes. When used in the mulching mode it acts as a shield to help protect the operator from flying debris. In the bagging mode, it serves as the upper top half of the bag and seals off the bag. In the side discharge mode, its spring action retains the side discharge in place.

The door pivots on hinge pins which support plastic bushings for long life. It is spring loaded in the closed position to help insure operator safety and the door is sealed along the sides and bottom by foam adhesive

Discharge Door - Operation (cont'd)

"weather stripping". It is important that this "weather stripping" be in tact or dust and fine particles will exit the bag area during mowing. Along the hinge line is a special plastic seal which conforms to the shape of the top of the door. The seal is also important to prevent the escape of fine particles.

The bag door is also the location of a safety decal which tells the operator not to mow with the door open unless the bag or side discharge chute is in place. If installing a new bag door, make sure that the decal is in its proper location.

Discharge Door - Disassembly

1. Remove the spark plug lead to prevent accidental starting.
2. Drain the gas from the unit.
3. Tip the mower on its right side and release the spring tension using a piece of small rope or insulated electrical wire. See Figure 130.



Figure 130

4. Remove the two flanged head self-tapping screws securing the screen panel to the housing and remove the screen panel.
5. Remove the plastic transmission cover.
6. Slip the spring from the door cable and pull the door cable out through the top of the door.
7. Remove the two socket head capscrews securing the hinge clamps to the deck and remove the hinge clamps.
8. Remove the door assembly complete with hinge pins and bushings and also the plastic door seal.

9. Pull the hinge pins and plastic bushings from the door.
10. If necessary, remove the door handle and door brace from the door by removing the two flanged head screws.
11. Inspect all parts for damage and/or wear and replace as necessary.

Discharge Door - Assembly

See Figure 131.

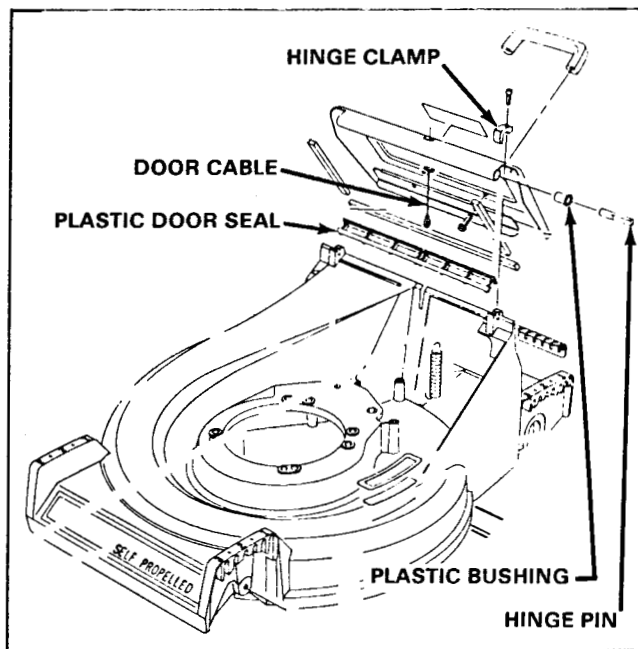


Figure 131

1. If necessary, install new seals along the side and bottom of the bag door. See Figure 132.

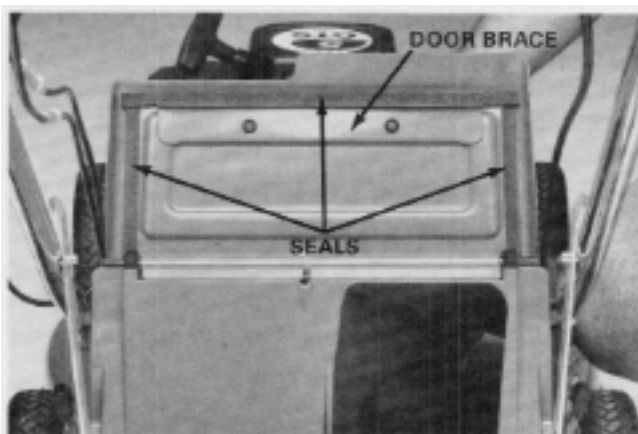


Figure 132

2. Place the door brace into position, flanged side down or away from the hinge and secure to the handle using the two flanged head screws as shown in Figure 132.

3. Slide a plastic bushing, flanged end last, into the hinge area on the door.
4. Insert a hinge pin into each hinge bushing, flat side out.
5. Place the plastic door seal into position on the deck making sure that the groove for the door cable faces the back of the door.
6. Place the door assembly into position on top of the door seal and the housing. Secure with the hinge clamps and socket head capscrews, one set per side. Check to make sure that the door operates freely.
7. Slip the door cable through the hole in the top of the door and slip the spring on, making sure that the J hook on the bottom faces the right side of the mower.
8. Tip the mower on its side and pull the bottom of the spring into position using a thin rope or insulated electrical wire. See Figure 130.
9. Check for proper operation of the spring by watching from the bottom of the unit while opening and closing the door.
10. Install the black plastic transmission cover.
NOTE: It may be necessary to rotate the transmission back slightly to provide clearance. Make sure that the belt slips into the grooves on the transmission cover.
11. Fasten the screen panel to the housing using the two flanged head self-tapping screws. Make sure that the top edge of the screen panel fits underneath the lip at the top of the housing.

SECTION 10 SIDE DISCHARGE CHUTE (Optional)

Side Discharge Chute - Operation

The side discharge chute when attached, takes clippings, propelled rearward by the blade, and redirects them off to the left side of the mower. It allows the operator to mow without bagging grass.

While the Vacu-Power mower will do a very good job at mulching in light cutting conditions, the side discharge chute is recommended for heavier cutting conditions. It disperses the clippings over a 3/4-1 meter (2-3 foot) area on the left side of the mower. Best results are obtained when the mower is operated at full throttle.

Construction of the side discharge chute is simple. The chute itself is of molded plastic. Affixed to it is a bracket that allows it to be clamped at each end of the door hinge, the same place that the bag attaches.

Side Discharge Chute - Disassembly

1. Remove the machine screws and nylon locknuts securing the chute hanger bracket and the stress plate to the chute. Remove the hanger bracket and the stress plate.
2. Repair or replace any damaged parts.

Side Discharge Chute - Assembly

1. Place the chute hanger bracket and stress plate into position as shown in Figure 133. Secure with two washer head capscrews and nylon locknuts.

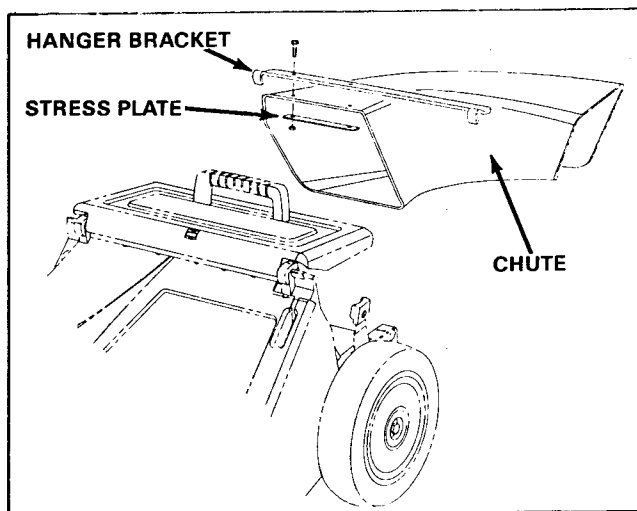


Figure 133

2. Place the side discharge chute onto the mower and check for correct fit around the perimeter of the chute. Loosen the machine screws and reposition the hanger bracket if necessary to ease removal and installation of the chute.

SECTION 11 - DETHATCHER (Optional)

Dethatcher - Safety Information

1. Operate your dethatcher only when there is adequate light.
2. Remove all debris such as wire, bottles, cans, sticks, and stones from the area to be dethatched.
3. Always remove the spark plug wire and disconnect the battery on electric start mowers before servicing your mower dethatcher.
4. Before each use, check to make sure all fasteners are tight, tines are functioning properly, and safety wires are in place.
5. Reduce speed and cautiously dethatch any area (rough ground) of the turf that may have hidden hazards.
6. Do not leave your mower running while unattended - stop the engine and remove the ignition key if so equipped.
7. Make a visual check of the dethatcher stop bracket - it must be in the proper location and tight!
8. Store dethatcher on the floor to prevent any injuries from occurring.

Dethatcher - Operation

When dethatching, an overlap or cross-hatch pattern is recommended. While all lawns are different, the ideal amount of thatch left on the lawn would be about 3 mm (1/8") thick. Very dense lawns generally require more frequent dethatching than do less dense lawns.

Grass should be less than 7.5 cm (3") tall for proper tine action. The tines should deflect back and then independently "flip" the thatch up and forward. If the tines tend to drag, raise them a little and recheck the "flipping" action. Adjust the tine tray up or down as necessary for proper action.

Dethatcher - Introduction

CAUTION! Carefully read and follow safety information (Cautions) in this manual and the Operator's Manual which came with your mower to prevent injury or damage.

NOTE: References to RIGHT SIDE and LEFT SIDE are made while standing in the operator's position - behind the dethatcher (or the mower).

When correctly assembled and adjusted, and with proper care, your dethatcher will provide years of trouble-free lawn maintenance.

Arrange each kind of hardware into a group to ease assembly.

NOTE: Locknuts must be used where specified. They have a slightly oblong hole or a fiber insert and are domed on one end.

Tools required for assembly:

- 1-screwdriver (flat)
- 1-pair of pliers (slip-joint recommended)
- 1-hammer
- 1-7/16" wrench
- 1-1/2" socket
- 1-9/16" socket
- 1-3/4" socket
- 1-socket wrench handle
- 1-medium side adjustable wrench (optional)

Dethatcher - Assembly

1. Install the 6 tines to the tine tray by laying the tray on a flat surface with the flanges facing up. See Figure 134.

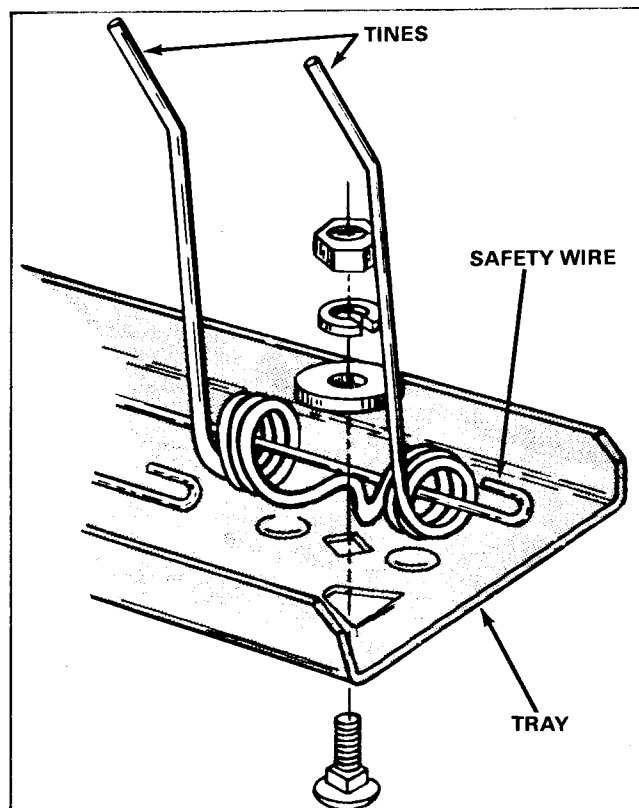


Figure 134

Dethatcher - Assembly (cont'd)

- Nest each tine loop between the embossed "dimples" with bent tips facing forward - toward tab cutouts "A" and secure with one 5/16" X 3/4" carriage bolt, a special washer, one 5/16" lock washer and a 5/16" hex nut. Tighten securely.
- Install both safety wires through the tine coils and bend the ends over to secure (use pliers).

CAUTION! Failure to install safety wires can result in personal injury if a tine should disengage from the tine tray.

- See Figure 135 to identify the type of front pivot arms which mount the wheels to your mower.

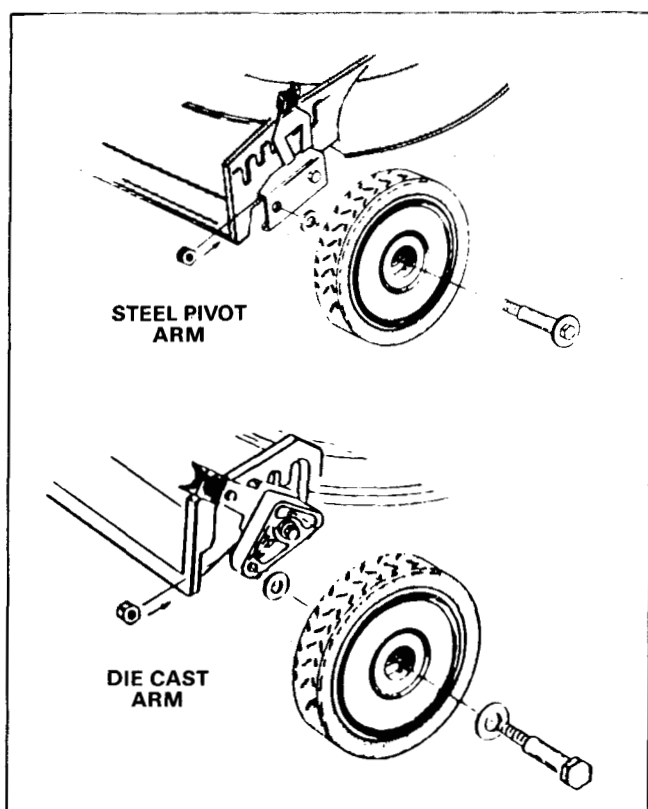


Figure 135

Once you've identified the pivot arm used on your mower, refer to the following table to determine which stop bracket to use.

Pivot Arm	Stop Bracket
Steel	R1417-01
Die Cast	B4055-01

- Turn the tine tray right side up and install the frame bar, right hand mount bar, and left hand mount bar to the inside of tabs "A" with offsets

it toward the center of the tray. See Figures 136 and 137.

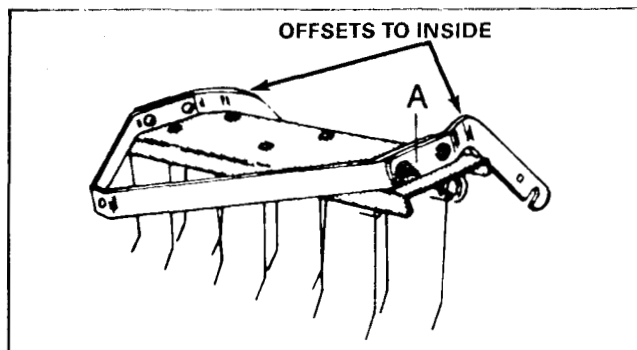


Figure 136

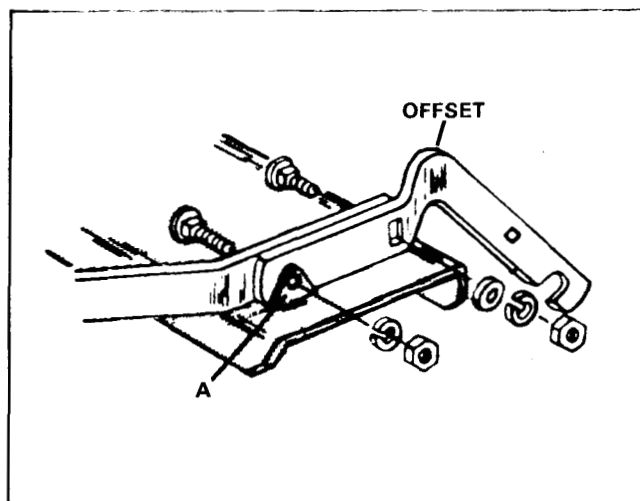


Figure 137

- Insert one 5/16" X 1" carriage bolt, threads FACING OUTWARD, through the FRONT square hole in the left side of the frame bar, the FRONT square hole in the left-hand bar and through the round hole in the left-hand tab "A" on the tine tray. Secure with one 5/16" lock washer and a 5/16" hex nut.
- Follow the same procedure for the right side.
- Install a 5/16" X 1" carriage bolt, threads FACING OUTWARD, through the rear square hole in the right-hand and the left-hand side of the frame bar and secure with two 5/16" flat washers, 5/16" lock washers and 5/16" hex nuts. Tighten these fasteners securely.
- See Figure 138. Assemble the wheel mount bracket to the frame bar and one 5/16" X 3/4" carriage bolt inserted through the square hole and secured with one 5/16" lock washer, and one 5/16" hex nut - on the inside of the frame bar. Tighten securely.

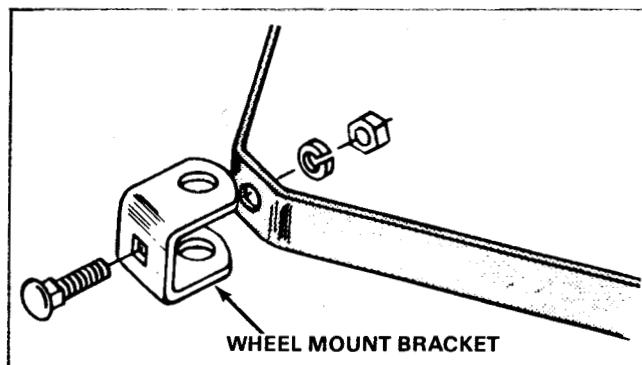


Figure 138

10. See Figure 139. Place one latch against the outside of both mount bars with the tab up (and facing outward) and the long slot located in front of the square hole near the mounting slot. Secure each latch with one 1/4" X 3/4" carriage bolt - threads facing inward, a special washer, O-ring, special washer and 1/4" hex locknut.

CAUTION! Tighten both locknuts until there is SOME friction when sliding the latches against the mount bars - do not over-tighten!

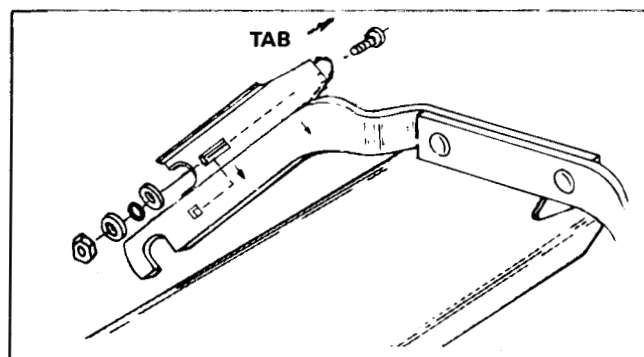


Figure 139

11. See Figure 140. Assemble the gauge wheel and axle to the wheel mount bracket as follows: slide one 1/2" ID flat washer on to the short end of axle, followed by the gauge wheel, with hub facing out, and another 1/2" flat washer, and then "tap" the push nut on the shaft with a hammer.
12. Next, insert the two 1/2" ID nylon bearings in the round holes (from inside) in wheel mount bracket with the flange surface on each bearing facing inward. Position the axle bushing between the flange surfaces of bearings and slide the long end of wheel axle up through the bracket, bearings, and the bushing, then secure with 5/16" X 1/4" set screw.

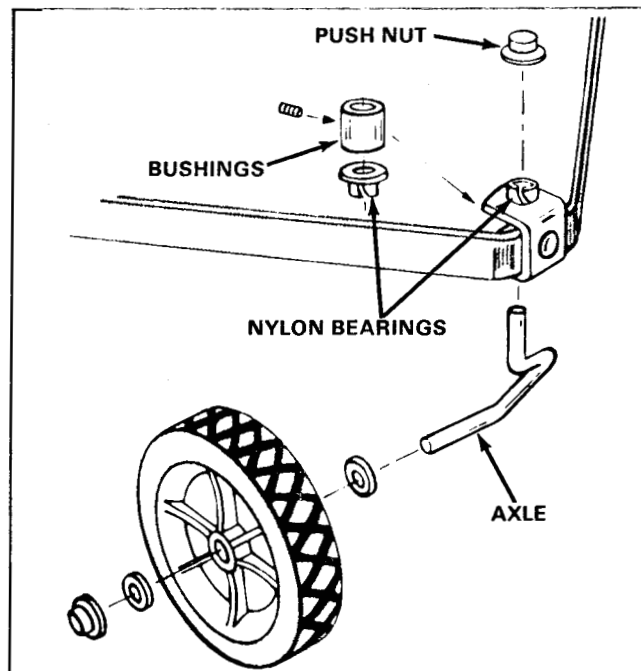


Figure 140

13. Finally, "tap" the remaining push nut down on the end of the axle with a hammer.
14. See Figure 141. Remove the large shoulder bolt, thin washer and locknut from the left FRONT wheel of mower. (They will not be reused as long as you use the dethatcher. Save these parts for future use.)

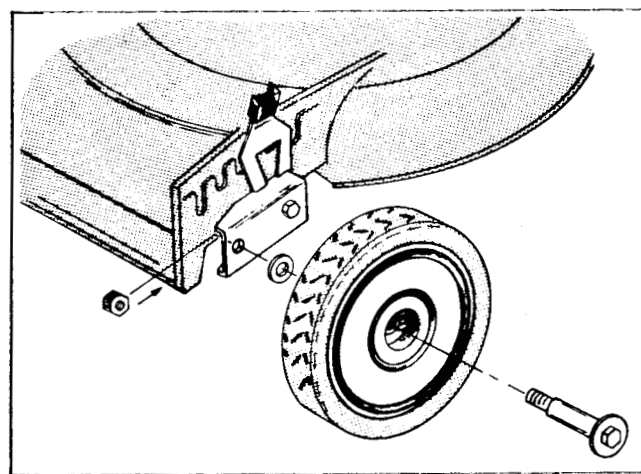


Figure 141

15. Repeat this procedure on the right side. Next, determine which type front pivot arms (for wheels) your mower is equipped with and proceed as follows. (Refer to Figure 136.)
16. Reinstall the LEFT mower wheel as follows (see Figures 142 and 143).

Dethatcher - Assembly (cont'd)

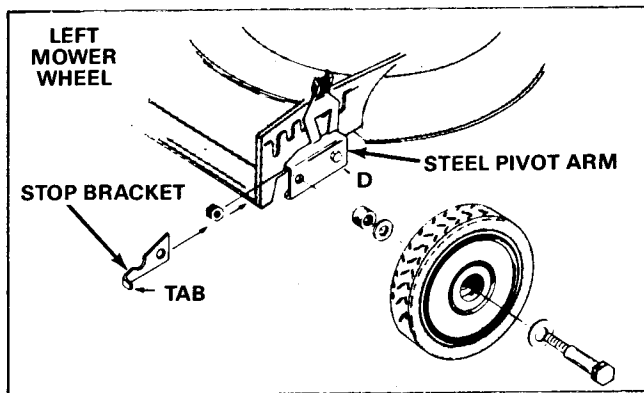


Figure 142

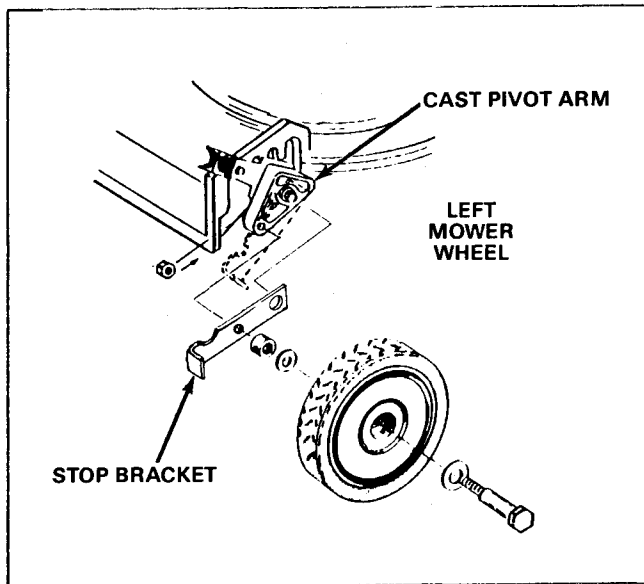


Figure 143

First, slip one 1/2" flat washer on one new shoulder bolt and insert the bolt through the hole in mower wheel (from "outside" surface of wheel). Next, slip on a 3/8" flat washer, frame spacer, and stop bracket.

17. Reinstall the right side wheel with new shoulder bolt, 1/2" flat washer, 3/8" flat washer, frame spacer, and 3/8" locknut but not using a stop bracket.

Now, insert this completed assembly through the hole in the wheel mount casting. Secure with a new 3/8" hex locknut supplied and tighten securely.

18. See Figures 144 and 145. Reinstall the right side wheel with new shoulder bolt, 1/2" flat washer, 3/8" flat washer, and frame spacer, and locknut, but not using a stop bracket.

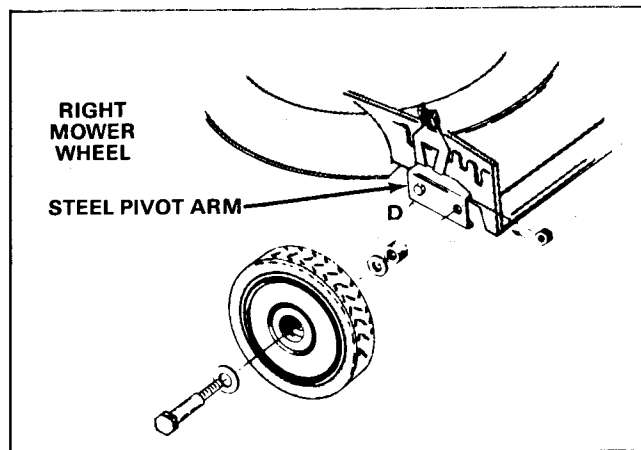


Figure 144

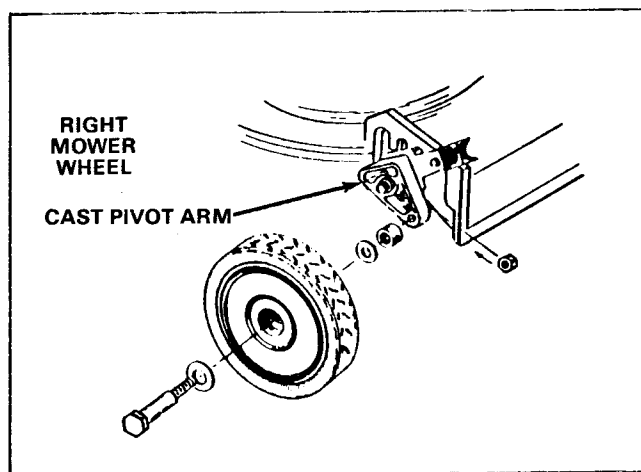


Figure 145

Dethatcher - Installation

See Figure 146. Install your dethatcher by sliding both latches up to clear the mounting slots on the mount bars. Then position the front wheel adjustments on your mower to the lowest cutting height and place the mounting slots over the frame spacers. Then slide the latches downward locking the thatcher to the mower. Check all fasteners for tightness.

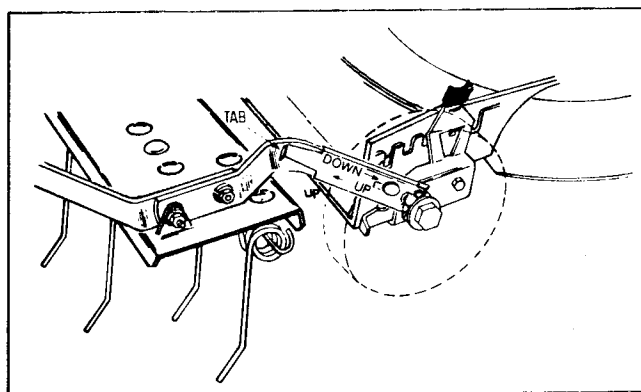


Figure 146

Dethatcher - Adjustment

See Figures 147 and 148. With the dethatcher mounted to your mower, position both units over a smooth flat surface such as a sidewalk, driveway or garage floor. Adjust the mower height (check your operator's manual for correct procedures) to the desired height-of-cut. With the gauge wheel directly under the wheel mount brackets, loosen the set screw in axle bushing and adjust the frame bar until the tine tips are approximately 1/2" above the flat surface in the "free" position, and touch the surface when deflected rearward. Tighten the set screw.

NOTE: The dethatcher and mower heights can be adjusted independently of each other.

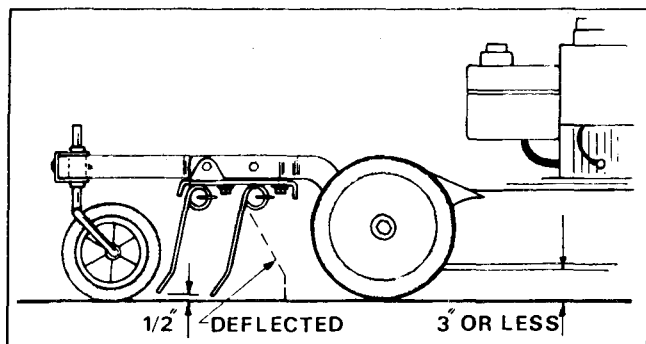


Figure 147

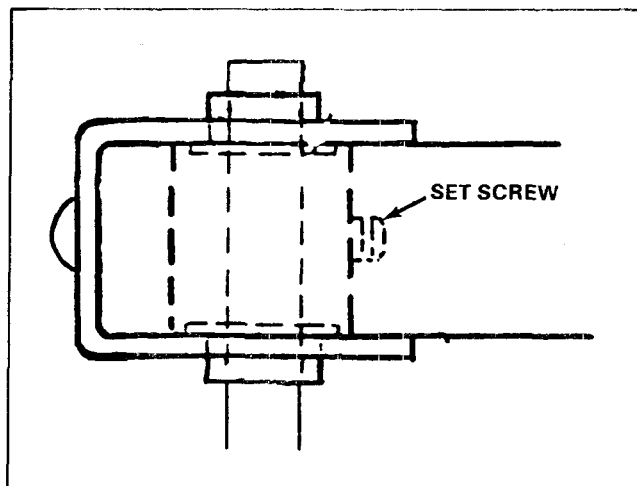


Figure 148

Dethatcher - Maintenance

Before each use, check all fasteners for tightness. Replace any missing fasteners before using.

Replace any worn or broken parts (including tines). Lubricate all pivot points and keep the dethatcher stored in a dry location with the tines resting on the ground. Although the dethatcher is generally a maintenance free steel product, it can rust. To prevent or eliminate rust on the tray, mount bars, or frame bar, sand the area lightly and apply a coat of enamel paint.

SECTION 12 ENGINES

Vacu-Power Mowers are powered by a variety of engines manufactured by a number of different companies. Manuals covering the maintenance and service of the each of these engines are available through the manufacturer or the distributor. Because it would be redundant to cover that information in this manual, we ask that you obtain the particular manual you need from the following sources:

The Toro Company
Consumer Service Dept.
8111 Lyndale Avenue South
Bloomington, MN, USA 55420
Phone: 612-887-8255

Briggs and Stratton Corporation
Milwaukee, WI, USA 53201
Phone: 414-259-5333

Tecumseh Products Company
Engine and Transmission Group Service
Division
Grafton, WI, USA 53024
Phone: 414-377-2700

If you are in doubt of which engine is on your mower use the following table:

<u>Model #</u>	<u>Engine</u>
26551	Tecumseh TVS840
26562	B & S 5 HP Quantum
26682	Toro M120X 2-Cycle
26622	Toro V140 OHV
26624	Toro V140 OHV Key-Lectric
26641	Tecumseh V140 OHV
26642	Tecumseh V140 OHV