TORO SNOW COMMANDER SERVICE MANUAL

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TORO®

Snow Commander
Service Manual

ABOUT THIS MANUAL

This service manual was written expressly for Toro servicing dealers. The Toro Company has made every effort to make the information in this manual complete and correct.

This manual was written with the assumption that the reader has basic mechanical knowledge and skills. This book contains material covering the Toro Snow Commander models produced in 2001 and 2002, and may be specified for use on products built after 2002 that are similar in design.

We hope you find this manual a valuable addition to your service shop. If you have questions or comments regarding this manual, please contact us at the following address:

The Toro Company
Consumer Service Department
8111 Lyndale Avenue South
Bloomington, MN 55420-1196

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

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MAINTENANCE

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Introduction

Read this manual carefully to learn how to operate and maintain your product properly. The information in this manual can help you and others avoid injury and product damage. Although Toro designs and produces safe products, you are responsible for operating the product properly and safely.

Engine

The Toro Snow Commanders are powered by a high output version of the R tek engine (Figure 1). The main difference between the standard R tek and the version used on the Snow Commander is in the piston and cylinder.

The piston has two additional square ports (Figure 2), which line up with two grooves machined in the cylinder wall (Figure 3). As the piston goes down and compresses the fuel/air charge in the crankcase, the ports in the piston uncover the grooves in the cylinder wall. This provides extra area for the fuel charge to move to the firing chamber. The result is a larger fuel charge, which makes more power.

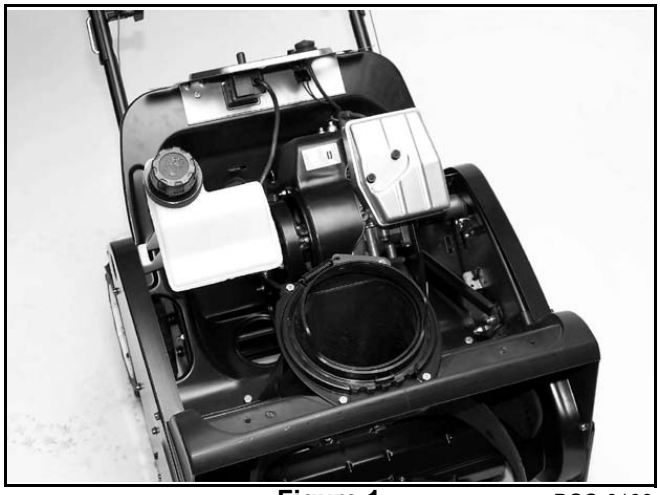


Figure 1 DSC-0138

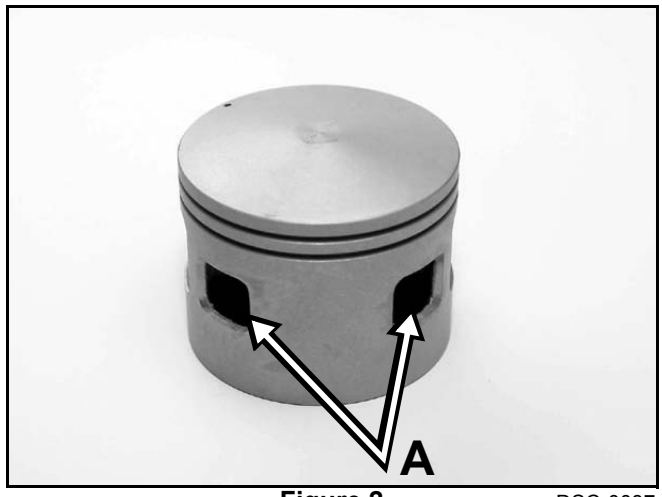


Figure 2 DSC-0037

(A) Ports

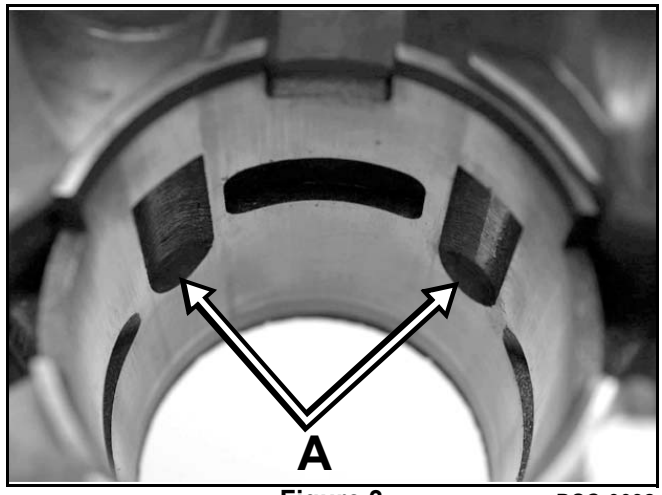


Figure 3 DSC-0032

(A) Grooves

All service procedures and techniques are the same as those on the other R tek engines. See E Engine Service Manual, Form #492-0647.

GENERAL INFORMATION

Identification and Ordering

Whenever you need service, genuine Toro parts, or additional information, contact an Authorized Service Dealer or Toro Customer Service and have the model and serial numbers of your product ready. Figure 1 illustrates the location of the model and serial numbers on the product.

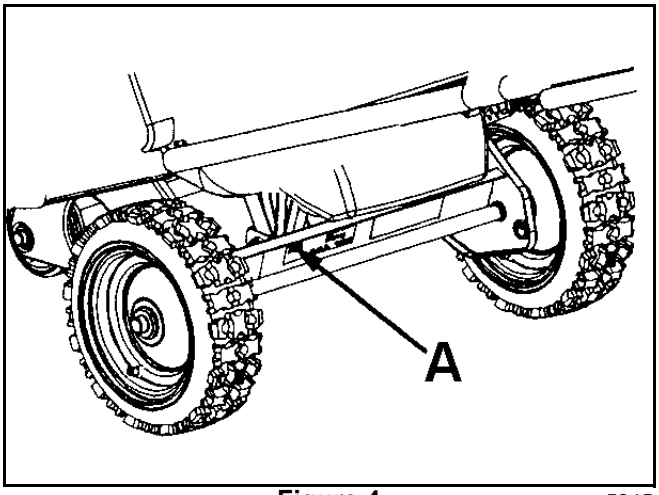


Figure 4 m-5045

(A) Location of the model and serial numbers

Provide the full model and serial number to any Authorized Toro Service Dealer. They will be able to look up the part number and provide you with price quotes and availability. The factory does not sell parts or products direct.

Should you wish to obtain your own parts catalog or a replacement owners manual, they can be obtained from the factory.

Be prepared to supply the complete model and serial number and contact us at the following address:

The Toro Company
8111 Lyndale Ave. S.
Bloomington, MN 55420
Phone: 1-800-348-2424

Follow the instructions to contact the parts dept. The parts department staff will be happy to assist you in obtaining replacement manuals.

General Safety Instructions
(Reproduced from Operator's Manual)

This manual identifies potential hazards and has special safety messages that help you and others avoid personal injury and even death. ***Danger***, ***Warning***, and ***Caution*** are signal words used to identify the level of hazard. However, regardless of the hazard, be extremely careful.

Danger signals an extreme hazard that *will* cause serious injury or death if you do not follow the recommended precautions.

Warning signals a hazard that *may* cause serious injury or death if you do not follow the recommended precautions.

Caution signals a hazard that may cause minor or moderate injury if you do not follow the recommended precautions.

This manual uses two other words to highlight information. **Important** calls attention to special mechanical information and **Note:** emphasizes general information worthy of special attention.

Safety

To ensure maximum safety and best performance, and to gain knowledge of the product, it is essential that you and any other operator of the snowthrower read and understand the contents of this manual before the engine is ever started.

⚠ This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

Improperly using or maintaining this snowthrower could result in injury or death. To reduce this potential, comply with the following safety instructions.

Safe Operating Practices

The following instructions have been adapted from the ANSI/OPEI B71.3–1995 standard and the ISO 8437:1989 standard. Information or terminology specific to Toro snowthrowers is enclosed in parenthesis.

Training

- Read the operator's manual carefully. Be thoroughly familiar with the controls and the proper use of the equipment. Know how to stop the unit and disengage the controls quickly.
- Never allow children to operate the snowthrower. Never allow adults to operate the snowthrower without proper instruction.
- Keep the area of operation clear of all persons (particularly small children) and pets.
- Exercise caution to avoid slipping or falling.

Preparation

- Thoroughly inspect the area where you will use the snowthrower. Remove all doormats, sleds, boards, wires, and other foreign objects.
- Release the control bar to disengage the rotor blades before starting the engine.
- Do not operate the snowthrower without wearing adequate winter garments. Wear footwear that will improve your footing on slippery surfaces.
- Handle fuel with care; it is highly flammable.
  - Use an approved fuel container.
  - Never add fuel to a running or hot engine.
  - Fill the fuel tank outdoors with extreme care. Never fill the fuel tank indoors.
  - Replace the fuel tank cap securely and wipe up any spilled fuel.
- Use only the power cord supplied with the snowthrower and a receptacle appropriate for use with the power cord for electric-start motors.
- Never attempt to make any adjustments while the engine is running, except where specifically recommended by Toro.
- Let the engine and the snowthrower adjust to the outdoor temperature before starting to clear snow.
- Operating any powered machine can result in foreign objects being thrown into the eyes. Always wear safety glasses or eye shields while operating, adjusting, or repairing the snowthrower.

Operation

- Do not put hands or feet near or under rotating parts. Keep clear of the discharge opening at all times.
- Exercise extreme caution when crossing gravel drives, walks, or roads. Stay alert for hidden hazards or traffic.
- Do not attempt to clear snow from a crushed-rock or gravel surface. This product is intended for use only on paved surfaces.
- After striking a foreign object, stop the engine, remove the ignition key, thoroughly inspect the snowthrower for any damage, and repair the damage before operating the snowthrower.
- If the unit should start to vibrate abnormally, stop the engine and check immediately for the cause. Vibration is generally a warning of trouble.
- Stop the engine whenever you leave the operating position, before unclogging the discharge chute, and when making any repairs, adjustments, or inspections.
- When cleaning, repairing, or inspecting, make certain that the rotor blades and all moving parts have stopped.

- Do not run the engine indoors, except when starting it and for moving the snowthrower in or out of the building. Open the outside doors; exhaust fumes are dangerous.
- Do not clear snow across the face of slopes. Exercise extreme caution when changing direction on slopes. Do not attempt to clear steep slopes.
- Never operate the snowthrower without proper guards, plates, or other safety protective devices in place.
- Never operate the snowthrower near glass enclosures, automobiles, window wells, and drop-offs without properly adjusting the snow discharge angle. Keep children and pets away.
- Do not overload the machine capacity by attempting to clear snow at too fast a rate.
- Look behind and use care when backing up with the snowthrower.
- Never direct the discharge at bystanders or allow anyone in front of the unit.
- Never operate the snowthrower without good visibility or light. Always be sure of your footing, and keep a firm hold on the handle. Walk; never run.

Maintenance and Storage

- Check all fasteners at frequent intervals for proper tightness to be sure that the equipment is in safe working condition.
- Never store the machine with fuel in the fuel tank inside a building where ignition sources are present, such as hot water and space heaters and clothes dryers. Allow the engine to cool before storing in any enclosure.
- Always refer to this operator's manual for important details if the snowthrower is to be stored for an extended period.
- Maintain or replace safety and instruction labels when necessary.

Toro Snowthrower Safety

The following list contains safety information specific to Toro products or other safety information that you must know.

- *Rotating rotor blades can injure fingers or hands.* Stay behind the handles and away from the discharge opening while operating the snowthrower. *Keep your face, hands, feet, and any other part of your body or clothing away from moving or rotating parts.*
- Before adjusting, cleaning, repairing, and inspecting the snowthrower, and before unclogging the discharge chute, *stop the engine, remove the key, and wait for all moving parts to stop.*
- Use a stick, *not your hands*, to remove obstructions from the discharge chute.
- *Before* leaving the operating position, stop the engine, remove the key, and wait for all moving parts to stop.
- Do not wear loose-fitting clothing that could get caught in moving parts.
- If a shield, safety device, or decal is damaged, illegible, or lost, repair or replace it before beginning operation.
- Also, tighten any loose fasteners.
- *Do not* smoke while handling gasoline.
- *Do not* use the snowthrower on a roof.
- Do not touch the engine while it is running or soon after it has stopped because the engine may be hot enough to cause a burn.
- Perform only those maintenance instructions described in this manual. Before performing any maintenance, service, or adjustment, stop the engine, remove the key. If major repairs are ever needed, contact your Authorized Service Dealer.
- Do not change the governor settings on the engine.
- When storing the snowthrower for more than 30 days, drain the fuel from the fuel tank to prevent a potential hazard. Store fuel in an approved fuel container. Remove the key from the ignition switch before storing the snowthrower.

To ensure the best performance and safety, purchase only genuine Toro replacement parts and accessories.

Safety and Instruction Decals

Safety decals and instructions are easily visible to the operator and are located near any area of potential danger. Replace any decal that is damaged or lost.

61-4790 (Electric-start model only)

104-0863 (Electric-start model only)

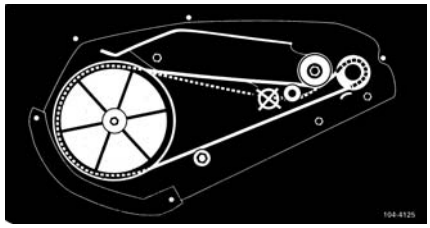
104-0874

104-2767

104-2775

104-4106 (Recoil-start model only)

104-4125



104-4135

Fuel and Oil Requirements

Mixing Gasoline and Oil

This Toro snowthrower is powered by a two-cycle engine that requires a 50:1 gasoline-to-oil mixture.

Use only clean, unleaded gasoline no more than 30 days old and with an octane rating of 87 or higher. Using unleaded gasoline reduces combustion chamber deposits and promotes longer spark plug life.

Engines certified to comply with U.S. EPA emission regulations for ULGE engines are certified to operate on a mixture of regular unleaded gasoline and oil, include the following emission control system(s): EM and TWC (if equipped), and do not include any user-adjustable features.

Important *Do not* use methanol, gasoline containing methanol, gasohol containing more than 10% ethanol, premium gasoline, or white gas. Using these fuels can damage the fuel system.

Important *Do not* use an automotive oil (such as SAE 30 or 10W30), a two-cycle oil that is not NMMA TCW-certified, or a fuel mixed at the wrong gasoline-to-oil ratio. This can cause engine damage not covered under the Toro warranty.

DANGER

In certain conditions, gasoline is extremely flammable and highly explosive. A fire or explosion from gasoline an burn you and others and cause property damage.

- **Fill the fuel tank outdoors, in an open area, and when the engine is cold. Wipe up any gasoline that spills.**
- **Do not fill the fuel tank completely full. Add gasoline to the fuel tank until the level is 1/4 to 1/2 in. (6 to 13mm) below the bottom of the filler neck. This empty space in the tank allows the gasoline to expand.**
- **Never smoke when handling gasoline, and stay away from an open flame or where a spark may ignite gasoline fumes.**
- **Store gasoline in an approved fuel container and keep it out of the reach of children.**
- **Never buy more than a 30-day supply of gasoline.**

DANGER

When fueling under certain circumstances, a static charge can develop igniting the gasoline. A fire or explosion from gasoline can burn you and other and damage property.

- **Always place gasoline containers on the ground and away from your vehicle before filling.**
- **Do not fill gasoline containers inside a vehicle or on a truck or trailer bed because interior carpets or plastic truck bed liners may insulate the container and slow the loss of any static charge.**
- **When practical, remove gas-powered equipment from the truck or trailer and refuel the equipment with its wheels on the ground.**
- **If this is not possible, then refuel such equipment on a truck or trailer from a portable container, not from a gasoline dispenser nozzle.**
- **If you must use a gasoline dispenser nozzle, keep the nozzle in contact with the rim of the fuel tank or container opening at all times until fueling is complete.**

Note: Use a fuel stabilizer/conditioner for all Toro gasoline-powered products during operation and storage. A fuel stabilizer/conditioner cleans the engine during operation and prevents gum-like varnish deposits from forming in the engine during storage. A fuel stabilizer/conditioner works best when you mix it with fresh gasoline. If you use *Toro 50:1 2-Cycle Oil (Fuel Stabilizer Added)*, you do not need to add a fuel stabilizer/conditioner.

Important Do not use fuel additives except a fuel stabilizer during storage. Do not use fuel stabilizers with an alcohol base, such as ethanol, methanol, or isopropanol.

1. Pour a half gallon (1.9 liters) of fresh, unleaded gasoline into an approved fuel container.

Note: Do not mix gasoline and oil in the fuel tank. Oil at room temperature mixes easier and more thoroughly than cold oil. Oil below 32°F (0°C) requires additional mixing.

2. Add the full amount of *Toro 50:1 2-Cycle Oil (Fuel Stabilizer Added)* or an equivalent high grade, NMMA TCW-certified two-cycle oil to the gasoline according to the chart below:

50:1 Gasoline-to Oil Ration Mixing Chart	
Gasoline	Oil
1 gallon (4 liters)	2.6 ounces (80 ml)
2 gallons (8 liters)	5.2 ounces (160 ml)
5 gallons (20 liters)	13 ounces (400 ml)

3. Install the cap on the fuel container.

4. Shake the container to mix the gasoline and oil thoroughly.

5. Slowly remove the cap and add the remaining amount of gasoline.

Filling the Fuel Tank

Important Do not overfill the fuel tank. The gasoline-and-oil mixture must have room to expand.

1. Clean around the fuel tank cap; do not allow snow or water to enter the fuel tank.

2. Remove the fuel tank cap and fill the fuel tank with the gasoline-and-oil mixture until the level is 1/4 to 1/2 in. (6 to 13mm) below the bottom of the filler neck. *Do not fill into the filler neck.*

3. Install the fuel tank cap securely and wipe up any spilled fuel.

Off-Season Storage

Emptying the Fuel Tank

1. Stop the engine and wait for all moving parts to stop.

2. Remove the key from the switch.

DANGER

Gasoline is highly flammable; it can ignite and cause serious personal injury.

- **Drain gasoline outdoors.**
- **Drain gasoline from a cold engine only.**
- **Wipe up any gasoline that may have spilled.**
- **Do not drain gasoline near any open flame or where gasoline fumes may be ignited by a spark.**
- ***Do not smoke* a cigar, a cigarette, or a pipe when handling gasoline.**

3. Remove the fuel tank cap and use a hand pump to pump the fuel into an approved fuel container.

4. Start the engine and allow it to run until it stops. Repeat this step two more times to ensure that the fuel tank and the carburetor are empty.

Storage

Important Store the snowthrower in its operating position and on its wheels. Storing the snowthrower on its front housing may cause hard starting.

WARNING

Gasoline fumes are highly flammable, explosive, and dangerous if inhaled. If you store the product in an area with an open flame, the gasoline fumes may ignite and cause an explosion.

Do not store the snowthrower in a house (living area), basement, or any other area where ignition sources may be present, such as hot water and space heaters, clothes dryers, furnaces, and other like appliances.

Preparing the Fuel System

1. Add a fuel stabilizer/conditioner to the fuel in the fuel tank as directed.

NOTE: If you use *Toro 50:1 2-Cycle (Fuel Stabilizer Added)*, you do not need to add a fuel stabilizer/conditioner.

2. Run the engine for five minutes to distribute the conditioned fuel through the fuel system.

3. Stop the engine, allow it to cool.

4. Use a hand pump to pump the fuel from the fuel tank into an approved fuel container, or run the engine until it stops.

5. Start the engine and run it until it stops.

6. Choke or prime the engine, start it a third time, and run the engine until it will not start.

7. Dispose of unused fuel properly. Recycle it according to local codes, or use it in your automobile.

Note: Do not store stabilized fuel for more than 90 days.

Preparing the Engine

Follow this procedure to prevent cylinder bore corrosion by closing both the intake and exhaust ports of the engine.

1. Slowly pull the recoil starter until you feel resistance due to compression pressure, then stop.

2. Release the starter tension gradually by allowing the rope to go back slowly to prevent the engine from reversing due to compression pressure.

Preparing the Snowthrower

1. Tighten all loose screws, bolts, and locknuts. Repair or replace any damaged parts.

2. Clean the snowthrower thoroughly.

3. Cover the snowthrower and store it in a clean, dry place out of the reach of children. Allow the engine to cool before storing it in any enclosure.

NOTE: Determine the left and right sides of the machine from normal operating position.

Operating Controls

The snowthrower control panel contains a key switch, a primer, a recoil starter, and an electric-start button (electric-start model only). The choke lever and the cord connection (for the electric-start model) are located below the control panel as show in Figure 5.

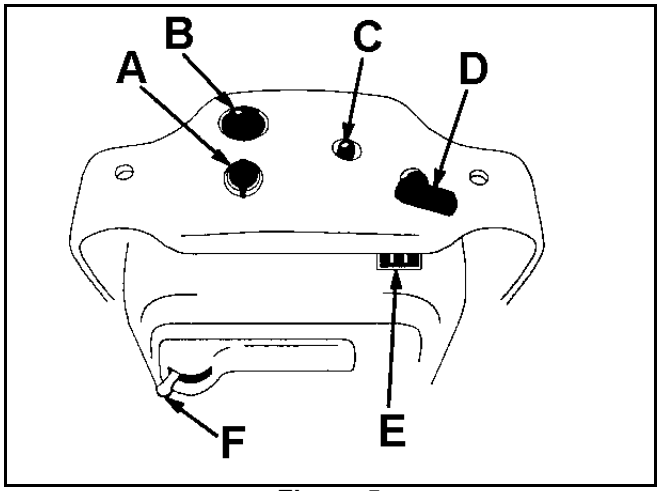


Figure 5 m-5067

(A) Key switch
(B) Primer
(C) Electric-start button (electric-start model only)
(D) Recoil start
(E) Cord connection (electric-start model only; underneath the control panel)
(F) Choke lever

Starting the Engine

1. Turn the key to the *On* position.

2. Move the choke lever to the right.

3. Cover the hole in the center of the primer with your thumb and push the primer in twice, pausing a moment between pushes. In extremely cold temperatures, repeat this step if necessary.

   Note: Take off your glove when you push in the primer so that air cannot escape from the primer hole.

   Note: Do not use the choke or the primer when starting a warm engine.

4. Start the engine by doing the following:

   For a recoil starter: Hold the snowthrower handle with one hand and pull the recoil starter vigorously with the other hand.

   For an electric starter:
   A. Connect the power cord to the snowthrower and to a standard household power outlet.

CAUTION

If you leave the snowthrower plugged into a power outlet, someone can inadvertently start the snowthrower and injure people or damage property.

Unplug the power cord whenever you are not starting the snowthrower.

   B. Push the starter button.

      Note: Run the electric starter no more than ten times at intervals of five seconds on, then five seconds off.

Important Running the electric starter extensively can overheat and damage the starter.

      Note: If the engine does not start after this series of attempts, wait at least 40 minutes to allow the starter to cool before attempting to start it again.

5. With the engine running, move the choke lever to the left slowly.

Stopping the Engine

Turn the key to the *Off* position and wait for all moving parts to stop before leaving the operating position.

CONTROLS LOCATION & OPERATION

Starting the Rotor Blades

To start the rotor blades, squeeze the control bar toward the handle until the snowthrower begins to pivot.

Stopping the Rotor Blades

To stop the rotor blades, release the control bar.

Note: When you release the control bar, the rotor blades stop, but the engine continues to run.

Starting the Traction Drive

To start the traction drive, slowly squeeze the control bar toward the handle. The front of the snowthrower pivots downward. When the rotor blades touch the ground, the snowthrower begins to move forward. Squeezing the control bar completely to the handle provides maximum traction.

Note: The traction is most aggressive (the traction speed is fastest) when the rotor blades are new. If you want to reduce the aggressiveness of the traction, refer to "Adjusting the Pivot Cable" on page 7 - 3.

Stopping the Traction Drive

To stop the traction drive, partially release the control bar until the rotor blades lift off the ground, disengaging the traction drive. Releasing the control bar completely stops both the traction drive and the rotor blades.

Adjusting the Discharge Chute

Chute Handle

On models equipped with a manual chute, move the chute handle left and right to adjust the direction of the snow stream (Figure 6). The chute deflector handle on top of the discharge chute controls the height of the snow stream. *Do not overtighten the chute deflector mounting locknuts.*

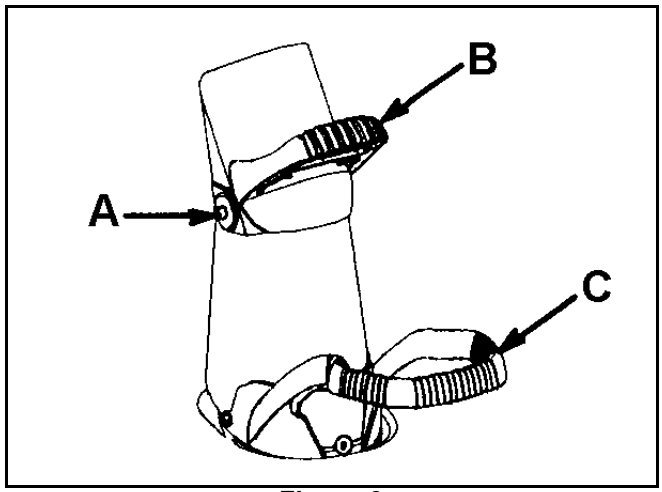


Figure 6 m-5052

(A) Chute deflector mounting locknut (2)
(B) Chute deflector handle
(C) Chute handle

Important Do not use the chute handle to lift the snowthrower. This can damage both the chute handle and the snowthrower.

Chute Crank

On models equipped with a chute crank, crank clockwise to rotate the chute to the right, counterclockwise to rotate the chute to the left (Figure 7). The chute deflector on these models is the same as on models with a chute handle.

Figure 7 0621-0073

Upper Shroud Removal

The first step in many service procedures will be removing the upper shroud for access to the engine.

Remove the three Phillips head screws, washer, and locknuts that hold the chute and chute handle to the chassis (Figure 8).

Remove two Phillips head screws, 4 washers, and 2 locknuts that secure the front corners of the upper shroud (Figure 8).

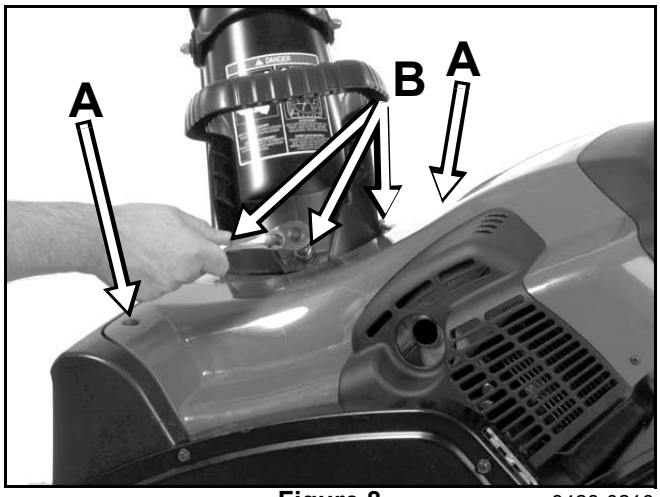


Figure 8 3428-0216

(A) 2 Phillips Head Screws, Washers, and Locknuts	(B) 3 Phillips Head Screws, Washers, and Locknuts

Remove two 5/16” screws that hold the control panel to the chassis (Figure 9).

Figure 9 3428-0217

Remove the fuel cap, lift the upper shroud off, and replace the fuel cap.

Snow Commander Chute Handle System

Some Snow Commander models were equipped with a manual chute system. As with the others, the component parts are all plastic to eliminate the need for lubrication and reduce icing.

On this version, the discharge chute attaches to the handle and chute ring. Three Phillips head bolts, nuts, and washers connect the parts. Below the upper shroud is the balance of the chute components.

Remove the upper shroud to access the chute ring, the 2 chute ring retainers, and the detent spring and arm (Figure 10). To remove the chute ring, remove the four bolts and nuts that retain the left and right chute ring retainers.

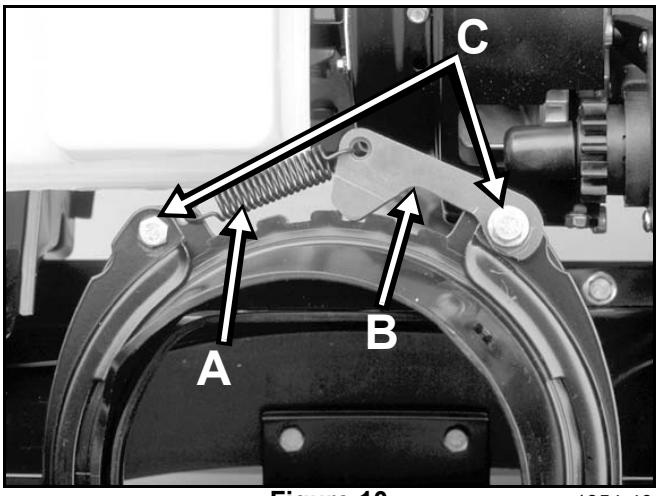


Figure 10 1854-40

(A) Spring	(C) Retainer Mounting Bolts
(B) Detent Arm	

NOTE: The rear bolt in the left hand chute ring retainer is also the pivot for the detent arm. This arm engages the notches in the chute ring to prevent unwanted movement. With the 4 bolts removed, the retainers and chute ring will lift off.

Reassembly is the reverse of disassembly.

Chute Crank System

The chute crank handle goes through hole in the control panel support (Figure 11).

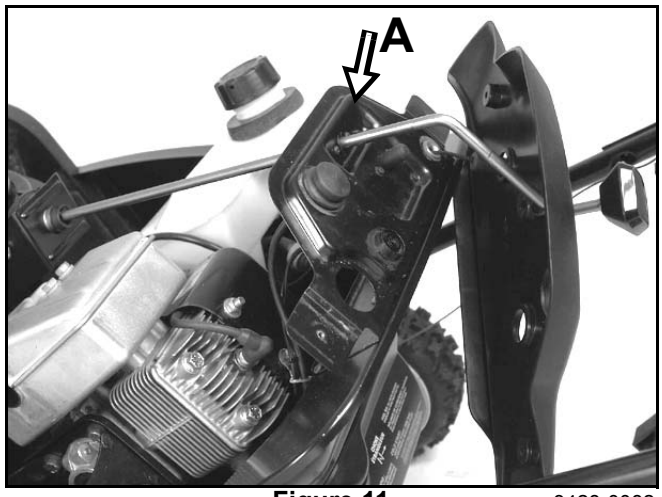


Figure 11 3428-0082

(A) Control Handle Support

Rotating the handle turns a set of gears that engage a ring gear that the chute is mounted to. The gears are contained in a bracket located under the upper shroud.

The chute ring gear rests on a support and is held in place by two retainers.

To access the chute ring and gears:

1. Remove the upper shroud.

2. The gears are held in the bracket by a shaft with a push nut on either end (Figure 12). To remove the shaft, remove one of the push nuts and pull the shaft out.

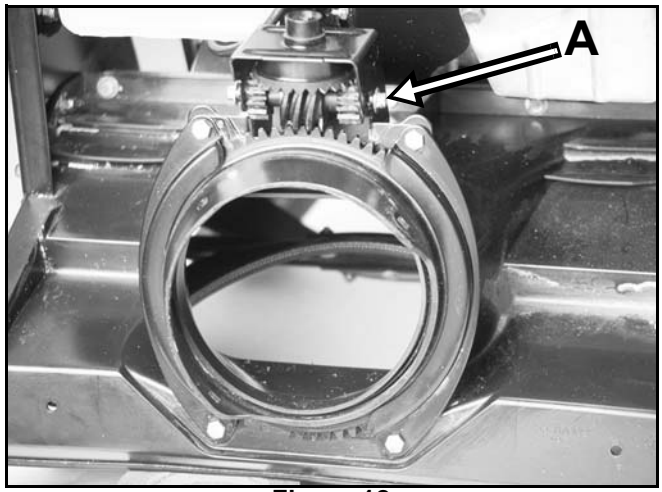


Figure 12 1854-19

(A) Shaft and Push Nut

3. To reassemble, reverse the process.

   NOTE: When installing the chute, the rounded heads of the Phillips head screws must be on the inside of the chute. The smooth head prevents snow from building up on the bolt head.

Gear Lash Adjustment

There are 4 capscrews that hold the chute gear assembly to the housing. Two are visible in Figure 13. There will be 2 identical capscrews on the other side. Loosen all 4 capscrews. Rotate the chute to find the tightest point. Adjust the clearance so that a 1/16" (1.6mm) drill bit will fit between the top of the tooth on the worm gear and the valley between two teeth on the chute ring gear (Figure 14). Grasp the chute rod and push it to the front. Hold the rod and tighten the capscrews. Remove the drill bit.

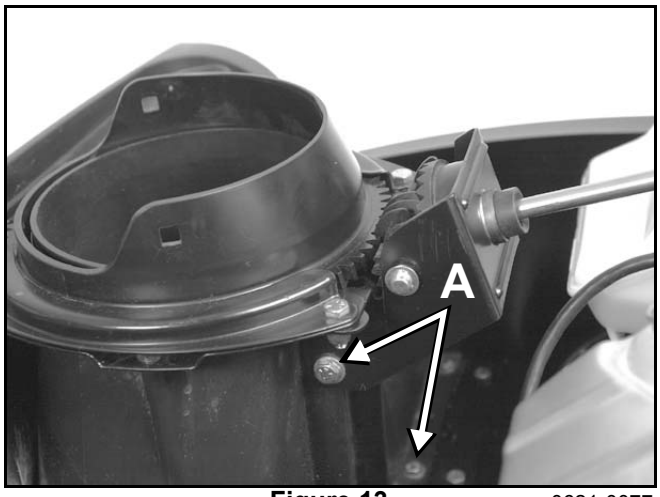


Figure 13 0621-0077

(A) Capscrews

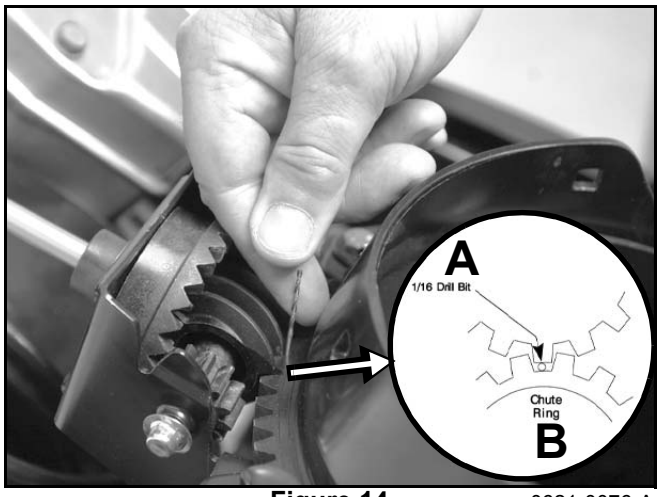


Figure 14 0621-0076-A

(A) 1/1" (1.6mm) Drill Bit (B) Chute Ring

Gear Assembly Repair

Should you need to replace 1 or more of the chute gears, proceed as follows. Remove the chute rod from the face gear. Remove the 4 capscrews referred to in Figure 13. The gear assembly can be lifted out and the gears replaced.

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The Snow Commander engine sits in a cradle which is bolted to the frame. It is best to remove the cradle and separate it from the engine after removing them as an assembly from the chassis (Figure 15). The steps are as follows:

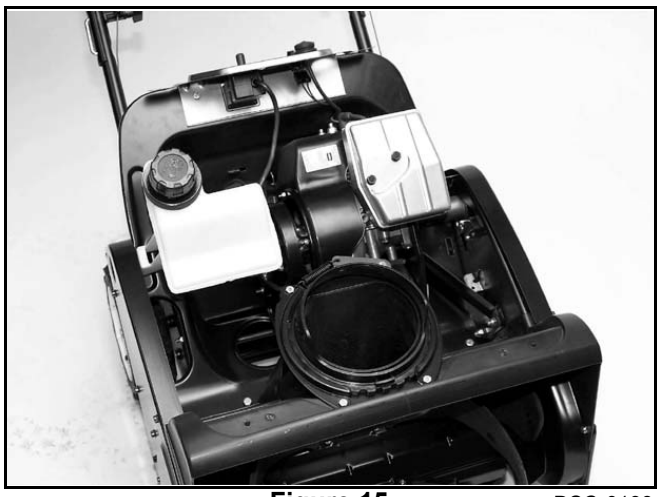

Figure 15 DSC-0138

1. Remove fuel from the tank. Remove the chute and upper shroud; refer to “Upper Shroud Removal” on page 2 - 3. Tie a slip knot in the starter rope where it comes out of the recoil (Figure 16).

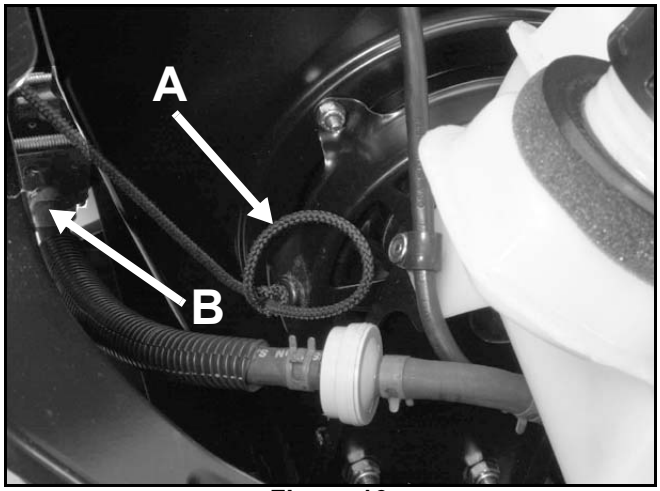

Figure 16 3428-0222

(A) Starter Rope	(B) Carburetor Fitting

2. Untie the knot in the starter handle and pull the rope through the control panel and support. Roll up the rope and secure with tape to keep it out of your way.

3. Remove the two screws in the carburetor cover, slide the cover to the left to disengage the tabs on the right side (Figure 17). Remove the cover.

Figure 17 DSC-0181

4. Temporarily clamp the fuel line and slip it off the carburetor fitting. Be prepared with something to catch any fuel remaining in the line or filter (Figure 16).

5. To remove the fuel tank, remove the two bolts and locknuts on the left side of the tank (Figure 18). Then slide the tank to the left to disengage it from the support pin on the right side (Figure 19). Lift the tank out of the machine.

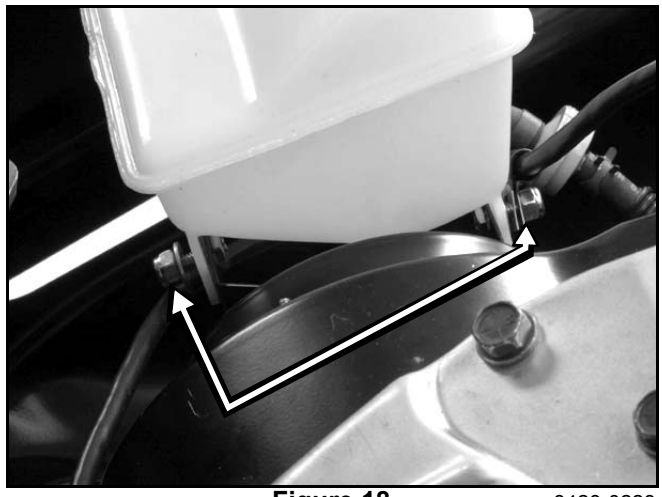

Figure 18 3428-0223

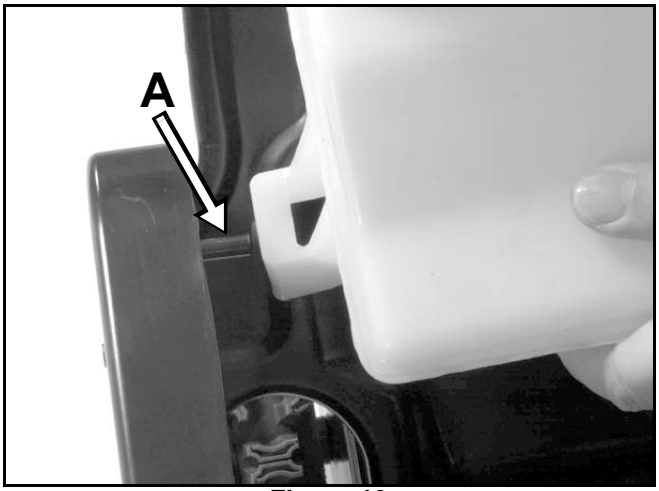

Figure 19 3428-0227

(A) Support Pin

6. Disconnect the primer line from the primer bulb and the wires from the ignition switch (Figure 20).

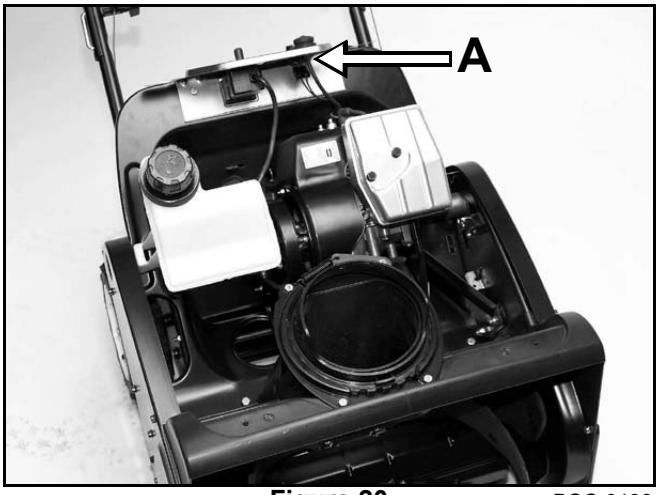

Figure 20 DSC-0138

(A) Primer and Ignition Switch

7. On electric start models, remove three screws connecting the switch box to the control panel support (Figure 21).

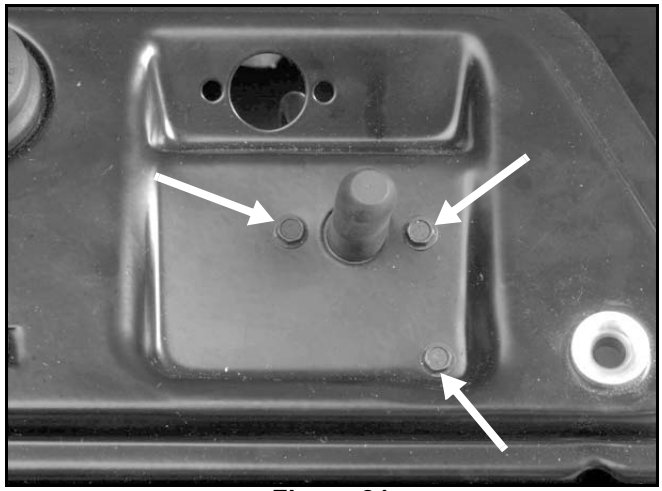

Figure 21 3428-0228

8. Remove the belt cover (3 bolts and 2 screws) (Figure 22). Some models were built with a diamond shaped washer.

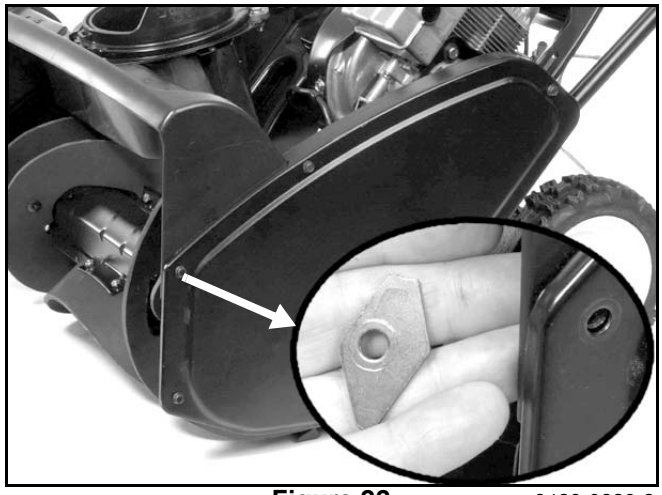

Figure 22 3428-0229-2

9. Remove the belt. Push the idler arm down as far as it will go. Measure the distance between the idler pulley and engine pulley at its closest point (Figure 23). Make a note of this distance as it will be needed during assembly.

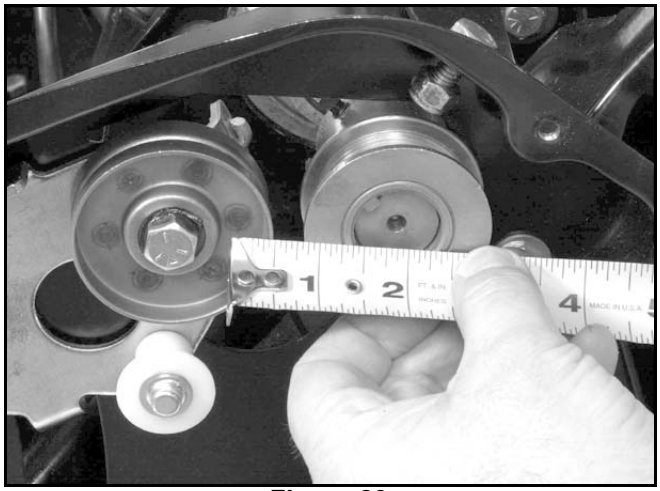

Figure 23 3428-0232

10. On the left side of the engine, is an engine brace which is bolted to the side plate in 3 places (Figure 24). Remove all three bolts.

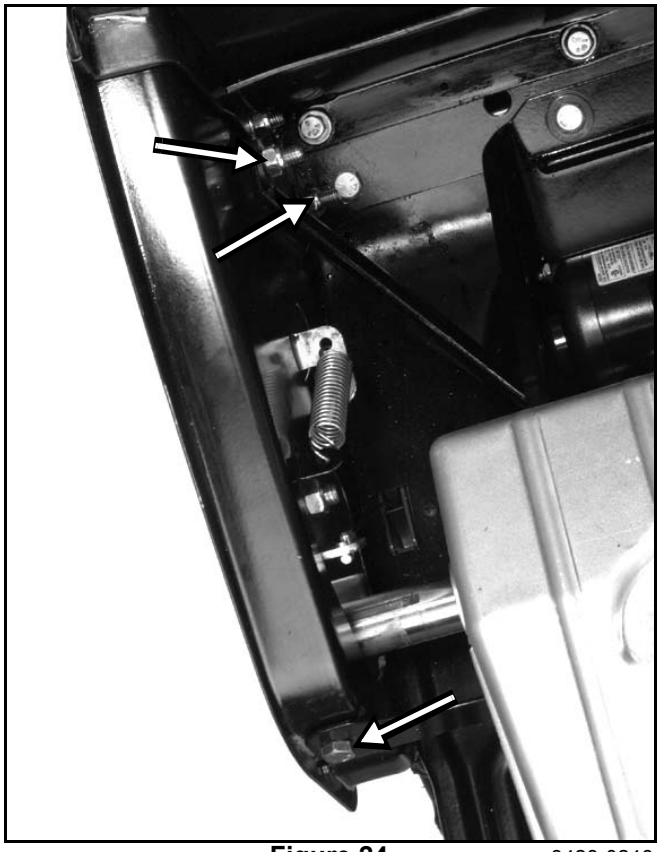

Figure 24 3428-0246

11. Remove the engine pulley. Loosen 2 set screws and pull the pulley straight off (Figure 25).

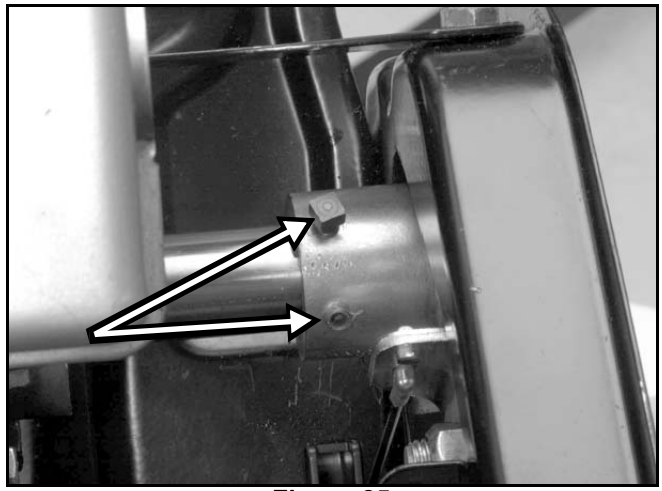

Figure 25 3428-0237

12. Tip the machine forward and remove the 3 locknuts securing the center pivot bracket (Figure 26). They are on studs, so it will not be necessary to try to hold the bolt head.

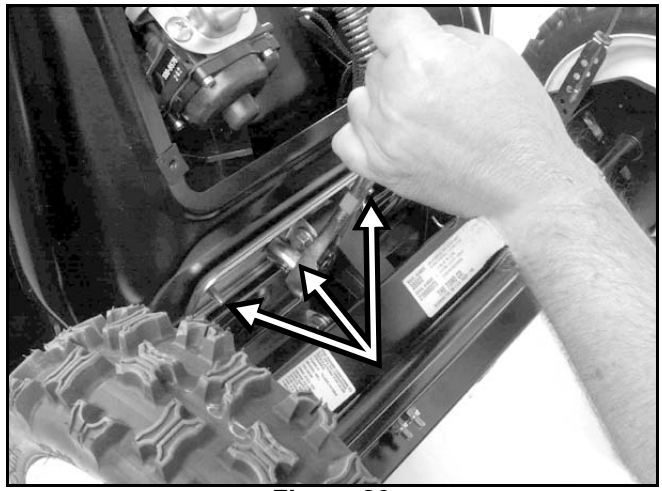

Figure 26 3428-0251

13. Remove 2 bolts right in front of the engine. It will be necessary to reach under the unit to access the locknuts (Figure 27).

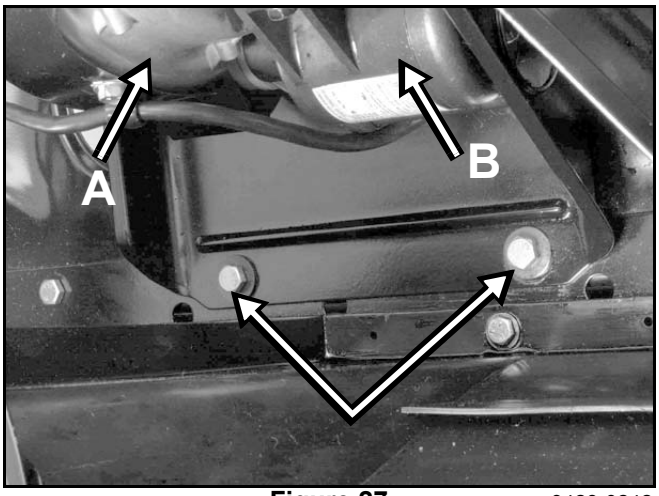

Figure 27 3428-0242

(A) Engine	(B) Starter Motor

14. The engine and engine cradle will now lift out of the chassis.

15. Remove the 3 locknuts shown in Figure 28 to access the recoil starter. Also the engine cradle and engine can be separated if necessary.

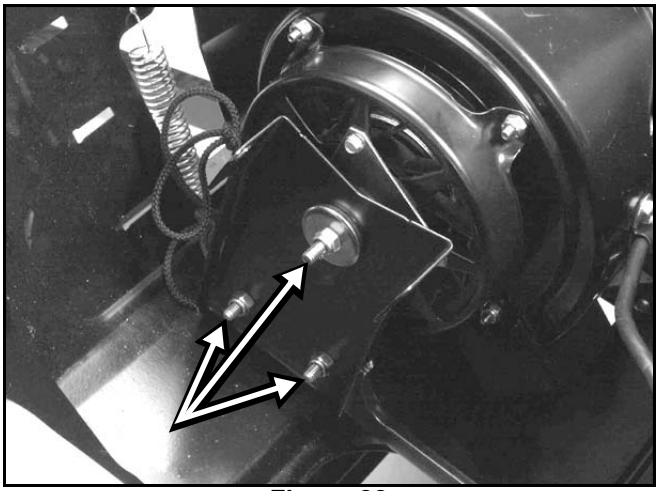

Figure 28 3428-0247

Assembly

Reverse the order.

If the engine was removed from the cradle, torque the 4 bolts around the crankshaft to 170 - 220 in. lbs (1355 - 2483 N·cm).

However, leave the bolts securing the engine cradle slightly loose until the engine location can be checked and adjusted.

Adjust the engine to achieve the same gap between the idler pulley and engine pulley, as measured previously (Figure 29). Then snug the mounting screws to hold the engine in place.

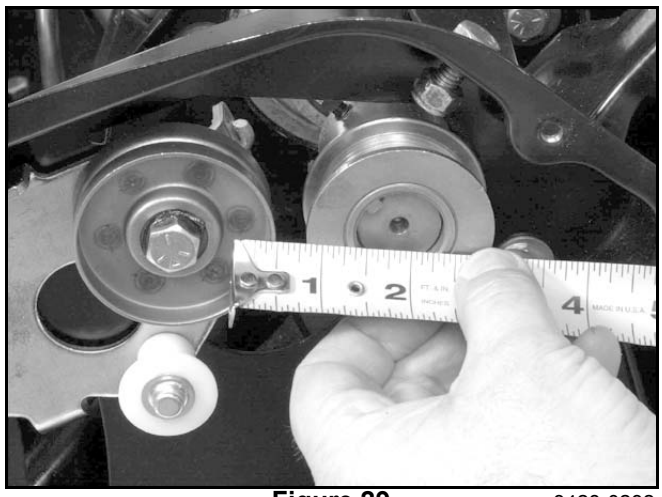

Figure 29 3428-0232

To assure the engine is properly located in the housing, measure the distance between the carburetor and the left side of the opening. When the engine is correct, the gap should be .030” (.762mm) (Figure 30). **NOTE:** If this check is not done, the choke lever may hang up on the shroud.

Secure the engine and cradle.

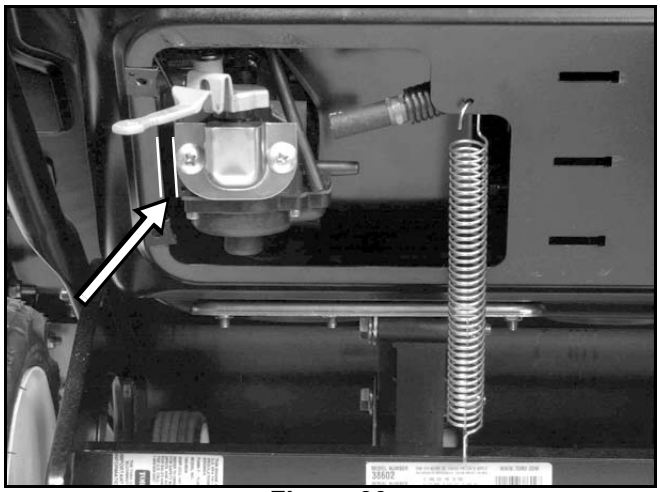

Figure 30 3428-0211

Before tightening the setscrews on the engine pulley, the alignment of the pulleys needs to be checked (Figure 31). Measure from the side plate to the outer pulley flange. Adjust the pulley until the gap is 1" (25.4mm).

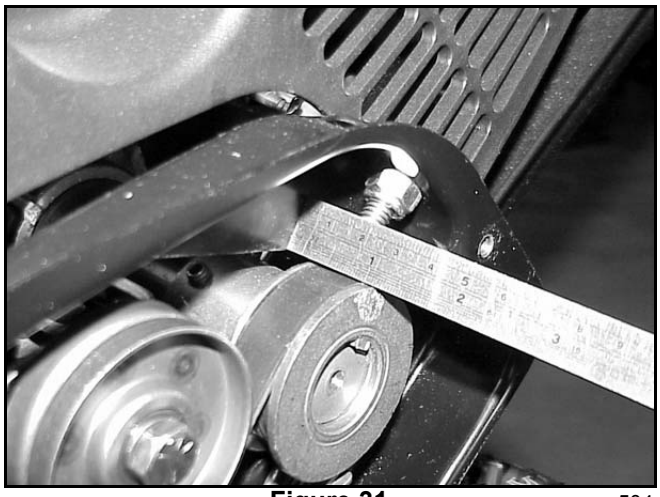

Figure 31 mvc-504

NOTE: Use Loctite on setscrews.

Torque the square head setscrew to 120 - 150 in. lbs. (1355 - 1694 N·cm). Torque the Allen head setscrew to 60 - 80 in. lbs. (678 - 904 N·cm). Torque the nut on the recoil side support to 90 - 120 in. lbs. (1016 - 1355 N·cm).

When reinstalling the wire harness on electric start models, route the wire as follows: The wire must come out of the starter motor to one of the blower housing screws (Figure 32). It then must run under the fuel tank up to the left rear mount for the fuel tank (Figure 33), then up to the switch box. Assure that the wires will not rub on the starter rope or other moving objects.

Figure 32 mvc-496

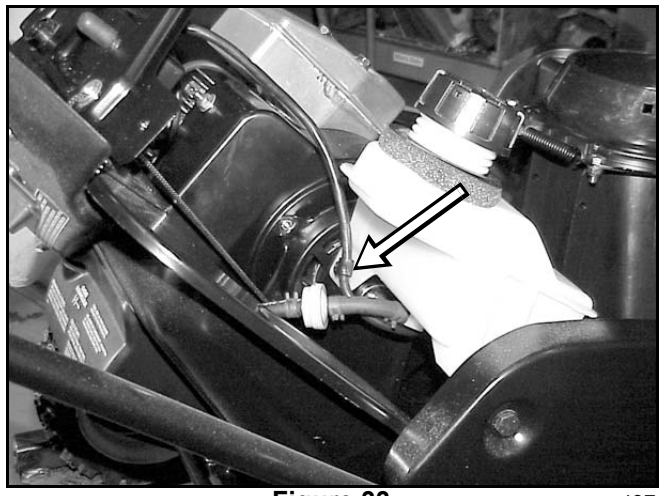

Figure 33 mvc-497

Recoil Starter Access

Beginning with 2002 production models, the blower housing and recoil starter is accessible without removing the engine from the chassis:

Process:

1. Remove the chute and upper shroud (refer to "Upper Shroud Removal" on page 2 - 3).

2. Remove fuel tank.

3. Remove the recoil support. You can remove the 2 bottom nuts and bolts and leave the support attached to the recoil or remove all 3 and separate the support (Figure 28).

4. Remove the self-tapping screws that secure the blower housing to the engine (Figure 34).

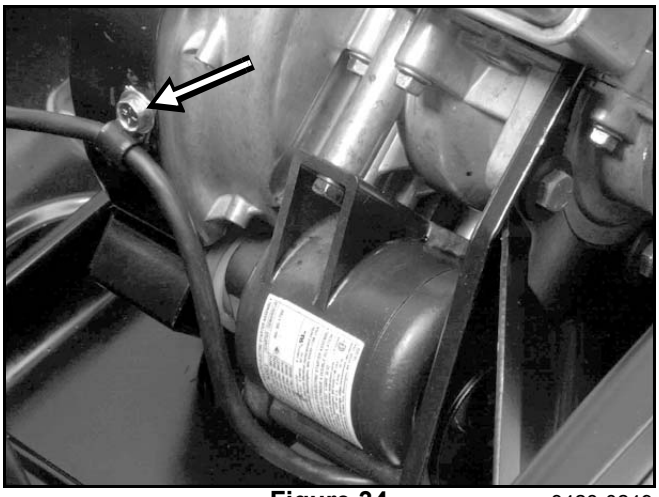

Figure 34 3428-0249

NOTE: One screw must be accessed by tipping the machine. Drain fuel from the tank if necessary (Figure 35).

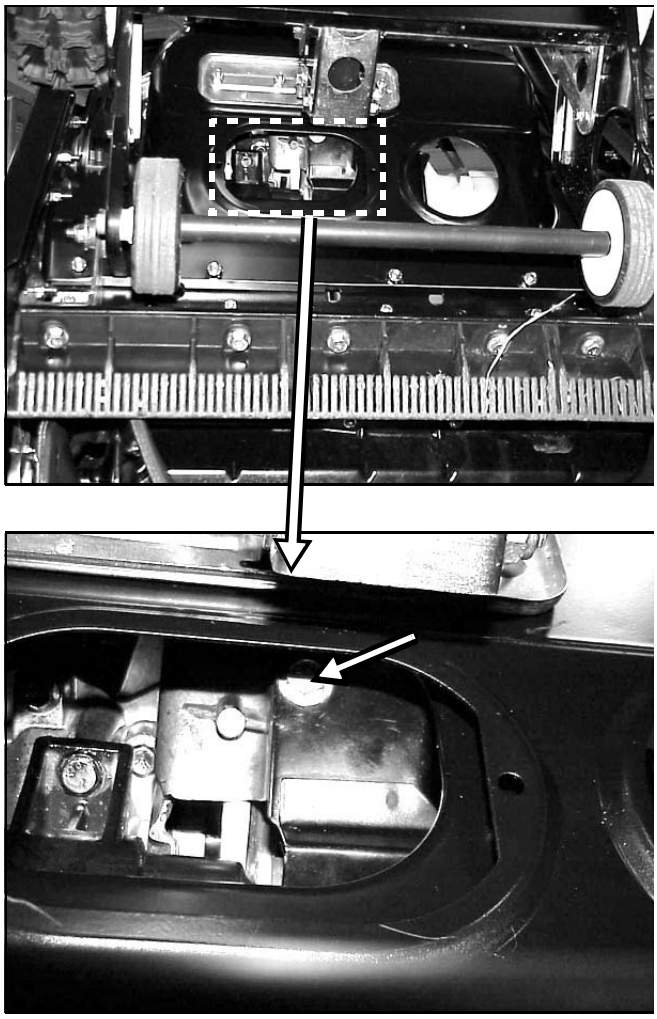

Figure 35

5. The recoil and blower housing can be removed.

Assembly

Reverse the above steps.

Note wiring routing on electric start units. When reinstalling the wire harness on electric start models, route the wire as follows: The wire must come out of the starter motor to one of the blower housing screws (Figure 32). It then must run under the fuel tank up to the left rear mount for the fuel tank (Figure 33), then up to the switch box. Assure that the wires will not rub on the starter rope or other moving objects.

Operation

A multigrooved V belt transfers power from the engine pulley to the rotor drive pulley. Belt clutching is controlled by a cable connected to a bail on the upper handle. When engaged, the combination idler/brake arm rotates to disengage the brake and move the idler to tighten the belt (Figure 36). When the bail is released, a spring pulls the idler away from the belt and engages the rotor brake. See Figure 46 for location of spring.

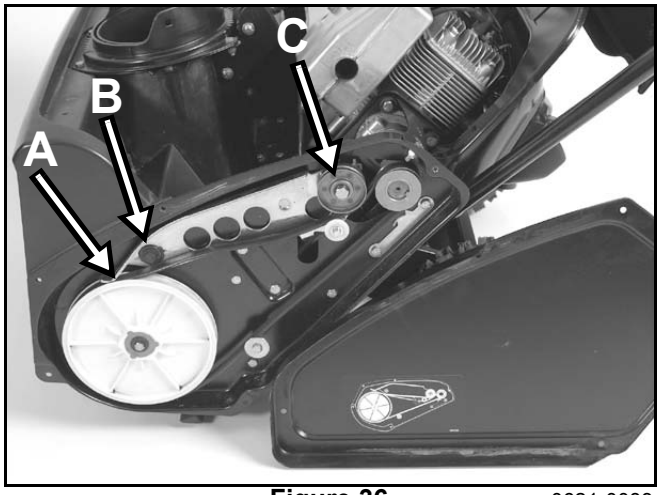

Figure 36 0621-0083

(A) Belt Brake	(C) Idler
(B) Pivot	

The same control bail on the handle has a second cable attached to it. This cable controls tilting of the powerhead (Figure 37).

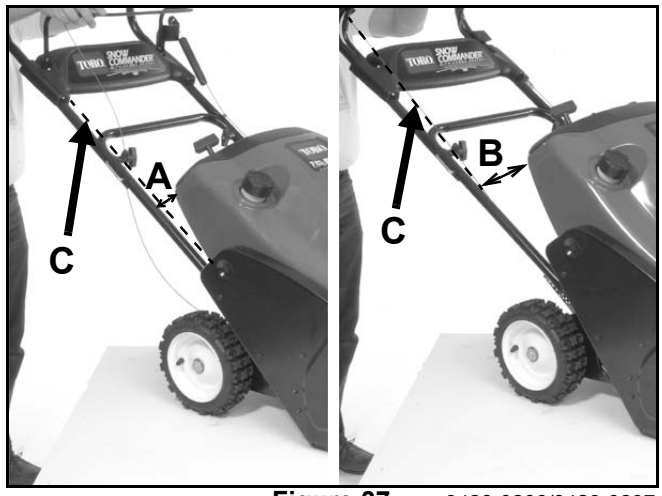

Figure 37 3428-0206/3428-0207

(A) At Rest	(C) Cable
(B) Engaged (tilted)	

When the bail is squeezed, the powerhead containing the engine and rotor is tilted forward until the rotor blades contact the surface. This action provides a self-propelling action by the rotor blades as well as cleaning down to the surface (Figure 38).

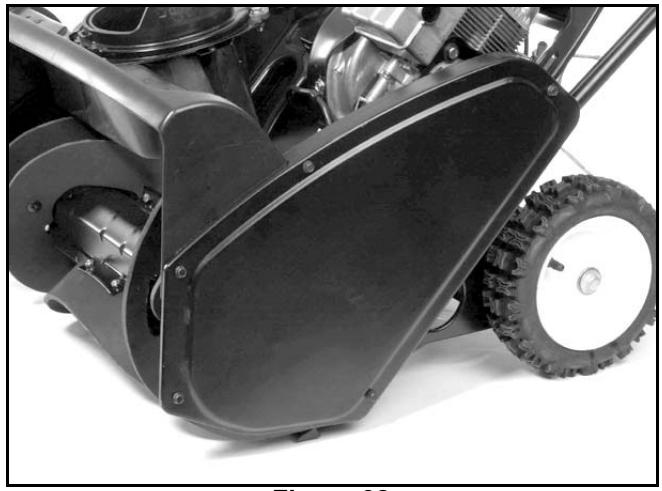

Figure 38 3428-0229

DRIVE SYSTEM

This machine is specifically designed to clean to the surface and propel itself in this manner. For this reason it is not recommended for use on unpaved surfaces. If the machine is adjusted correctly and used on a gravel surface, it will pick up and throw gravel along with the snow. This is undesirable due to possible injury to passers by and potential damage to property. Any attempt to adjust it up to pass over the gravel will result in not cleaning to the surface and a complete loss of self-propelling.

Drive System Disassembly

1. The belt cover is on the left-hand side of the machine. The belt cover is held on with two screws and three bolts.

   NOTE: The first year only there was a special diamond shape washer used in the front top hole. Subsequent years use a standard washer (Figure 39).

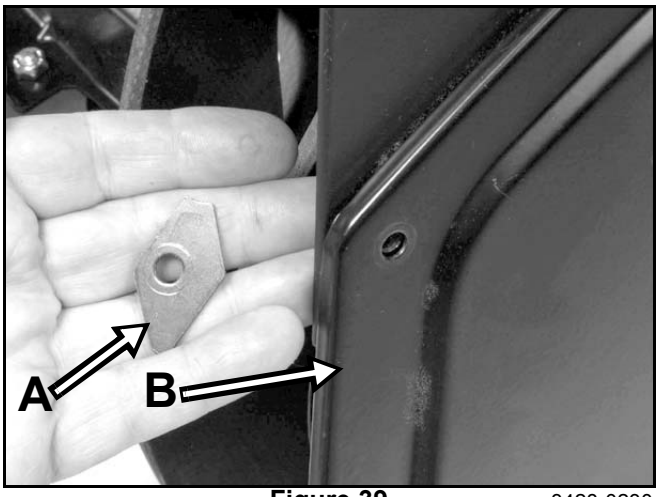

Figure 39 3428-0230

(A) Diamond Shaped Washer	(B) Belt Cover

2. Remove the belt cover and the left rotor guard. The belt system is now fully exposed (Figure 40).

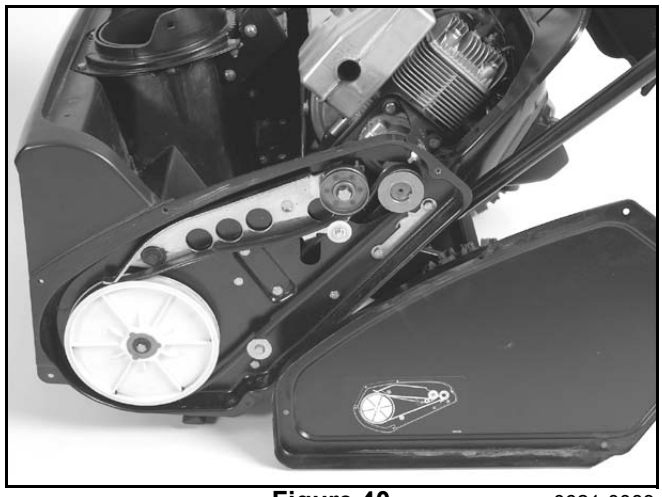

Figure 40 0621-0083

3. Before you remove the belt, note the routing and if the belt is damaged. There is a belt routing decal on the inside of the belt cover and a copy of that decal in the owners manual (Figure 41). If the belt was misrouted or has jumped the pulleys, it will likely be damaged. A damaged belt should be replaced.

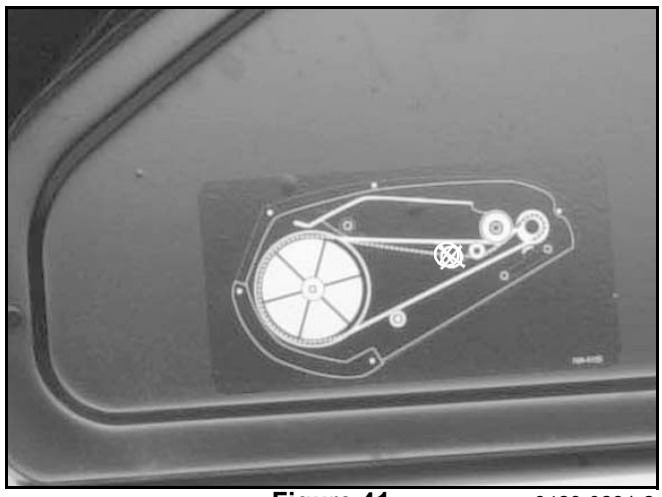

Figure 41 3428-0231-2

4. To remove the rotor pulley, it will be necessary to hold the rotor steady. A block of wood can be used to stop the rotor from turning (Figure 42), allowing the capscrew to be removed from the rotor pulley (Figure 43). The rotor pulley is removed by pulling straight off.

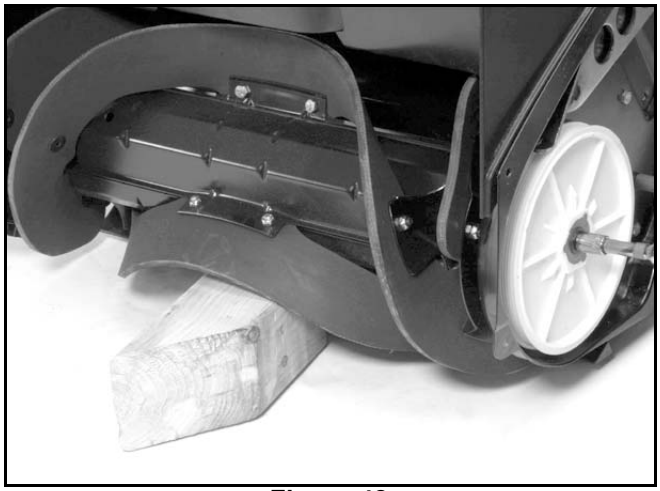

Figure 42 3428-0250

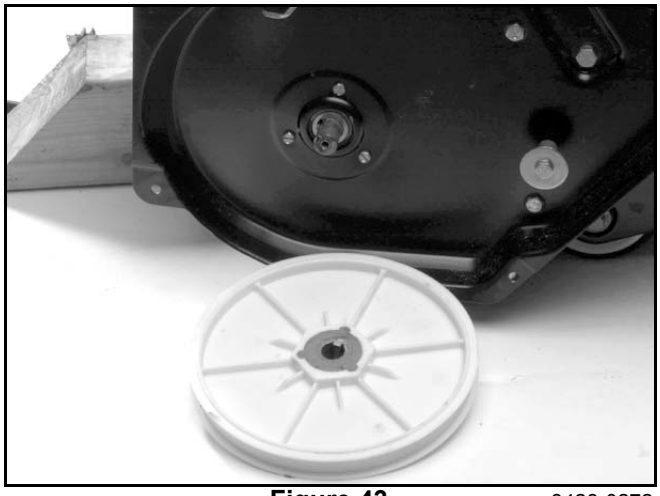

Figure 43 3428-0272

5. Remove upper shroud, refer to “Upper Shroud Removal” on page 2 - 3.

6. The idler pulley is secured to the idler/brake arm with a capscrew and locknut (Figure 44).

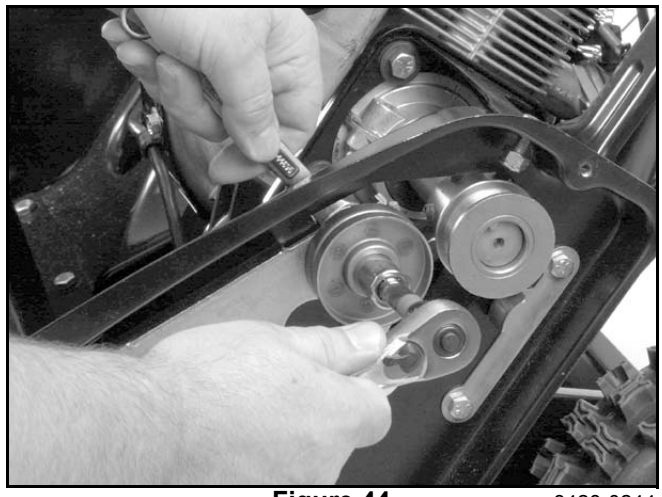

Figure 44 3428-0244

7. To remove the engine pulley, loosen the setscrews and pull the pulley straight off (Figure 45).

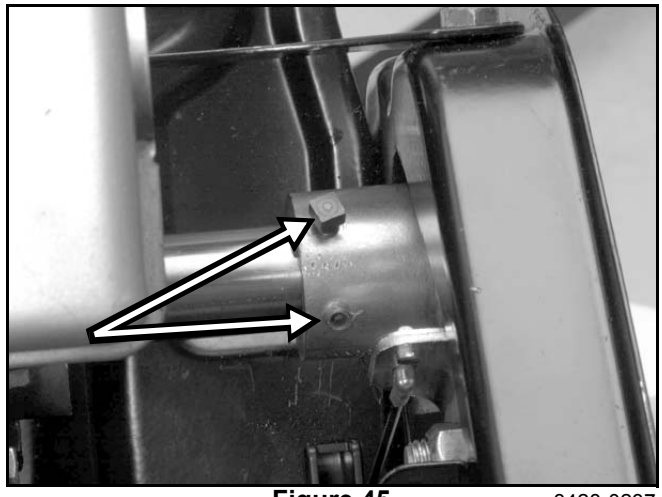

Figure 45 3428-0237

8. To remove the brake arm, first unhook the brake spring (Figure 46). The brake arm is attached by a single shoulder bolt through the side plate (Figure 47). Remove the locknut and large washer. Pull the brake arm off carefully as there is a pivot washer between the brake arm and side plate.

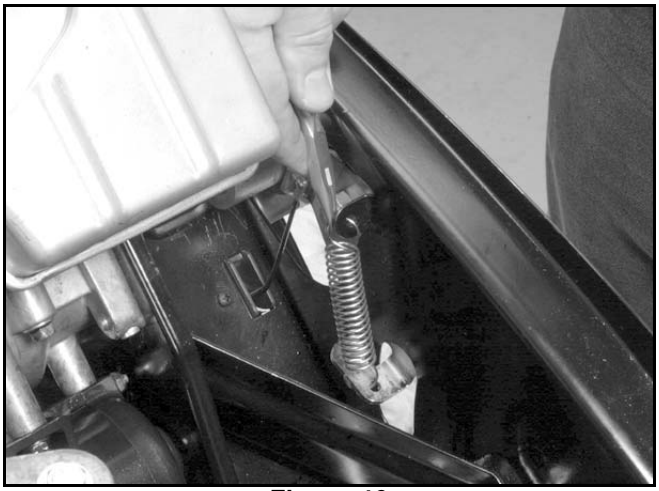

Figure 46 3428-0240

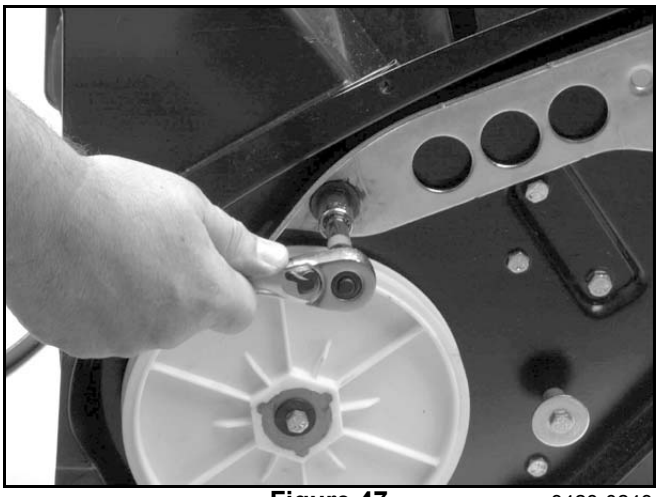

Figure 47 3428-0243

9. Replace nylon rollers if worn or damaged. One is retained by a cap nut (Figure 48). Use side cutters to remove it, and replace with a new cap nut.

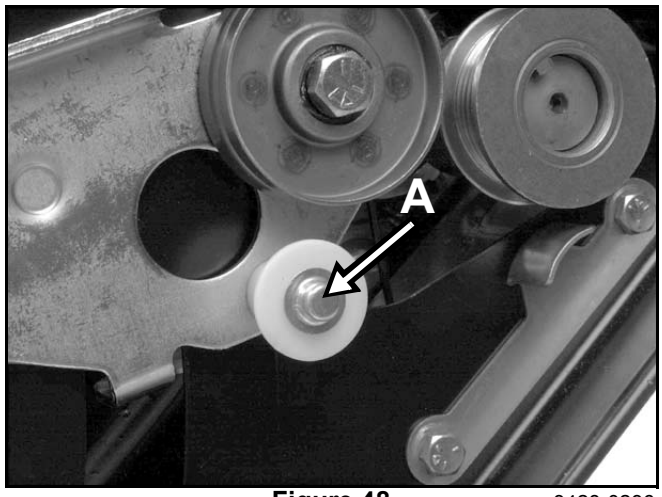

Figure 48 3428-0236

(A) Cap Nut

Drive System Assembly

Assemble in reverse order. The following are tips to assist you.

1. Many of the capscrews and nuts are the locking type. However, the material in the threads that provides the locking feature, wears out. If the parts assemble easily, we suggest either replacing the locknut or capscrew or, **cleaning the screw threads** and applying a chemical thread locker such as Loctite brand.

2. Before tightening the setscrews on the engine pulley, the alignment of the pulleys needs to be checked (Figure 49). Measure from the side plate to the outer pulley flange. Adjust the pulley until the gap is 1” (25.4mm).

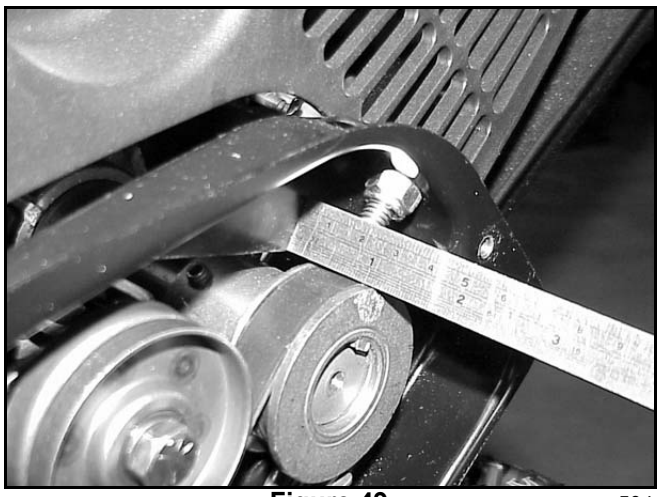

Figure 49 mvc-504

Torque the square head setscrew to 120 - 150 in. lbs. (1355 - 1694 N·cm). Torque the Allen head setscrew to 60 - 80 in. lbs. (678 - 904 N·cm). Torque the capscrew securing the rotor pulley to 100 in. lbs. (1125 N·cm).

3. The idler pulley must be installed with the longer hub towards the brake arm (Figure 50). If it is installed backwards, it will not rotate when tightened down. Torque the shoulder bolt to 170 - 250 in. lbs. (1920 - 2824 N·cm).

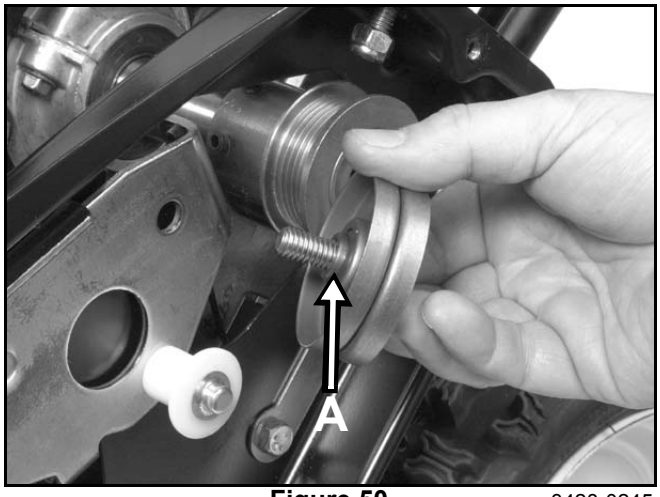

Figure 50 3428-0245

(A) Hub

4. Check the belt adjustment even if the belt was not replaced. Most belt failures are due to not maintaining proper adjustment. Refer to "Rotor Control Cable" on page 5 - 1.

Rotor Bearing Replacement

1. To replace the rotor bearings, remove the belt cover, belt and rotor pulley as shown in the preceding steps.

2. Remove the three nuts and bolts attaching the bearing and bearing retainers to each side plate (Figure 51).

Figure 51 3428-0273

3. On the right side (opposite the belt) there is one bolt that goes through the bearing and into the rotor shaft. Remove this bolt (Figure 52).

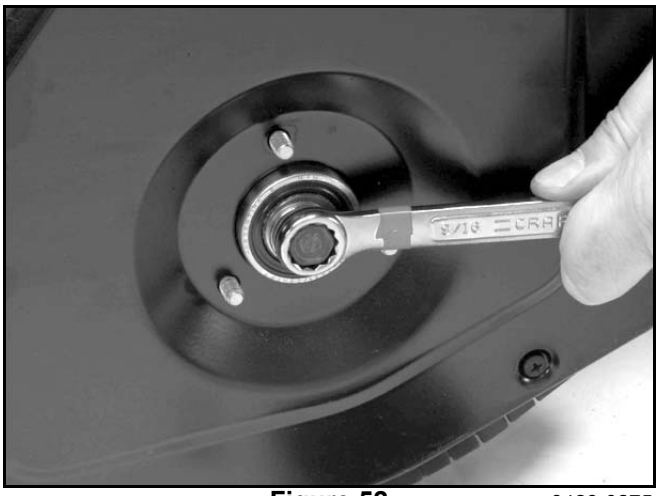

Figure 52 3428-0275

4. You might now be able to work the rotor assembly out of the chassis. It may be necessary to loosen the bolts securing the right-hand side plate to obtain more clearance.

5. The bearings will now slide off the rotor shaft.

Assembly

Assemble in reverse order. Note the locations of the special thrust washers (Figure 53).

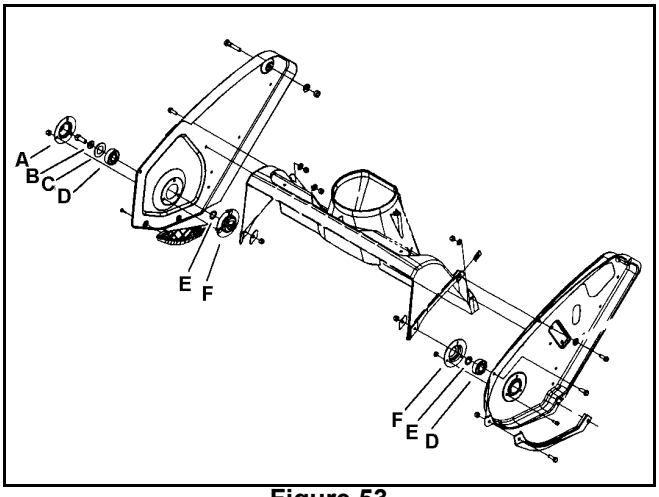

Figure 53

(A) Bearing Retainer	(D) Ball Bearing
(B) Flat Washer	(E) Thrust Washer
(C) Rubber Washer	(F) Bearing Flange

Rotor Cable Replacement

The first step is to remove the belt cover and upper shroud. Unhook the end of the cable from the idler/ brake arm (Figure 54). Pull the cable down through the opening in the side plate. Unhook the upper end from the clutch cable adjuster (Figure 55). Reverse the process to replace the cable. The ends of the cable are interchangeable; there is no top or bottom end. Replace the belt cover and adjust per the "Adjusting the Rotor Control Cable" on page 7 - 2.

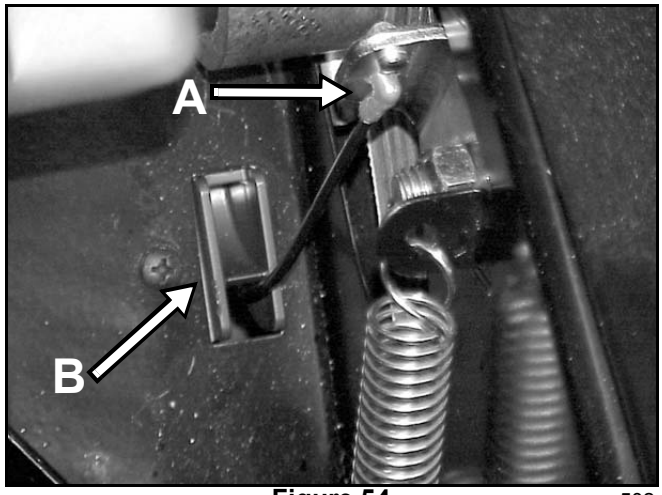

Figure 54 mvc-502

(A) Cable Z Bend	(B) Opening

Figure 55 3428-0198

Operation

The electric start system consists of a 120 (USA) or 220 (Europe) VAC motor, a momentary switch, a plug terminal, and a connecting wire (Figure 56). A cord from a household power supply is plugged into the machine. When the starter button is depressed, current is directed to the motor. When the engine starts, release the starter button and unplug the extension cord.

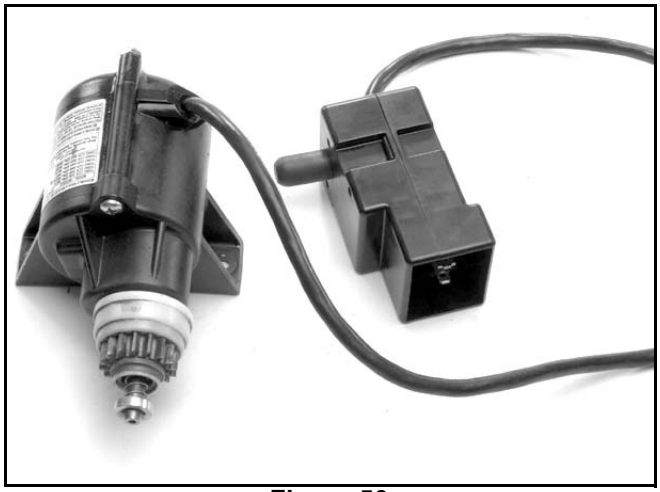

Figure 56 3428-0257

Troubleshooting

1. First check the electric outlet. An easy way to do that is plug a light into that outlet.

2. Substitute a different extension cord or plug the same light into the cord.

3. If the cord and outlet are supplying power, the problem must be in the motor, wires, or switch.

4. A continuity tester or ohmmeter can be connected to the terminals where you would normally plug in the extension cord (Figure 57).

   NOTE: For clarity, the switch box has been removed and opened. Normally, this test would be done with the machine fully assembled.

   If there is no continuity with the starter button depressed, the switch box will need to be removed and opened. Proceed to Disassembly.

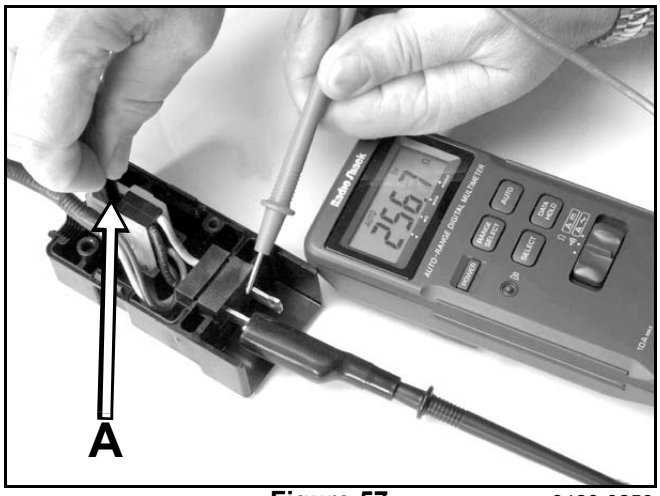

Figure 57 3428-0259

(A) Starter Button

System Disassembly

1. Remove the upper shroud. Refer to “Upper Shroud Removal” on page 2 - 3.

2. Remove three screws holding the switch box to the control panel support (Figure 58).

   NOTE: At this point, the switch box can be opened and the parts tested. It may not be necessary to remove the starter motor. Proceed to "Switch Box Repair" on page 5 - 3

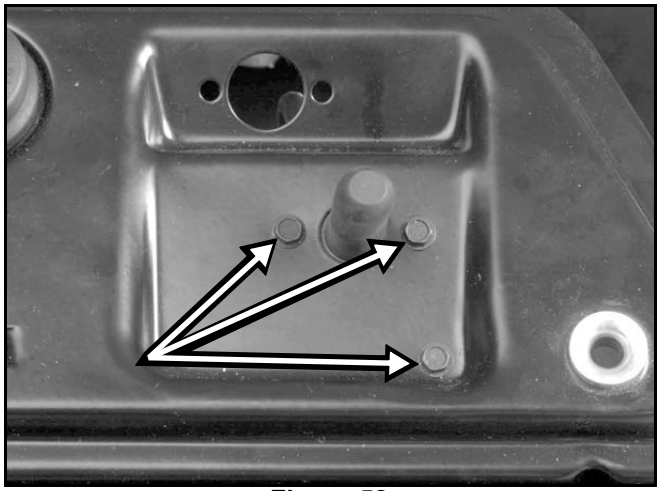

Figure 58 3428-0228

3. Remove the left rear fuel tank mounting bolt securing the wire harness clamp (Figure 59).

Figure 59 3428-0223

4. Remove one screw (A) (Figure 60) which holds the wire harness to the blower housing.

5. Remove one starter motor mounting screw (B) (Figure 60) from the front.

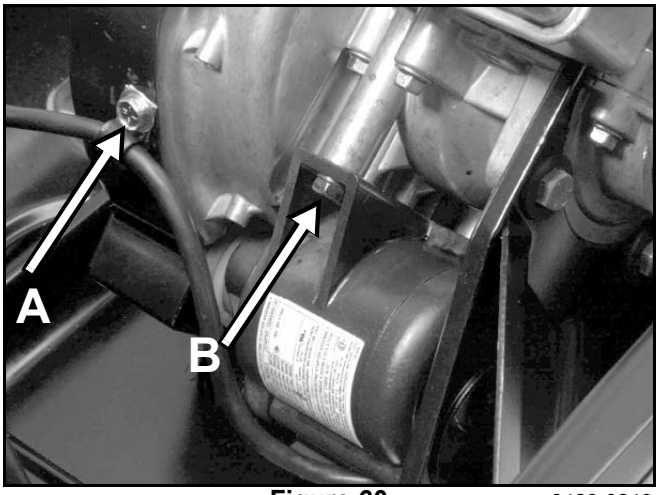

Figure 60 3428-0249

6. To access the other motor mounting screw, the machine must be tipped forward. Depending on how much fuel is in the tank it may be necessary to drain the tank.

7. Tip the machine forward and reach in with a ratchet and extension to remove the last motor mounting screw through the access hole provided (Figure 61).

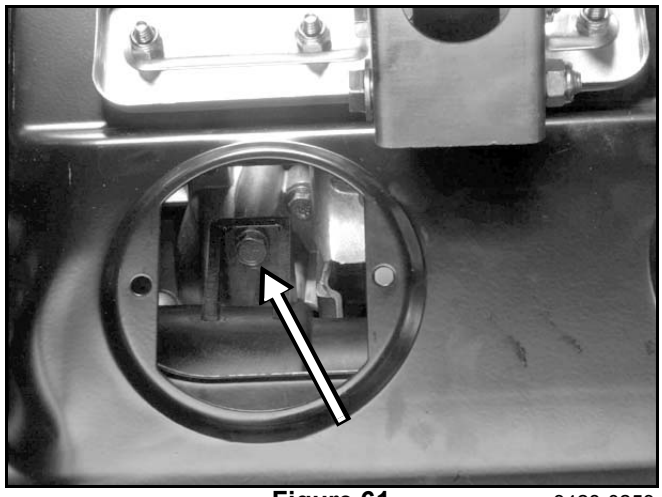

Figure 61 3428-0253

8. The motor, wire harness and switch box can now be removed from the chassis.

Assembly

Assemble in reverse order. When mounting the starter motor itself, we suggest that you loosely install the front or top mounting screw first. This will make it easier to line up the motor and start the rear mounting screw.

When reinstalling the wire harness on electric start models, route the wire as follows: The wire must come out of the starter motor to one of the blower housing screws (Figure 62). It then must run under the fuel tank up to the left rear mount for the fuel tank (Figure 63) then up to the switch box. Assure that the wires will not rub on the starter rope or other moving objects.

Figure 62 mvc-496

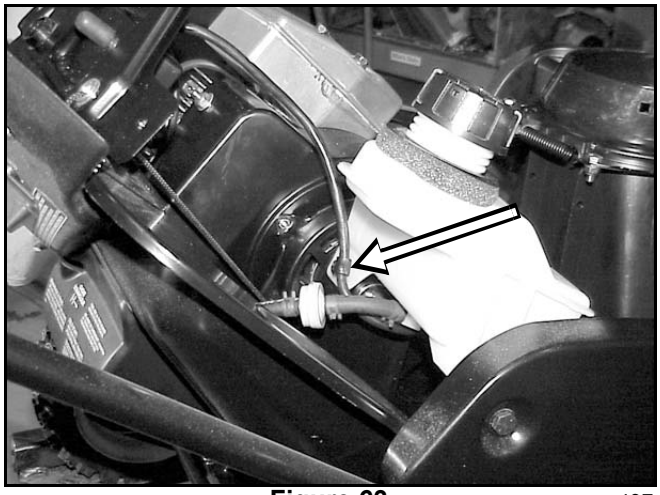

Figure 63 mvc-497

Switch Box Repair

Power Plug

By opening the switch box you can access all (3) major components of the electric start system. The plug terminal, switch, and the wire harness/starter motor.

NOTE: There are two versions of the electric start system. A 120 VAC sold in North America and a 220 VAC system sold in Europe. The plug terminal and motor will be different because of the different electrical systems. However, the troubleshooting and repair procedures are the same. The 120VAC system is shown.

After removing and opening the switch box, note the location of all wires (Figure 64) before removing any parts from the box.

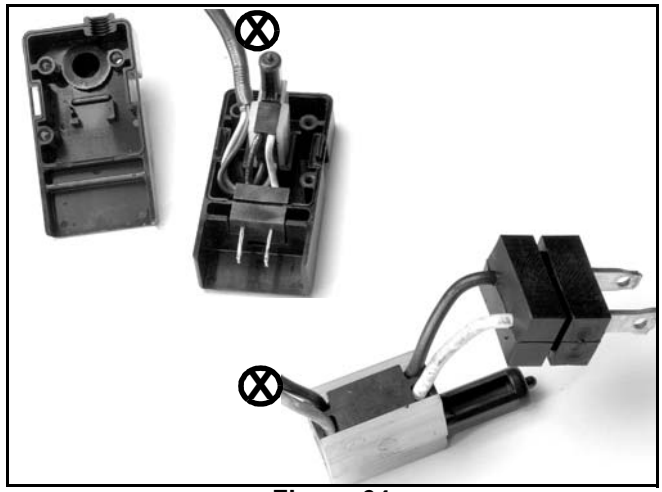

Figure 64 3428-0258 / -0260

⊗ To Motor

Plug Terminal

The possible failure modes of the plug are simple. It can be broken (physical damage) or burnt (signs of arcing).

Physical damage is apparent. However, a burnt terminal requires an understanding of the process. The terminal becomes burnt when it is loosely plugged into the extension cord or the terminal inside the female end of the cord is worn or damaged. The loose fit results in electrical arcing between the terminals on the snowthrower and the extension cord. This arcing causes the burnt terminals. Replace BOTH the plug terminal AND the terminal on the end of the extension cord as both are damaged by the arcing. (Extension cord terminals are available at your local hardware store.) Replacing only one half of the connection will likely result in a repeat failure.

To remove the wires from the switch, slip the smooth end of a small drill bit in next to the wire (Figure 65). The inside of the switch has spring loaded jaws that grip the wire. The jaws will not grab the hardened drill bit. This allows the drill to be easily removed after it opens the jaws to allow the wire to be removed.

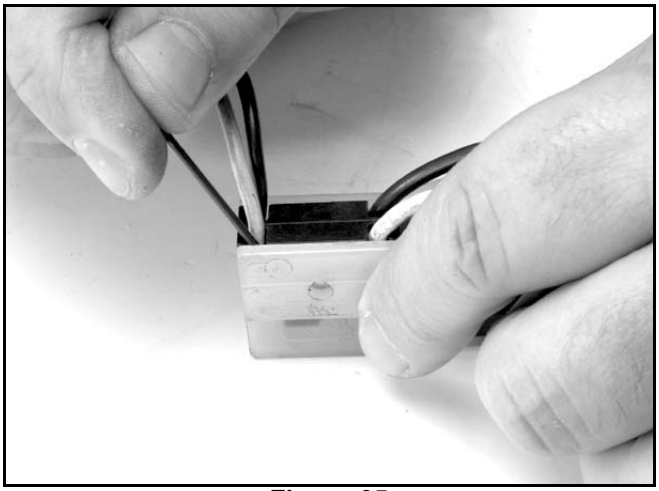

Figure 65 3428-0262

Switch

The switch is a simple push button on/off switch. It is intended to make continuity only when the button is depressed. To test the switch, use a continuity light or ohmmeter. Remove the wires and insert the probes from the tester. Use two holes that are directly across from each other (Figure 66). With the button depressed there should be continuity, when it is released there should be no continuity. At no time should there be continuity between the diagonal terminals.

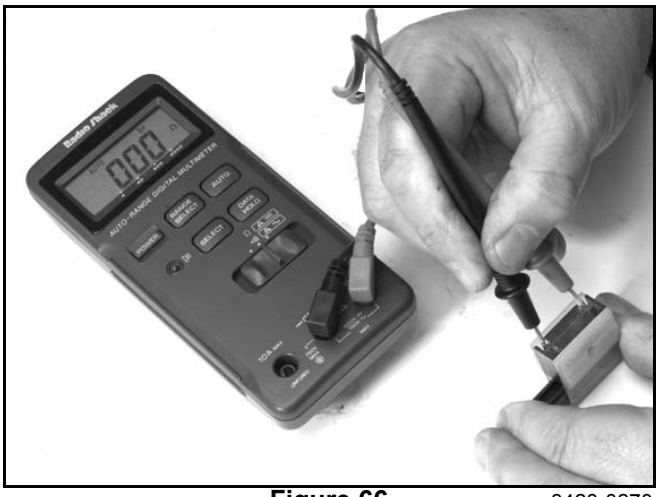

Figure 66 3428-0270

Motor Testing

To properly test the motor it must be removed from the chassis. Refer to "System Disassembly" on page 5 - 1.

Remove the two motor wires from the switch (Figure 67). Attach one ohmmeter test lead to each wire. SLOWLY rotate the motor shaft and watch the ohmmeter. At no time should continuity be lost, although it will fluctuate. The motor comes with the wires permanently attached. If the wires are damaged or there is internal damage to the motor, it must be replaced.

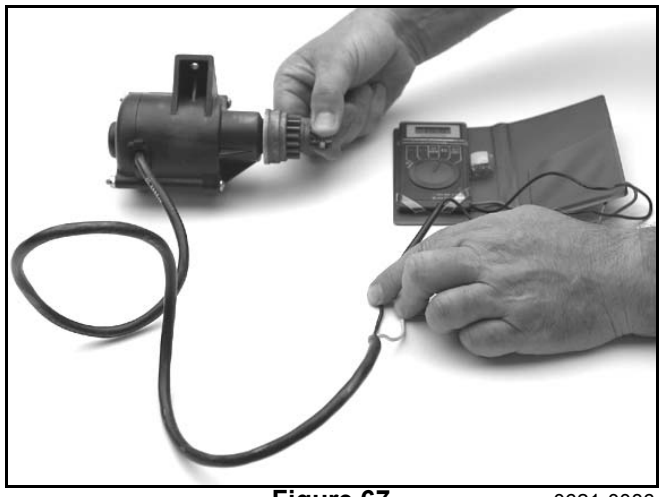

Figure 67 0621-0086

Assembly

Assemble in reverse order.

To install the wires in the switch merely push them into the holes. The jaws will grab them.

NOTE: When installing the wires, install the black wires directly across from each other and the light wires across from each other (Figure 68).

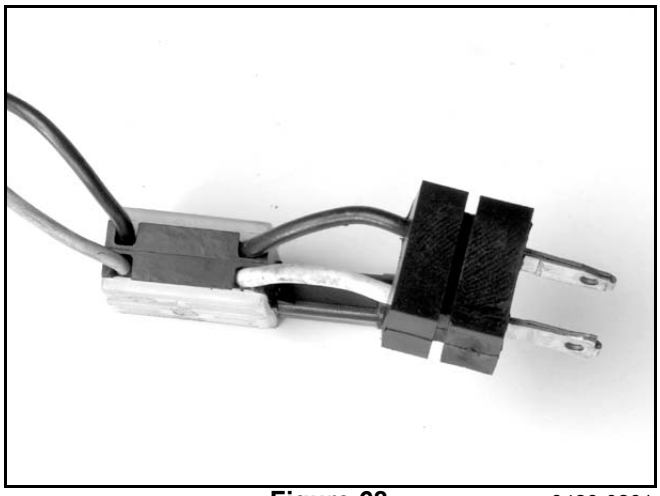

Figure 68 3428-0261

Starter Pinion Replacement

In order to replace the pinion, the upper shroud must be removed and at least the two motor mounting screws removed. If you know the wire, switch, and motor are all ok, they can be left in place. Refer to "System Disassembly" on page 5 - 1.

With the motor mounting screws removed, the motor can be accessed from the top. To remove the pinion, push the pinion stop down to uncover the wire lock ring around the end of the armature (Figure 69). The lock ring can be grasped with a pliers or side cutters and pulled off. Replace the ring; do not re-use. With the ring off the pinion and spring can be removed (Figure 70).

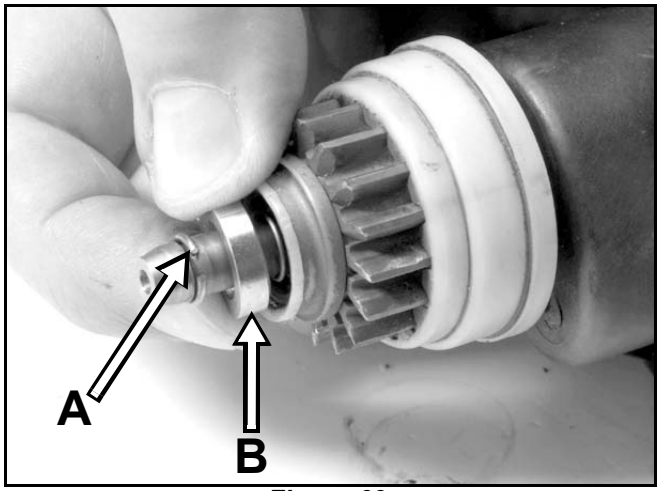

Figure 69 3428-0264

(A) Ring	(B) Pinion Stop

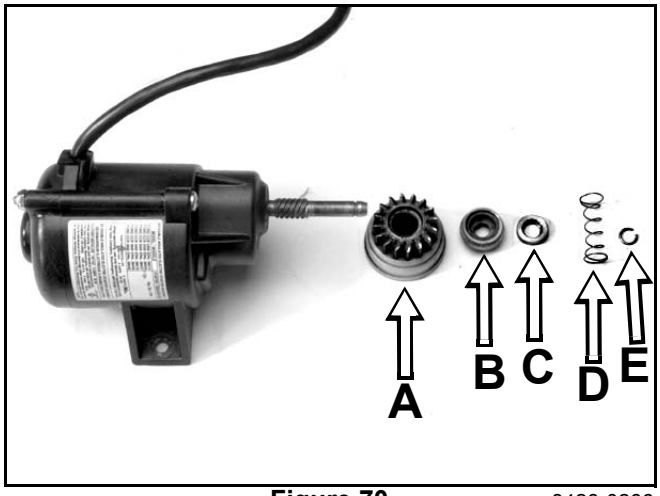

Figure 70 3428-0266

(A) & (B) Pinion Assembly	(D) Spring
(C) Pinion Stop	(E) Lock Ring

Assembly

Apply a thin coat of light weight oil to the motor shaft. Just enough to prevent rust.

Slip the pinion and spring on the shaft. Slide the pinion stop on with the recessed side facing outward. Press the lock ring on over the end of the motor shaft. Sometimes a small socket helps when used like a seal installer (Figure 71).

Figure 71 3428-0269

The pinion stop should come outward and keep the lock ring from coming out of the groove (Figure 72).

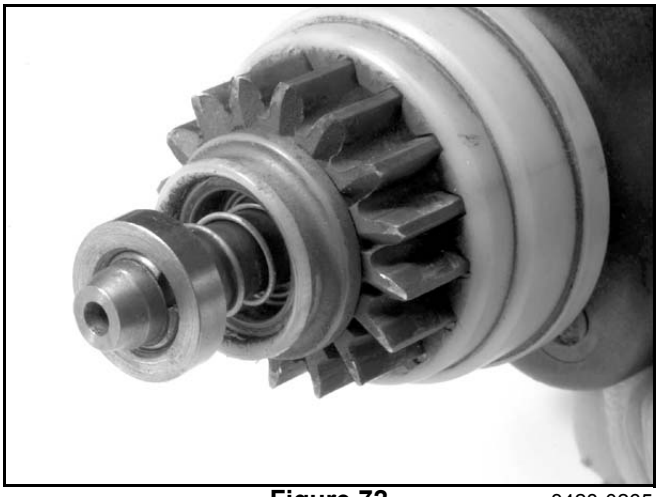

Figure 72 3428-0265

Slip the starter motor back into place. Loosely install the front/top mounting screw. then tip the machine forward to install the bottom screw. Tighten both mounting screws.

Wheels and Tires

The machine is setting on two solid rubber front tires and two pneumatic rear tires (Figure 73). Should one of the front tires become damaged, remove one push nut and the axle can be pulled out to replace a wheel. Use a new push nut to secure the wheel.

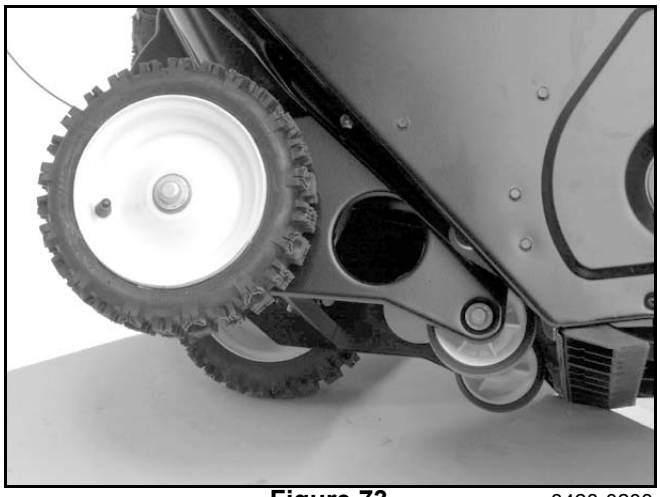

Figure 73 3428-0203

The rear tires are pneumatic. The normal pressure is 15 - 20 psi. (103 - 137kPa). In this case, pressure is not critical to function. The rear wheels are retained by a push nut. Use a new push nut to secure the wheel.

Tilt Mechanism/Frame

The basic function of this machine requires the engine and rotor to tilt forward until the rotor blades engage the ground (Figure 74). This provides the self-propelling action and the ability to clean down to the surface.

Figure 74 3428-0207-2

The wheel frame stays level with the ground at all times. There is a hinge point at the front that the engine and rotor assembly pivots on (Figure 75).

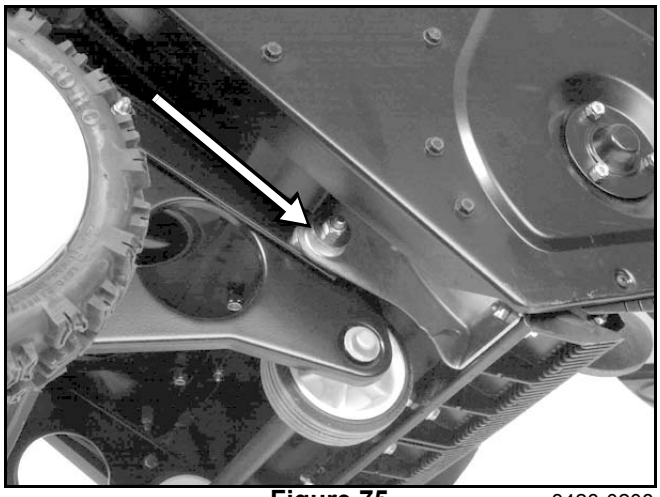

Figure 75 3428-0208

The normal resting position is with the engine and rotor to the rear. A spring connected between the engine and wheel frame assures that the engine and rotor return to the resting position when the controls are released (Figure 76).

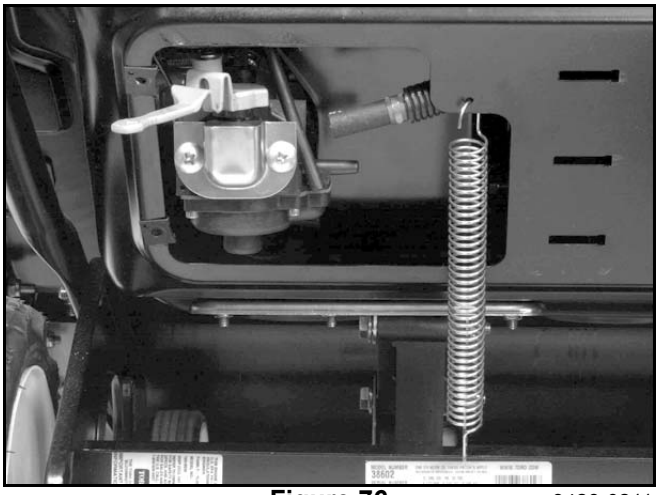

Figure 76 3428-0211

When the operator engages the bail, the cable that runs down the right-hand handle causes the pivot assembly to rotate and move the engine and rotor frame (Figure 77).

Figure 77 3428-0199

(A) Pivot Cable

Pivot Cable Replacement

Replacement of the tilt cable requires no tools. Both ends are made with a Z bend and can be removed by hand only. Insert the Z bend into the handle as shown in Figure 78. If the cable is not connected this way, it will have a tendency to come unhooked from the handle. See "Adjusting the Pivot Cable" on page 7 - 3.

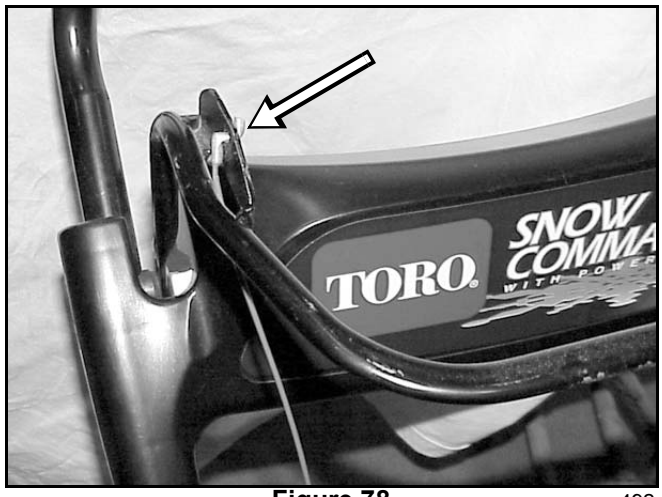

Figure 78 mvc-492

NOTE: Determine the left and right side of the machine from the normal operating position.

Recommended Maintenance Schedule

Maintenance Service Interval	Maintenance Procedure
Initial	• Check the rotor control cable and the pivot cable initially, and after the first hour of operation. Adjust if necessary. • Check for loose fasteners and tighten if necessary.
Annually	• Check the rotor control cable and the pivot cable. Adjust if necessary. • Inspect the rotor blades and replace if necessary. Replace the scraper when you replace the rotor blades. • Inspect the scraper and replace if necessary. If the rotor blades are partially or completely worn, replace the rotor blades when you replace the scraper. • Inspect and gap the spark plug; replace if necessary. • Inspect the drive belt and replace if necessary. • For storage, add stabilizer, drain the fuel, and run the engine until the fuel tank and the carburetor are empty. • Check the pressure in the tires and inflate them to between 15 and 20 psi (103 and 137 kPa). • Check for loose fasteners and tighten them if necessary.

CAUTION

If you leave the wire on the spark plug, someone could start the engine accidentally and seriously injure you or other bystanders.

Disconnect the wire from the spark plug before you do any maintenance. Set the wire aside so that it does not accidentally contact the spark plug.

Rotor Control Cable

Check the rotor control cable for proper adjustment initially, after the first operating hour, and then annually thereafter.

Checking the Rotor Control Cable

1. Stop the engine and wait for all moving parts to stop.

2. Move the left side of the control bar back toward the handle until you remove the slack in the cable (Figure 79 and "m-5065" on page 7 - 1).

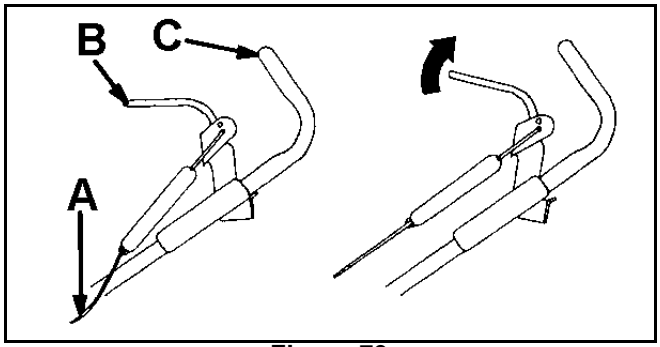

Figure 79 m-5065

(A) Rotor Control Cable (C) Handle
(B) Control Bar

3. Ensure that a 1/8 to 1/4 inch (3 to 6mm) gap exists between the control bar bracket and the handle as shown in Figure 80.

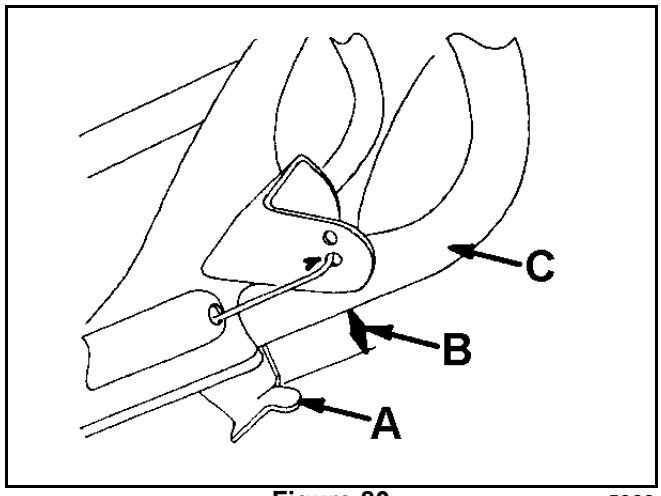

Figure 80 m-5069

(A) Control Bar Bracket	(C) Handle
(B) 1/8 to 1/4 in. (3 to 6mm) gap	

Important The rotor control cable must have slack in it when you disengage the control bar in order for the rotor brake to operate properly.

Adjusting the Rotor Control Cable

1. Unhook the spring end from the hole in the center of the control bar bracket (G) as shown in Figure 81.

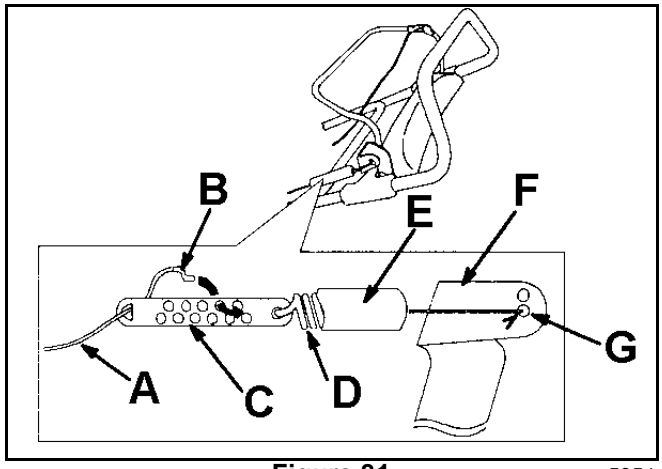

Figure 81 m-5054

(A) Cable	(E) Spring Cover
(B) Z-fitting	(F) Control Bar Bracket
(C) Cable Adjuster	(G) Hole in the center of the control bar bracket
(D) Spring	

2. Slide the spring cover off the cable adjuster.

3. Unhook the Z-fitting from the cable adjuster (Figure 81), and position it in a different hole on the adjuster to obtain specified gap of 1/8 to 1/4 inch (3 to 6mm) between the control bar bracket and the handle (Figure 80).

NOTE: Moving the Z-fitting to a hole closer to the spring decreases the gap between the control bar bracket and the handle; moving it to a hole farther from the spring increases the gap.

4. Install the spring cover over the cable adjuster.

5. Hook the spring into the hole in the center of the control bar bracket as shown in Figure 81.

6. Check the adjustment ("Checking the Rotor Control Cable" on page 7 - 1).

NOTE: After extended use, the drive belt may wear and result in a loss of belt tension. Improper belt tension allows the belt to slip and decreases the performance under a heavy load. Belt slippage may occur after two or three seasons of normal usage (10 to 15 hours). If the drive belt slips (continuously squeals) under a heavy load, increase the belt tension by positioning the spring end in the other hole in the control bar bracket as shown in Figure 81. Adjust the gap between the control bar bracket and the handle to 1/8 to 1/4 in. (3 to 6mm).

NOTE: Using the incorrect adjusting hole in the control bar bracket can reduce the drive belt life. Occasional belt slippage (squealing) may occur in extremely wet conditions due to moisture in the drive system. To remove moisture, start the rotor and operate it without a load for 30 seconds. Once you remove the moisture, the drive belt should not slip.

Adjusting the Pivot Cable

Check the pivot cable for proper adjustment initially, after the first operating hour, and then annually thereafter.

Checking the Pivot Cable

1. Stop the engine and wait for all moving parts to stop.

2. Squeeze the control bar toward the handle.

3. Hold the control bar against the right side of the handle as shown in Figure 11.

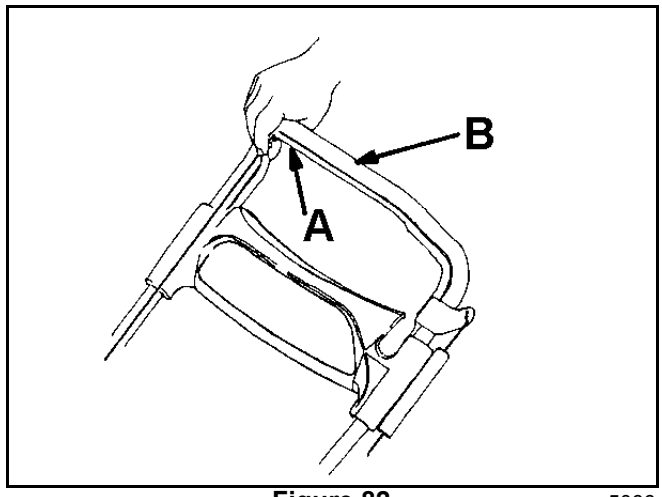

Figure 82 m-5066

(A) Right side of the control bar	(B) Handle

4. Ensure that the distance between the pivot plate and the wheel frame is 0 to 1/8 in. (0 to 3mm) as shown in Figure 83.

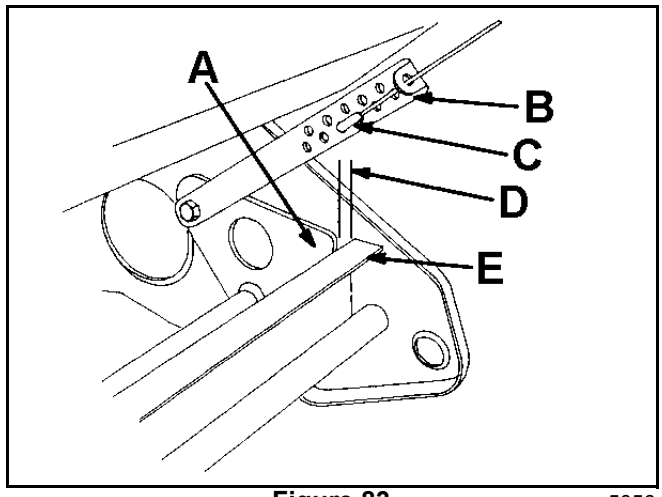

Figure 83 m-5056

(A) Pivot Plate	(D) 0 to 1/8 in. (0 to 3mm) gap
(B) Pivot Cable Adjuster	
(C) Z-fitting	(E) Wheel Frame

Important If the pivot plate touches the wheel frame before the control bar touches the handle, the cable is too tight. Adjust the cable to increase the gap between the pivot plate and the wheel frame, but ensure that the gap is not more than 1/8 in. (3mm). Adjusting the cable correctly minimizes the effort needed to operate the control bar.

Adjusting the Pivot Cable

Unhook the Z-fitting from the pivot cable adjuster (Fig. 12), and position the Z-fitting in a different hole on the pivot cable adjuster to obtain the proper gap between the pivot plate and the wheel frame.

Note: Moving the Z-fitting to a hole closer to the ground decreases the gap between the pivot plate and the wheel frame; moving it to a hole farther from the ground increases the gap.

Note: The traction is most aggressive (the traction speed is fastest) when the rotor blades are new. If you want to reduce the aggressiveness of the traction, move the Z-fitting one hole farther from the ground. The gap between the pivot plate and the wheel frame will be about 1/4 in. (6mm).

After the rotor blades have worn slightly, the traction won't feel as aggressive. To increase the traction, adjust the pivot cable to attain the original gap between the pivot plate and the wheel frame of 0 to 1/8 in. (0 to 3mm).

Replacing the Rotor Blades

Before each season, inspect the rotor blades for wear. When a rotor blade edge has worn to the wear indicator hole (Figure 84), replace all three rotor blades to ensure proper performance and to prevent damage to the underside of the snowthrower.

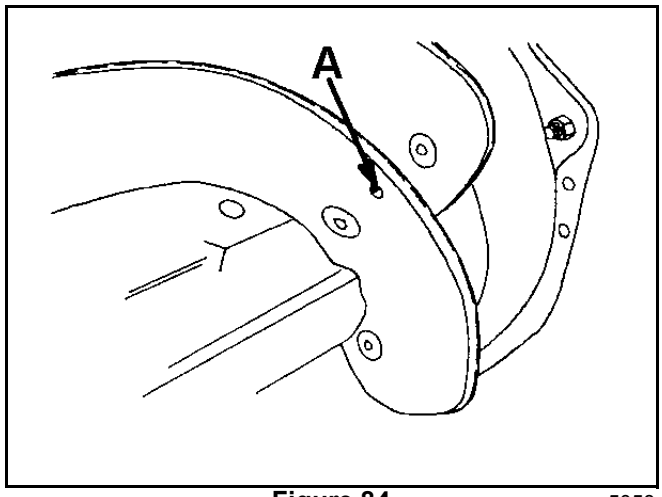

Figure 84 m-5058

(A) Rotor blade wear indicator hole

Important Replace the scraper whenever you replace the rotor blades. This ensures proper snowthrower operation and performance.

NOTE: The running time and the roughness of the driveway or the sidewalk determines the wear rate of the rotor blades.

NOTE: You need a T27 Torx driver to complete this procedure.

1. Stop the engine and wait for all moving parts to stop.

2. Remove the key from the switch.

3. Disconnect the wire from the spark plug. Refer to steps 1 through 3 of "Replacing the Spark Plug" on page 7 - 6.

Removing the Old Rotor Blades

NOTE: To make replacing the rotor blades easier, do not remove all the old rotor blades at once; this disassembles the rotor drum, making installing the new rotor blades more difficult. Replace the rotor blades one at a time to keep the rotor drum intact.

1. Remove the four Torx screws and the four locknuts that secure the outer edges of the rotor blade to the rotor assembly (Figure 85).

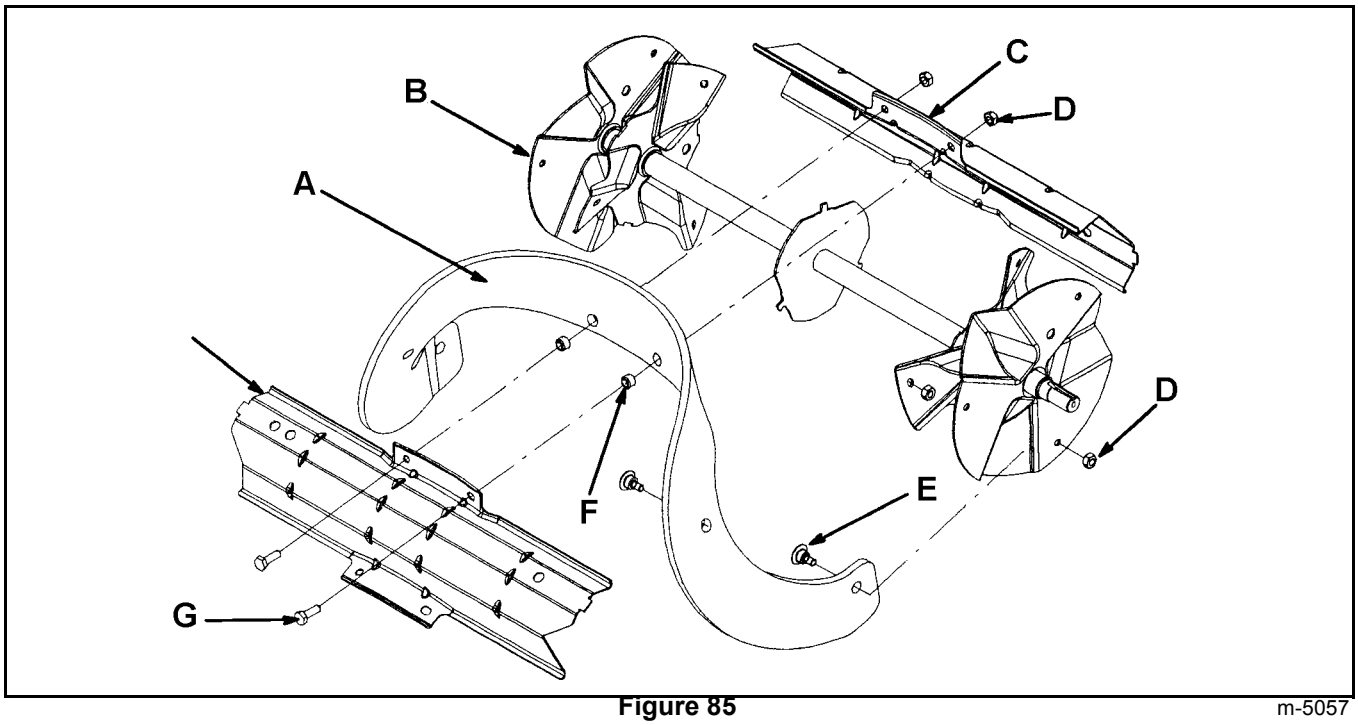

Figure 85 m-5057

(A) Thick rubber side of the rotor blade (3)	(B) Rotor Assembly	(D) Locknut (18)	(F) Spacer (6)
	(C) Rotor Drum	(E) Torx Screw (12)	(G) Hex-head Cap Screw (6)

2. Remove the two hex-head cap screws and two locknuts that secure the center of the rotor blade to the rotor drum (Figure 85).

3. Slide the rotor blade out from between the rotor drum parts (Figure 85).

4. Remove the two spacers from the old rotor blade and install them in the new blade.

Installing the New Rotor Blades

1. Examine a new rotor blade edge for the difference in the thickness of the rubber layers (Figure 86).

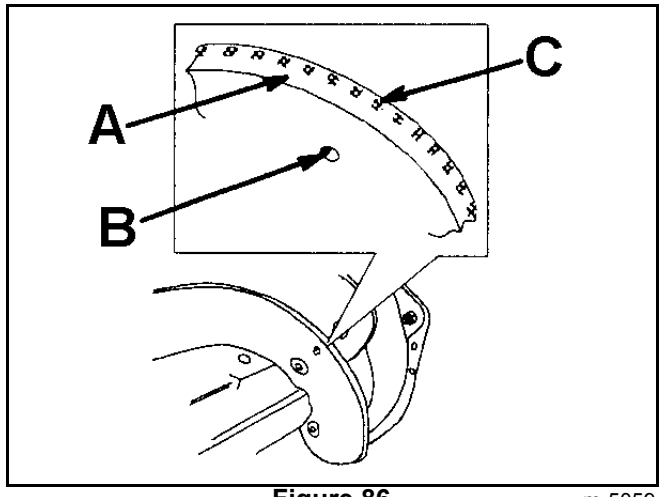

Figure 86 m-5059

(A) Thick Rubber Side	(C) Thin Rubber Side
(B) Wear Indicator Hole	

Install the rotor blades with the thick rubber layer on the *inside* of the curve. (Figure 86). If you do not install the rotor blades properly, they will wear more quickly and may vibrate excessively.

2. Insert the new rotor blade between the rotor drum parts.

3. Secure the rotor blade to the rotor drum parts with the two hex-head cap screws and two locknuts that you previously removed. Position the bolt heads on the thick rubber side of the rotor blade (Figure 85).

4. Curve the rotor blade and secure it with the remaining Torx screws and locknuts, positioning the screw heads on the thick rubber side of the rotor blade (Figure 85).

5. Tighten all screws and locknuts securely.

6. Replace the scraper. Refer to “Replacing the Scraper” (below).

7. Connect the wire to the spark plug.

8. Install the control panel.

9. Insert the key in the switch.

Replacing the Scraper

NOTE: If the rotor blades are partially or completely worn, replace the rotor blades when you replace the scraper. This ensures proper snowthrower operation and performance.

1. Stop the engine and wait for all moving parts to stop.

2. Remove the key from the switch.

3. Disconnect the wire from the spark plug. Refer to steps 1 through 3 of “Replacing the Spark Plug” (below).

4. Tip the snowthrower backward onto its handle.

5. Remove the six bolts and locknuts that hold the scraper in place (Fig. 17).

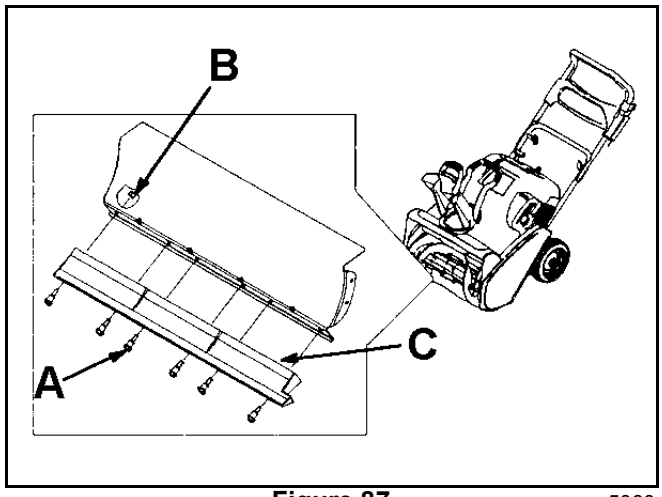

Figure 87 m-5060

(A) Carriage Bolt (6)	(C) Scrapper
(B) Locknut (6)	

6. Remove the scraper.

7. Install the new scraper to the housing using the bolts and the locknuts you previously removed.

8. Connect the wire to the spark plug.

9. Install the control panel.

10. Insert the key in the switch.

Replacing the Spark Plug

Before each season, check the spark plug. Replace the plug if fouled with deposits or if the electrodes in the center of the plug are dark or have deteriorated spark plug - *NGK BPMR4A or equivalent.*

1. Remove the two mounting screws that secure the control panel to the housing (Fig. 18).

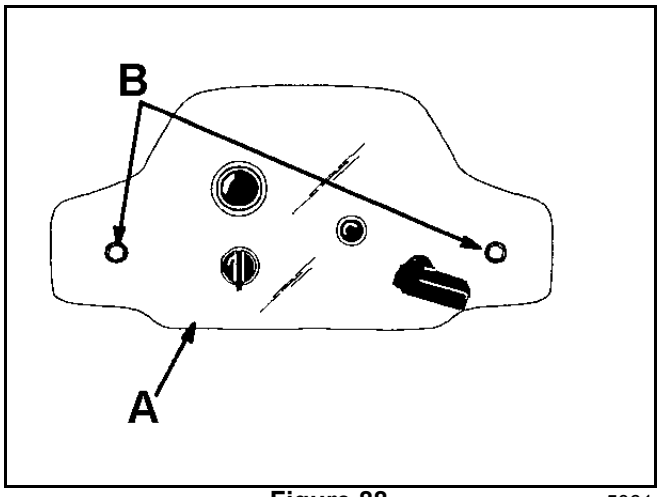

Figure 88 m-5061

(A) Control Panel	(B) Mounting Screws (2)

2. Remove the ignition key and lift off the panel, allowing it to hang on the recoil rope.

3. Lift up the shroud and disconnect the wire from the spark plug (Figure 89).

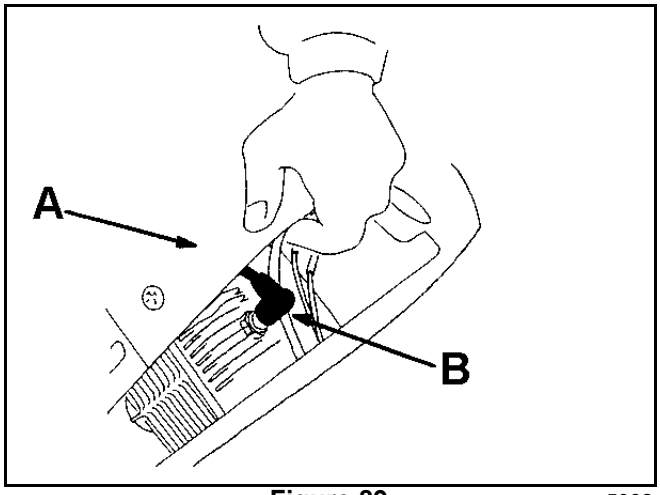

Figure 89 m-5062

(A) Shroud	(B) Spark Plug Wire

4. Clean any debris from around the base of the spark plug.

5. Remove the spark plug (Figure 89).

6. Examine the spark plug and replace it if it is cracked, fouled, or dirty.

Important Do not sandblast, scrape, or clean the spark plug. Dirt may fall into the cylinder and cause engine damage.

7. Set the spark plug gap (Figure 90) between the electrodes to 0.030 in. (0.76mm).

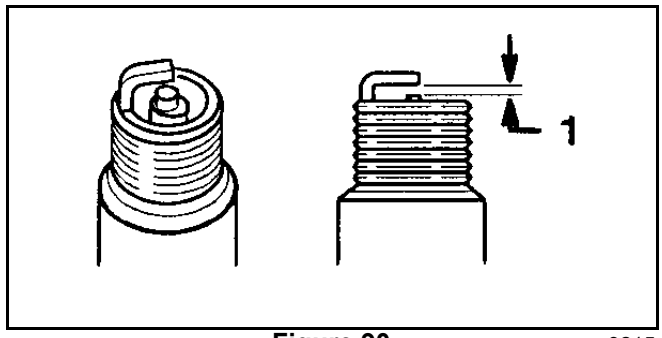

Figure 90 m-3215

8. Install the spark plug and torque it to 15 ft-lb (20.4 N·m). If you do not have a torque wrench, tighten the plug firmly.

9. Connect the wire to the spark plug.

10. Install the control panel.

Replacing the Drive Belt

Inspect the drive belt before each season, and replace it if it is worn or damaged.

1. Stop the engine and wait for all moving parts to stop.

2. Remove the key from the switch.

3. Disconnect the wire from the spark plug. Refer to steps 1 through 3 of "Replacing the Spark Plug" on page 7 - 6.

4. Remove the two self-tapping screws, three cap screws, one washer, and three locknuts that secure the drive belt cover to the snowthrower frame (Figure 91). Set the drive belt cover aside.

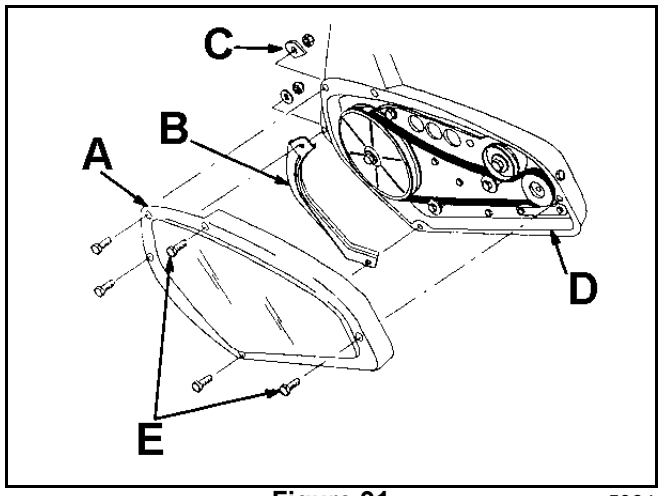

Figure 91 m-5064

(A) Drive Belt Cover	(D) Snowthrower Frame
(B) Left Rotor Guard	(E) Self-Tapping Screws
(C) Washer (diamond-shaped on some models)	

5. Remove the left rotor guard (Figure 91) and save it for installation in step 10.

Important The left rotor guard acts as a water seal for the drive. Do not assemble the drive cover without installing this part or the drive belt will slip and fail.

6. Remove the old drive belt from the engine pulley and the idler pulley (Figure 92).

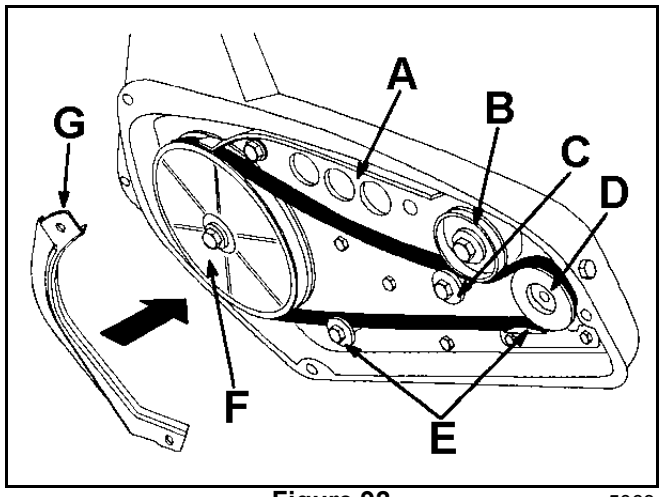

Figure 92 m-5063

(A) Brake Arm Assembly	(E) Belt Guides
(B) Idler Pulley	(F) Rotor Pulley
(C) Roller	(G) Left Rotor Guard
(D) Engine Pulley	

7. Push down on the idler pulley and remove the drive belt from the rotor pulley (Figure 92).

8. Push down on the idler pulley and route the new drive belt around the rotor pulley (Figure 92).

9. Release the idler pulley and route the drive belt over the two belt guides, around the engine pulley, and between the idler pulley and the roller (Figure 92).

Important The drive belt must be on top of the roller and the two belt guides as shown in Figure 92.

10. Install the left rotor guard.

11. Install the drive belt cover. Tighten the fasteners securely, *but do not overtighten*.

NOTE: Install the diamond-shaped washer as shown in Figure 91 and Figure 93.

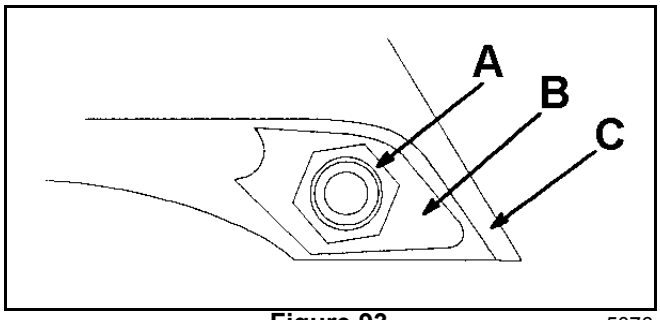

Figure 93 m-5076

(A) Locknut	(C) Housing
(B) Washer (diamond-shaped on some models)	

12. Connect the wire to the spark plug.
13. Install the control panel.
14. Insert the key in the switch.

Checking the Tire Pressure

Inflate both tires to between 15 and 20 psi (103 and 137 kPA).

Troubleshooting

Problem	Possible Causes	Corrective Action
Electric starter does not turn (electric-start models only)	1. The power cord is disconnected at the outlet or the snowthrower.	1. Connect the power cord to the outlet and/or the snowthrower.
	2. The power cord is worn, corroded, or damaged.	2. Replace the power cord.
	3. The power outlet is not energized.	3. Have a qualified electrician energize the power outlet.
Engine does not start or starts hard	1. The key is not in the ignition or is in the *Off* position.	1. Insert the key into the ignition and turn it to the *On* position.
	2. The choke is in the *Off* position and the primer has not been pressed.	2. Move the choke to the *On* position and press the primer two times.
	3. The fuel tank is empty or the fuel system contains stale fuel.	3. Drain and fill the fuel tank with a fresh gasoline-and-oil mixture (not more than 30 days old). If the problem persists, contact an Authorized Service Dealer.
	4. The engine is flooded.	4. Move the choke to the *Off* position and pull the rope several times to clear out the rich fuel-and-air mixture from the engine.
	5. The spark plug wire is loose or disconnected.	5. Connect the wire to the spark plug.
	6. The spark plug is pitted, fouled, or the gap is incorrect.	6. Check the spark plug and adjust the gap if necessary. Replace the spark plug if it is pitted, fouled, or cracked.
	7. The fuel cap vent is restricted.	7. Remove the vent restriction or replace the fuel cap.
Engine runs rough	1. The choke is in the *On* position.	1. Move the choke to the *Off* position.
	2. The fuel system contains stale fuel.	2. Drain and fill the fuel tank with a fresh gasoline-and-oil mixture (not more than 30 days old). If the problem persists, contact an Authorized Service Dealer.
	3. The spark-plug wire is loose.	3. Connect the wire to the spark plug.
	4. The spark plug is pitted, fouled, or the gap is incorrect.	4. Check the spark plug and adjust the gap if necessary. Replace the spark plug if it is pitted, fouled, or cracked.

Troubleshooting

Problem	Possible Causes	Corrective Action
Engine runs, but the snowthrower discharges snow poorly or not at all	1. You are walking too fast or too slow.	1. Change your walking speed.
	2. You are trying to remove too much snow per swath.	2. Reduce the amount of snow removed per swath.
	3. You are trying to remove extremely heavy or wet snow.	3. Don't overload the snowthrower with extremely heavy or wet snow; reduce the amount of snow removed per swath.
	4. The discharge chute is plugged.	4. Stop the engine, wait for all moving parts to stop, and use a stick to remove the snow from the discharge chute.
	5. The rotor control cable is improperly adjusted or broken.	5. Adjust or replace the rotor control cable.
	6. The drive belt is loose or is off the pulley.	6. Inspect the drive belt, and install or replace it.
	7. The drive belt is worn or broken.	7. Replace the drive belt.
	8. The rotor blades are worn.	8. Replace the rotor blades and the scraper.
Snowthrower does not properly clear snow off the surface	1. The snow on the surface to be cleared is compacted down	1. Throw the snow off the surface before it becomes compacted.
	2. The front of the snowthrower is not down.	2. Check the pivot cable, and adjust or replace it.
	3. The scraper is excessively worn.	3. Replace the scraper and the rotor blades.
	4. The rotor blades are excessively worn.	4. Replace the rotor blades and the scraper.
Snowthrower does not self-propel	1. The front of the snowthrower is not down.	1. Check the pivot cable, and adjust or replace it.
	2. The rotor blades are excessively worn.	2. Replace the rotor blades and the scraper.
	3. The snow is too deep or the surface is too slippery.	3. Push forward on the handle, but allow the snowthrower to work at its own pace.
Rotor blades do not stop properly	1. The rotor control cable is improperly adjusted.	1. Adjust the rotor control cable.

SPECIFICATIONS (General)

Item	Description
Engine Mfg.	The Toro Company 141cc E series (R tek)
Fuel Mix Ratio	50:1
Spark Plug	NGK BPMR4A or equivalent
Fuel Capacity	1.2 US quart (1.1 l)
Weight	113 lbs. (51.4 kg) (recoil start) 115 lbs. (52.3 kg) (electric start)
Width	24.3” (61.7 cm)
Height	40.4” (102.6 cm) (highest point)
Length	51.3” (130.3 cm)
Chute Rotation	210 degrees
Chute Throat Diameter	6.2” (15.7 cm)
Impeller Diameter	10” (25.4 cm)
Rotor Drive Reduction	3.95:1

TORQUE SPECIFICATIONS

Description / Where Used	Torque Value	
	In-Lbs	N·cm
Engine Pulley Square Head Set Screw Allen Head Set Screw	 120 - 150 60 - 80	 1355 - 1694 678 - 904
Nut On Recoil Support	90 - 120	1016 - 1355
Engine Mounting Screws	170 - 220	1920 - 2483
Rotor Pulley Capscrew	100	1125
Brake Arm Shoulder Bolt	170 - 250	1920 - 2824 (Must pivot freely)
Plastite Screws	Tighten securely, but do not deform the plastic	
Belt Cover Top Screw (has an O-ring on it)	Tighten to compress O-ring to .08” - .11” (2.03 - 2.79mm) thick.	

LUBRICATION

Engine - “Fuel and Oil Requirements” on page 1 - 6.
Engine crankshaft pulley. Apply anti-seize compound to shaft before installation of pulley.
Apply a light coat of #2 general purpose grease to the brake arm, shoulder bolt, and washers.

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