Form No. 3417-602 Rev A

TORO®

Count on it.

Operator's Manual

30in Stand-On Aerator

Model No. 29519—Serial No. 400000000 and Up

Register at www.Toro.com.
Original Instructions (EN)

3417-602 A

⚠ WARNING

CALIFORNIA
Proposition 65 Warning

This product contains a chemical or chemicals known to the State of California to cause cancer, birth defects, or reproductive harm.

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

Important: **This engine is not equipped with a spark arrester muffler. It is a violation of California Public Resource Code Section 4442 to use or operate the engine on any forest-covered, brush-covered, or grass-covered land. Other states or federal areas may have similar laws.**

The enclosed *Engine Owner's Manual* is supplied for information regarding the US Environmental Protection Agency (EPA) and the California Emission Control Regulation of emission systems, maintenance, and warranty. Replacements may be ordered through the engine manufacturer.

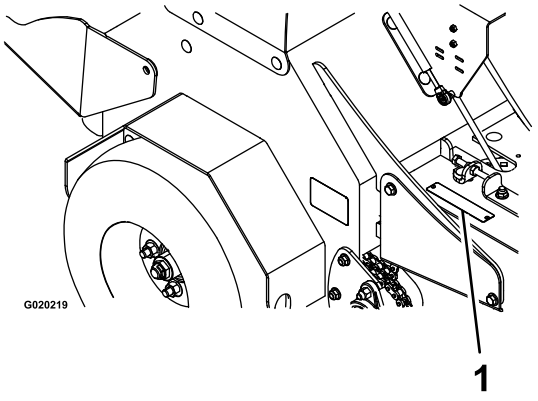
Introduction

This aerator is intended to be used by trained operators in residential and commercial applications. It is primarily designed for aerating areas of well-maintained lawns on residential grounds, parks, sports fields, and on commercial grounds.

Read the information in the manual carefully to learn how to operate and maintain your product properly and to avoid injury and product damage. You are responsible for operating the product properly and safely.

You may contact Toro directly at www.Toro.com for product safety and operation training materials, accessory information, help finding a dealer, or to register your product.

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. Write the numbers in the space provided.



g020219

Figure 1

1. Location of the model and serial numbers

Model No. _____

Serial No. _____

This manual identifies potential hazards and has safety messages identified by the safety-alert symbol (Figure 2), which signals a hazard that may cause serious injury or death if you do not follow the recommended precautions.

g000502

Figure 2

1. Safety-alert symbol

This manual uses 2 words to highlight information. **Important** calls attention to special mechanical information and **Note** emphasizes general information worthy of special attention.

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Bloomington, MN 55420

Contact us at www.Toro.com.
Printed in the USA

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Safety

Improper use or maintenance by the operator or owner can result in injury. To reduce the potential for injury, comply with these safety instructions, and pay attention to the safety-alert symbol, which means **Caution, Warning,** or **Danger**—"personal safety instruction." **Failure to comply with the instructions may result in personal injury or death.**

⚠ WARNING

Removing or modifying original equipment, parts and/or accessories may alter the warranty, controllability, and safety of the machine. Unauthorized modifications to the original equipment or failure to use original Toro parts could lead to serious injury or death. Unauthorized changes to the machine, engine, fuel or venting system, may violate applicable safety and government standards.

Replace all parts including, but not limited to, tires, belts, and fuel system components with original Toro parts.

Important: **This machine was manufactured according to the appropriate regulatory standards in effect at the time of manufacture. Modifying this machine in any way may cause it to be out of compliance with those standards and with the instructions in this *Operator's Manual*. Modifications to this machine should be made only by either the manufacturer or an Authorized Service Dealer.**

This product is capable of injuring your hands and feet. Follow all safety instructions to avoid serious injury or death.

The owner/user can prevent and is responsible for accidents or injuries occurring to people, or damage to property.

Any use of this machine other than aerating turf grass could prove dangerous to the user and bystanders.

Important: **The addition of attachments made by other manufacturers that do not meet ANSI certification may cause noncompliance of this machine.**

Safe Operating Practices

The following instructions are from ANSI standard B71.4-2012.

Training

- Read the *Operator's Manual* and other training material.

  Note: If the operator(s) or mechanic(s) cannot read the manual language, it is the owner's responsibility to explain this material to them.
- Become familiar with the safe operation of the equipment, operator controls, and safety signs.
- All operators and mechanics should be trained. The owner is responsible for training the users.
- Never let children or untrained people operate or service the equipment.

  Note: Local regulations may restrict the age of the operator.
- The owner/user can prevent and is responsible for accidents or injuries occurring to himself or herself, other people, or damage to property.

Preparation

- Evaluate the terrain to determine what accessories and attachments are needed to properly and safely perform the job. Use only accessories and attachments approved by the manufacturer.
- Wear appropriate clothing; including safety glasses, long pants, substantial, slip-resistant footwear, gloves, and hearing protection. Tie back long hair. Do not wear jewelry.
- Inspect the area where you will use the equipment and remove all objects from the area before using the machine.
- Use extra care when handling fuels. They are flammable and its vapors are explosive.
  - Use only an approved container.
  - Do not remove the fuel cap or add fuel with the engine running. Allow the engine to cool before refueling. Do not smoke near the machine when the engine is running.
  - Do not refuel or drain the machine indoors.
- Check that the operator's presence controls, safety switches, and shields are attached and functioning properly. Do not operate the machine unless they are functioning properly.

Operation

- Lightning can cause severe injury or death. If lightning is seen or thunder is heard in the area, do not operate the machine; seek shelter.
- Do not run an engine in an enclosed area.
- Operate the machine only in well-lit areas, keeping away from holes and hidden hazards.
- Ensure that all drives are in neutral and that the parking brake is engaged before starting the engine. Start the engine only from the operator's position.
- Make sure that you have good footing while using this machine, especially when backing up.

  Note: Reduced footing could cause slipping.
- Slow down and use extra care on hillsides. Be sure to travel side to side on hillsides. Turf conditions can affect the stability of the machine. Use caution while operating near drop-offs.
- Slow down and use caution when making turns and when changing directions on slopes.
- Do not operate the machine without the shields or other guards securely in place. Be sure all interlocks are attached, adjusted properly, and functioning properly.
- Do not change the engine governor setting or overspeed the engine.
- Stop on level ground, disengage drives, engage the parking brake (if provided), shut off the engine before leaving the operator's position for any reason.
- Stop equipment and inspect the tines after striking objects or if an abnormal vibration occurs. Make the necessary repairs before resuming operations.
- Keep your hands and feet away from the tine assembly.
- Look behind and down before backing up to ensure a clear path.
- Stop the machine if anyone enters the area. Keep pets and bystanders away from an operating machine.
- Slow down and use caution when making turns and crossing roads and sidewalks. Fully raise the tines if you are not aerating.
- Do not operate the machine while ill, tired, or under the influence of alcohol or drugs.
- Use care when loading or unloading the machine into or from a trailer or truck.
- Use care when approaching blind corners, shrubs, trees, or other objects that may obscure vision.

Safe handling of fuels

- To avoid personal injury or property damage, use extreme care in handling fuel. Fuel is extremely flammable and the vapors are explosive.
- Extinguish all cigarettes, cigars, pipes, and other sources of ignition.
- Use only an approved fuel container.
- Do not remove the fuel cap or add fuel with the engine running.
- Allow the engine to cool before fueling.
- Do not fuel the machine indoors.
- Do not store the machine or fuel container where there is an open flame, spark, or pilot light such as on a water heater or on other appliances.
- Do not fill containers inside a vehicle, on a truck, or on a trailer bed with a plastic liner. Always place containers on the ground away from your vehicle before filling.
- Remove equipment from the truck or trailer and fuel it on the ground. If this is not possible, then add fuel with such equipment as a portable container rather than from a fuel-dispenser nozzle.
- Keep the nozzle in contact with the rim of the fuel tank or container opening at all times until fueling is complete. Do not use a nozzle lock-open device.
- If fuel is spilled on clothing, change your clothing immediately.
- Do not overfill the fuel tank. Replace the fuel cap and tighten it securely.

Maintenance and Storage

- Do not allow untrained personnel to service the machine.
- Do not touch equipment or attachment parts that may be hot from operation. Allow all of the parts of the machine to cool before attempting to maintain, adjust, or service the machine.
- Keep your hands and feet away from moving parts. If possible, do not make adjustments with the engine running.
- Disengage the drives, raise the tines, engage the parking brake, shut off the engine, and remove the key or disconnect the spark-plug wire. Wait for all movement to stop before adjusting, cleaning, or repairing.
- Disconnect the battery or remove the spark-plug wire before making any repairs. Disconnect the negative terminal first and the positive terminal last. Connect the positive first and negative last.

- Use care when checking the tines. Wrap the tine(s) or wear gloves, and use caution when servicing them. Only replace tines; do not straighten or weld them.
- Clean grass, dirt, and debris from the tines, drives, mufflers, and engine to help prevent fires.
- Clean up oil or fuel spills.
- Park machine on level, hard ground. Never allow untrained personnel to service the machine.
- Use jack stands to support components when required.
- Carefully release pressure from components with stored energy.
- Do not store fuel near flames or drain the fuel indoors.
- Let the engine cool before storing the machine.
- Keep all parts in good working condition and all hardware tightened. Replace all worn or damaged decals.

Hauling

- Use care when loading or unloading the machine into a trailer or a truck.
- Use a full-width ramp for loading the machine into a trailer or a truck.
- Tie the machine down securely using straps, chains, cable, or ropes. Both front and rear straps should be directed down and outward from the machine.

Aerator Safety

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

General Operation

- Check carefully for overhead clearances (i.e., branches, doorways, electrical wires, etc.) before operating under any objects, and do not contact them.
- Use caution when you are riding on the platform and driving the machine over curbs, rocks, roots, or other obstructions.
- Do not jerk the controls; use a steady motion.
- Do not carry passengers.
- Do not carry equipment on the machine.

Slope Operation

Use extreme caution when aerating and/or turning on slopes as loss of traction and/or tip-over could occur. You are responsible for safe operation on slopes.

- Use Figure 3 to help you determine the appropriate slope angle of area to aerate.
- Remove or mark obstacles such as rocks, tree limbs, etc. from the aerating area.
- Watch for holes, ruts, or bumps.

  Note: Tall grass can hide obstacles.
- Use caution near drop-offs, ditches, or embankments.

  Note: The machine could suddenly turn over if a wheel goes over the edge of a cliff or ditch, or if an edge caves in.
- Be aware that operating on wet grass, across steep slopes or downhill may cause the machine to lose traction. Loss of traction to the drive wheels may result in sliding and a loss of braking and steering.
- Do not aerate slopes greater than 15 degrees.
- Avoid sudden starts and stops when aerating uphill because the machine may tip backward.

  Note: The machine is more stable going uphill with the tines raised.
- Keep all movement on slopes slow and gradual.
- Do not make sudden changes in speed or direction.
- Reduce the tine-down pressure to prevent the drive tires from raising off the ground and to prevent the front tires from raising off the ground while aerating uphill.
- Follow the manufacturer's recommendations for wheel weights or counterweights to improve stability.
- Use extra care with attachments.

  Note: Use of attachments can change the stability of the machine.

Service

- To ensure optimum performance and continued safety certification of the machine, use only genuine Toro replacement parts and accessories. Replacement parts and accessories made by other manufacturers could be dangerous, and such use could void the product warranty.
- Never remove or tamper with safety devices. Check their proper operation regularly. Never do anything to interfere with the intended function of a safety device or to reduce the protection provided by a safety device.
- Check the brake operation frequently. Adjust and service the brakes as required.

Slope Indicator

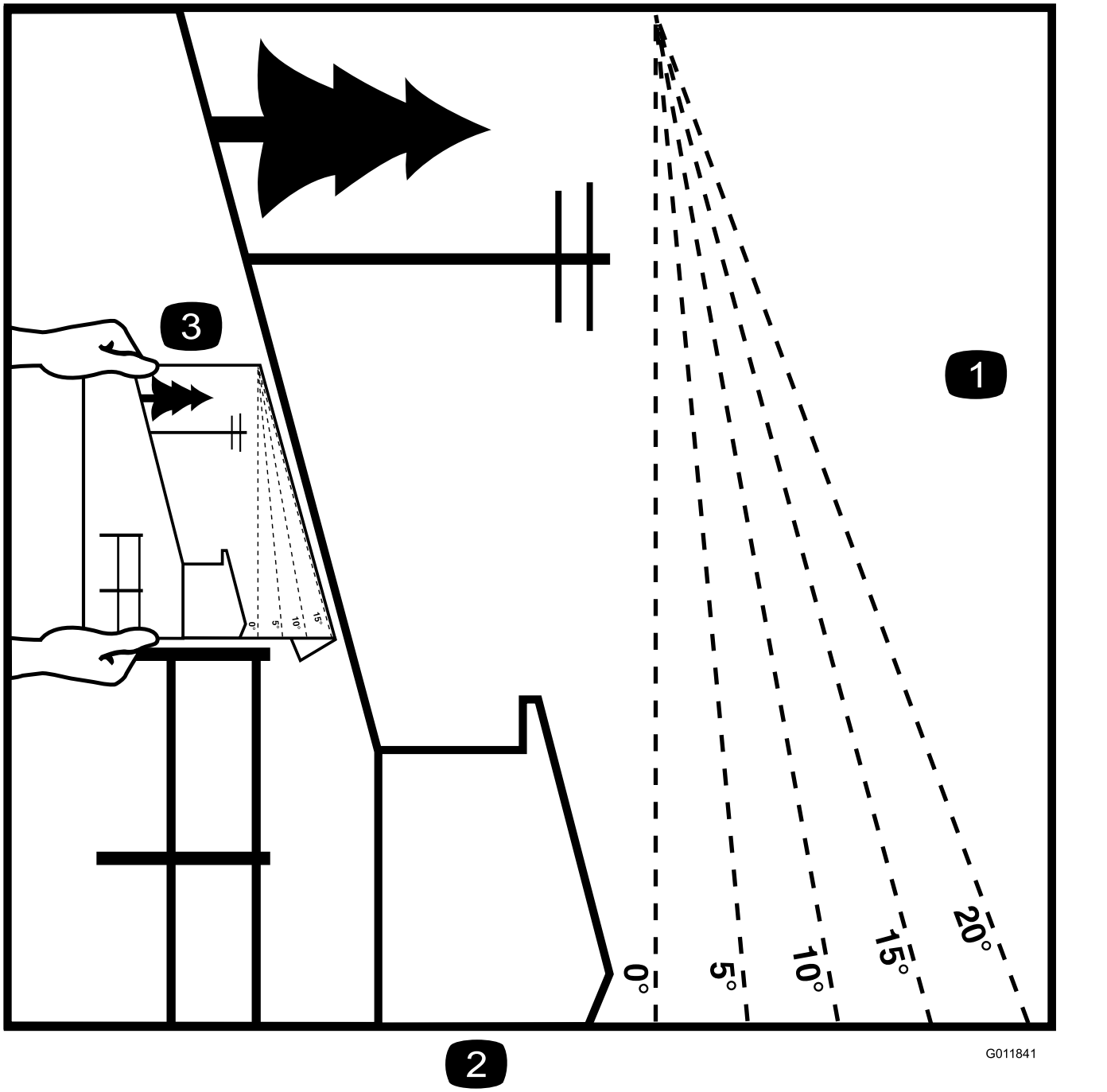

Figure 3

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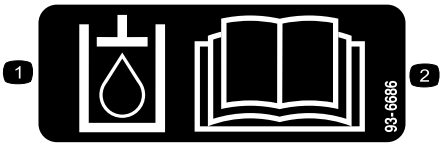
1. The maximum slope you can safely operate the machine on is **15 degrees**. Use the slope chart to determine the degree of slope of hills before operating. **Do not operate this machine on a slope greater than 15 degrees.** Fold along the appropriate line to match the recommended slope.
2. Align this edge with a vertical surface, a tree, building, fence pole, etc.
3. Example of how to compare slope with folded edge

Safety and Instructional Decals

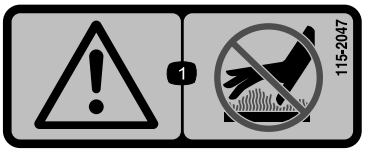
Safety decals and instructions are easily visible to the operator and are located near any area of potential danger. Replace any decal that is damaged or missing.



decal93-6686

93-6686

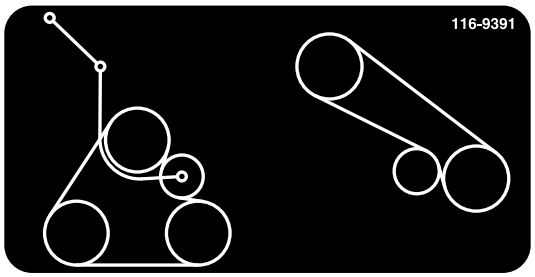
1. Hydraulic fluid
2. Read the *Operator's Manual*.



decal115-2047

115-2047

1. Warning—do not touch the hot surface.



decal116-9391

116-9391

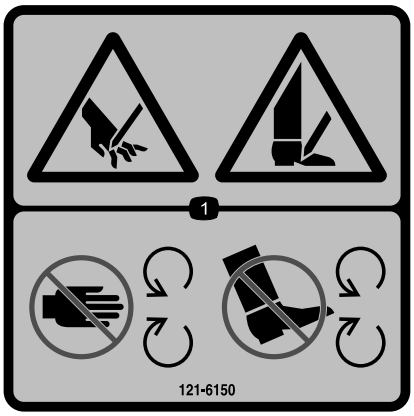
decal117-2718

117-2718

decal120-9570

120-9570

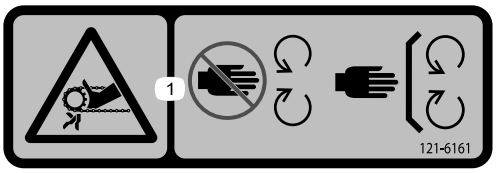
1. Warning—stay away from moving parts; keep all guards and shields in place.



decal121-6150

121-6150

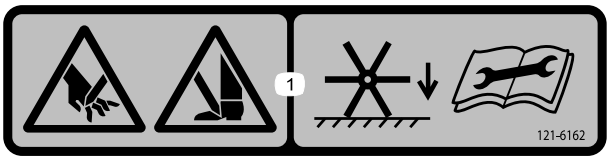
1. Cutting hazard of hand and foot—stay away from moving parts.



decal121-6161

121-6161

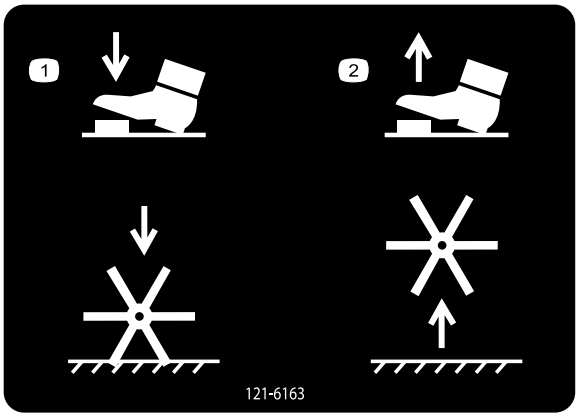
1. Entanglement hazard, belt—stay away from moving parts; keep all guards in place.



decal121-6162

121-6162

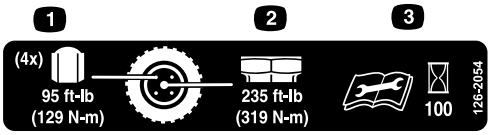
1. Cutting/dismemberment hazard of hand or foot—lower the tines to the ground; read the *Operator's Manual* for the disassembly procedure.



decal121-6163

121-6163

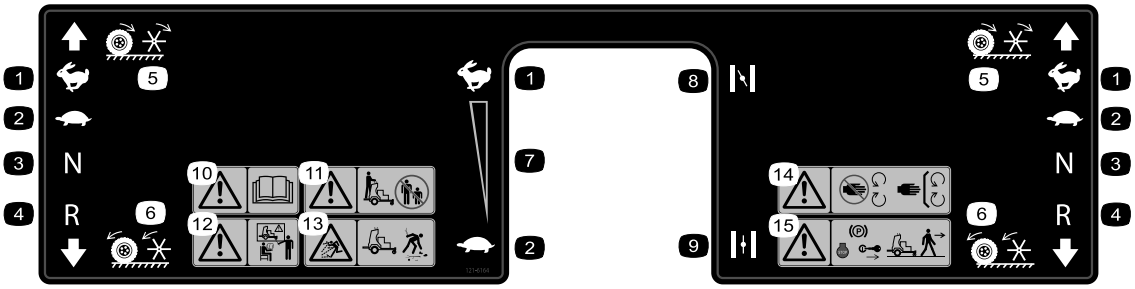
1. Press to lower the tines.
2. Release to raise the tines.



decal126-2054

126-2054

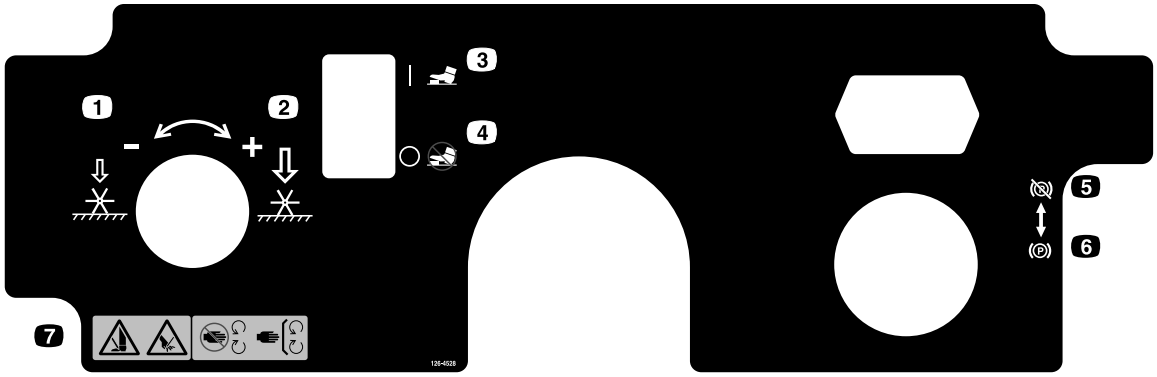
1. Wheel lug nut torque 129 N·m (95 ft-lb) (4x)
2. Wheel hub nut torque 319 N·m (235 ft-lb)
3. Read and understand the *Operator's Manual* before performing any maintenance; check the torque every 100 hours.



decal121-6164

121-6164

1. Fast
2. Slow
3. Neutral
4. Reverse
5. Wheels and tines rotate when moving forward
6. Wheels and tines rotate when moving backward
7. Continuous-variable setting
8. Choke—on
9. Choke—off
10. Warning—read the *Operator's Manual.*
11. Warning—keep bystanders a safe distance away from the machine.
12. Warning—do not operate the machine unless you are trained.
13. Thrown object hazard—pick up debris before operating the machine.
14. Warning—keep away from moving parts; keep all guards in place.
15. Warning—shut off the engine, engage the parking break, and remove the key before leaving the machine.



decal126-4528

126-4528

1. Rotate counterclockwise to decrease pressure
2. Rotate clockwise to increase pressure
3. Tine ground-engagement foot switch—On
4. Tine ground-engagement foot switch—Off
5. Parking brake—Disengaged
6. Parking brake—Engaged
7. Cutting/dismemberment hazard of hand or foot, tines—stay away from moving parts; keep all guards in place

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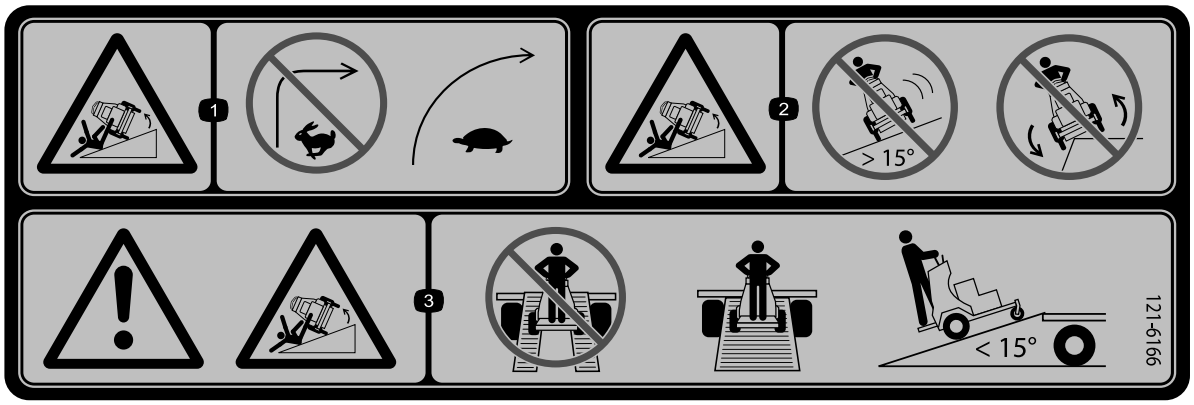
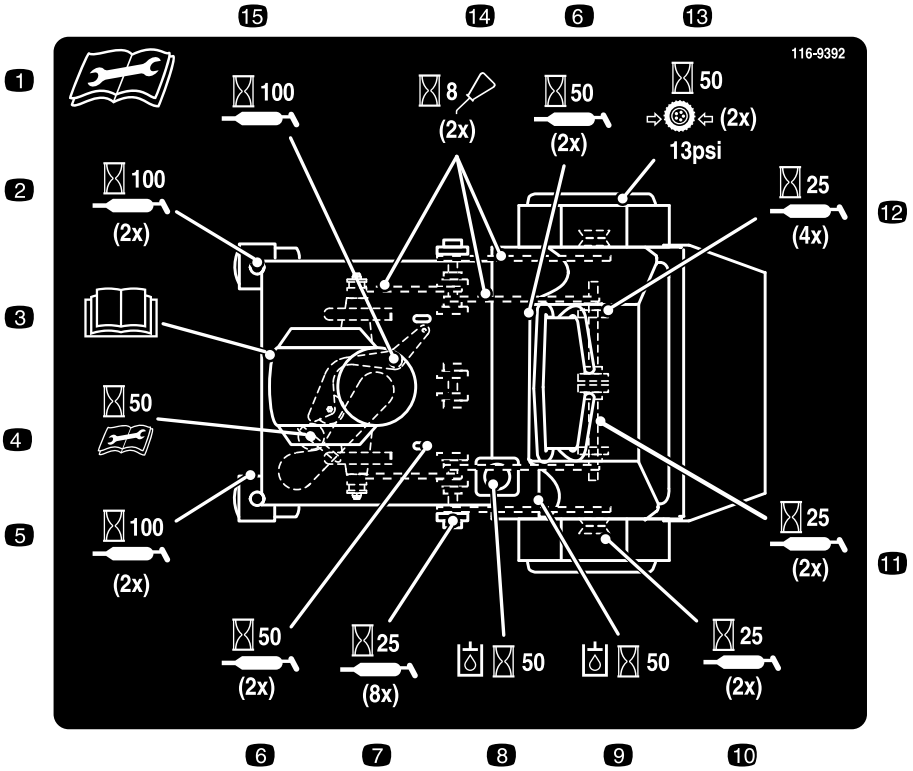


decal121-6166

121-6166

1. Tipping hazard—do not turn sharply while travelling fast; slow down and turn gradually.
2. Tipping hazard—do not operate the machine on slopes greater than 15 degrees; do not operate the machine near drop-offs.
3. Warning; tipping hazard—do not use split ramps; use a full-width ramp to load a machine for transport; use a loading ramp at a maximum of 15 degrees.



decal116-9392

116-9392

1. Read and understand the *Operator's Manual* before servicing this machine.
2. Grease the front caster pivots (2x) every 100 hours.
3. Refer to the engine owner's manual for service.
4. Check the auxiliary pump-drive belt tension every 50 hours.
5. Grease the front caster wheel bearings (2x) every 100 hours.
6. Grease the control pivots (4x) every 50 hours.
7. Grease the jackshaft bearings (8x) every 25 hours.
8. Check the hydraulic-fluid level (2x) every 50 hours.
9. Check the auxiliary hydraulic tank every 50 hours.
10. Grease the wheel bearings (2x) every 25 hours.
11. Grease the tine assembly idlers (2x) every 25 hours.
12. Grease the tine shaft bearings (4x) every 25 hours.
13. Check the tire pressure, 13 psi, (2x) every 50 hours.
14. Clean and oil the chains and check the chain tension (2x) every 8 hours.
15. Grease the belt idler pivot every 100 hours.

Setup

Media and Additional Parts

Description	Qty.	Use
Operator's Manual	1	Read before operating the machine.
Key	2	Start the machine.

1

Checking Tire Pressure

No Parts Required

Procedure

1. Check the tire pressure in the drive tires.

   Note: Proper inflation for drive tires is 83 to 97 kPa (12 to 14 psi).

2. Adjust the tire pressure if necessary.

2

Servicing the Battery

No Parts Required

Procedure

⚠ WARNING

CALIFORNIA
Proposition 65 Warning

Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.

Note: The machine is shipped with a filled, lead-acid battery.

⚠ DANGER

Charging or jump-starting the battery may produce explosive gases. Battery gases can explode, causing serious injury.

- **Keep sparks, flames, or cigarettes away from the battery.**
- **Ventilate when charging or using the battery in an enclosed space.**
- **Make sure that the venting path of the battery is always open once the battery is filled with acid.**
- **Always shield your eyes and face from the battery.**

⚠ DANGER

Battery electrolyte contains sulfuric acid, which is poisonous and can cause severe burns. Swallowing electrolyte can be fatal or if it touches skin can cause severe burns.

- **Wear safety glasses to shield your eyes and rubber gloves to protect your skin and clothing when handling electrolyte.**
- **Do not swallow electrolyte.**
- **In the event of an accident, flush with water and call a doctor immediately.**

1. Move the key switch to the OFF position and remove the key.
2. Measure the voltage of the battery with a voltmeter.
3. Use the table below to locate the charge state or the battery, and if needed, the battery-charger setting and charging interval recommended to charge the battery to 12.6 V or greater; refer to the battery charge table below.

   Important: **Make sure that the negative battery cable is disconnected and the battery charger used for charging the battery has an output of 16 V and 7 A or less to avoid damaging the battery (see chart for recommended charger settings).**

Battery Charge Table

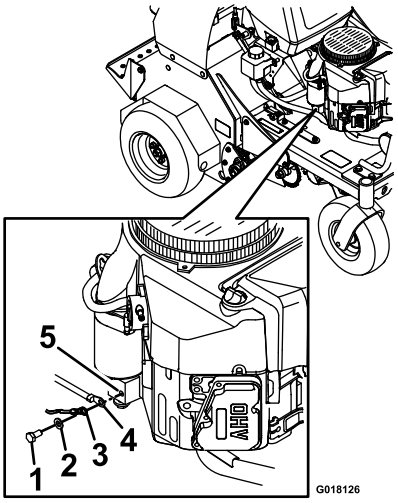
Voltage Reading	Percent Charge	Maximum Charger Settings	Charging Interval
12.6 or greater	100%	16 V/ 7 A	No charging required
12.4 to 12.6	75 to 100%	16 V/ 7 A	30 minutes
12.2 to 12.4	50 to 75%	16 V/ 7 A	1 hour
12.0 to 12.2	25 to 50%	14.4 V/ 4 A	2 hours
11.7 to 12.0	0 to 25%	14.4 V/ 4 A	3 hours
11.7 or less	0%	14.4 V/ 2 A	6 hours or more

⚠ CAUTION

If the key switch is in the ON position, there is potential for sparks and engagement of components. Sparks could cause an explosion or moving parts could accidentally engage, causing personal injury.

Ensure that the key switch is in the OFF position before charging the battery.

4. If the positive cable is also disconnected, connect the **positive (red) cable** to the positive battery terminal and slip the terminal cover over the positive terminal.
5. Remove the screw, washer, and ground cable from the engine. Connect the negative battery cable as shown in Figure 4.



g018126

Figure 4

1. Screw
2. Washer
3. Ground wire
4. Negative battery cable
5. Engine

Note: If time does not permit charging the battery or if charging equipment is not available, connect the negative battery cables and run the vehicle continuously for 20 to 30 minutes to charge the battery.

3

Servicing the Engine Oil

No Parts Required

Procedure

The engine is shipped with oil; check the engine-oil level and, if necessary, add oil to the appropriate level. Refer to Checking the Engine-Oil Level (page 18) for instructions and the oil specification.

4

Servicing the Transmission Fluid

No Parts Required

Procedure

Transmission fluid type: Toro Hypr-oil 500

The machine is shipped with hydraulic fluid in the expansion tank.

1. Run the machine for approximately 15 minutes to purge any extra air out of the hydraulic system.
2. Shut off the engine and allow the machine to cool.
3. Check the hydraulic-fluid level in the expansion tank (Figure 5).

   Note: The transmission-fluid level should cover the Full Cold line molded into the side of the tank.

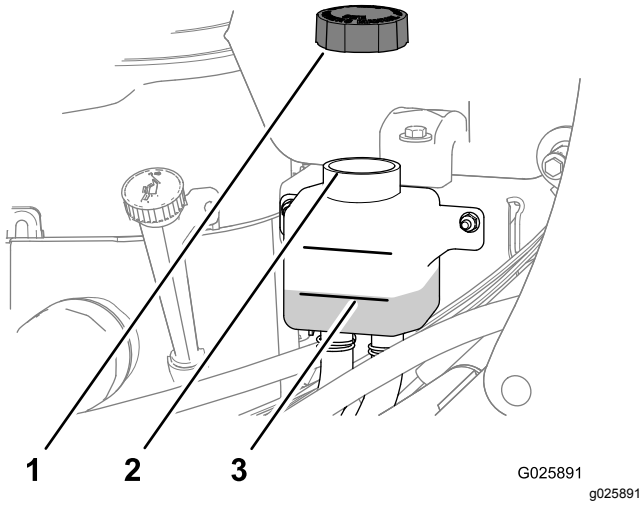


Figure 5

1. Cap
2. Filler neck (expansion tank)
3. Full Cold line

4. If necessary, add the specified transmission fluid until the fluid level is at the Full Cold line of the expansion tank (Figure 5).
5. Install the cap onto the expansion tank and tighten the cap until it is snug.

   Note: Do not overtighten expansion-tank cap.

5

Servicing the Auxiliary Hydraulic Fluid

No Parts Required

Procedure

Hydraulic fluid type: AW-32 hydraulic fluid

Note: The machine is shipped with hydraulic fluid in the reservoir.

1. Run the machine for approximately 15 minutes to purge any extra air out of the hydraulic system.
2. Completely raise and lower the tines 3 times to purge the air.
3. Shut off the engine and allow the machine to cool.
4. Loosen the 4 bolts inside the frame securing the pad to the machine.
5. Lift the pad up and back to remove it (Figure 6).

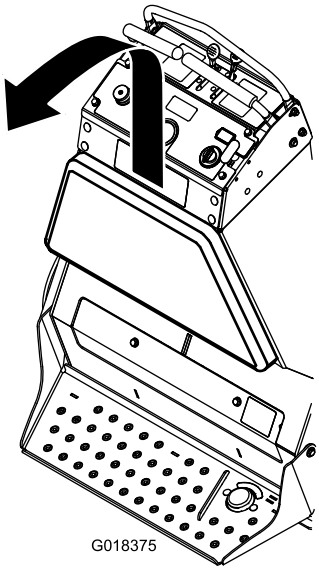


Figure 6

6. Remove the cap and check the hydraulic-fluid level in the reservoir (Figure 7).

   Note: The hydraulic-fluid level should cover the word **Cold** that is embossed into the baffle of the reservoir.

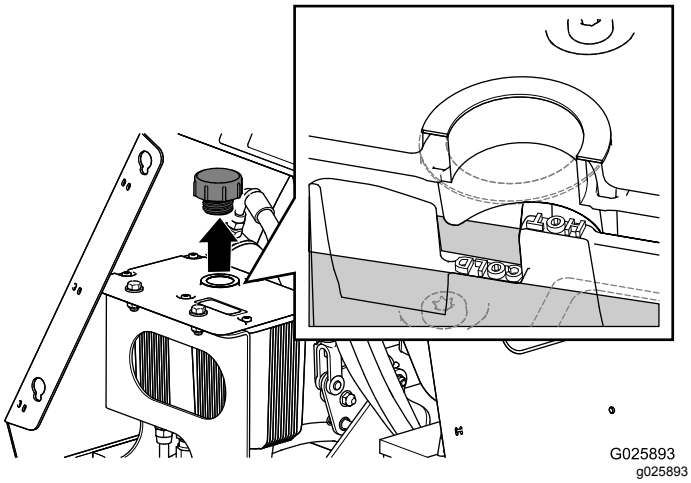


Figure 7

1. Cold fluid level
2. Hot fluid level

7. If necessary, add the specified hydraulic fluid to the reservoir until the fluid covers the **Cold** fluid level on the baffle (Figure 7).

   Note: The baffle in the reservoir is labeled **Hot** and **Cold**. Fill the reservoir to the appropriate level depending upon the temperature of the fluid. The fluid level varies with the temperature of the fluid. The **Cold** level shows the level of the fluid when it is at 24°C (75°F). The **Hot** level shows the level of fluid when it is at 107°C (225°F).

   For example: If the fluid is at ambient-air temperature, about 24°C (75°F), fill only to the **Cold** level. If the fluid is about 65°C (150°F), fill to halfway between the **Hot** and **Cold** levels.

8. Replace the hydraulic reservoir cap and tighten it until snug (Figure 7).

   Note: Do not overtighten the reservoir cap.

9. Install the pad that you removed in steps 4 and 5 top the frame, and tighten the 4 bolts to 1978 to 2542 N·cm (175 to 225 in-lb).

Product Overview

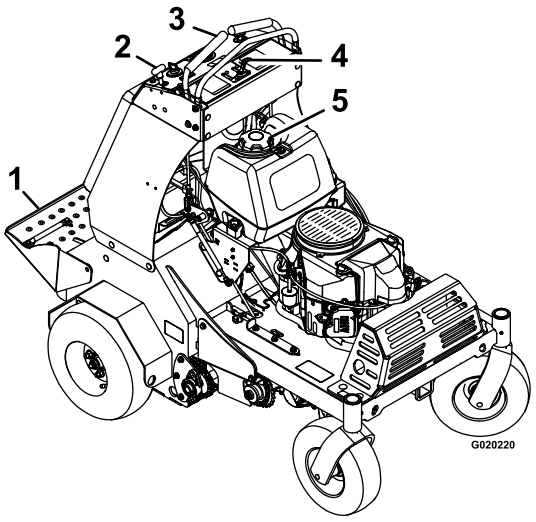


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Figure 8

1. Platform
2. Parking-brake knob
3. Motion-control levers
4. Engine controls
5. Fuel cap

Controls

Motion-Control Levers

The motion-control levers are located on each side of the top console and control the forward and reverse motion of the machine.

Move the levers forward or backward to control the drive wheel on the same side forward or reverse respectively. The wheel speed is proportional to the amount you move the lever.

Important: **The tines rotate when the motion-control levers are moved out of the NEUTRAL position.**

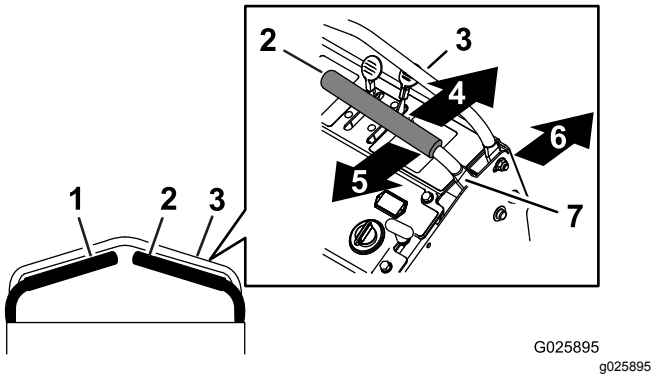

Figure 9

1. Left motion-control lever
2. Right motion-control lever
3. Front reference bar
4. Forward
5. Reverse
6. Front of the machine
7. Neutral

Tine-Pressure Control

The tine-pressure control is located on the left side of the control console (Figure 10).

Use the tine-pressure control to adjust the downward pressure on the tines and core depth. Rotate the control counterclockwise to decrease the pressure and the length of the aeration plug; rotate clockwise to increase pressure and increase the length of the aeration plug.

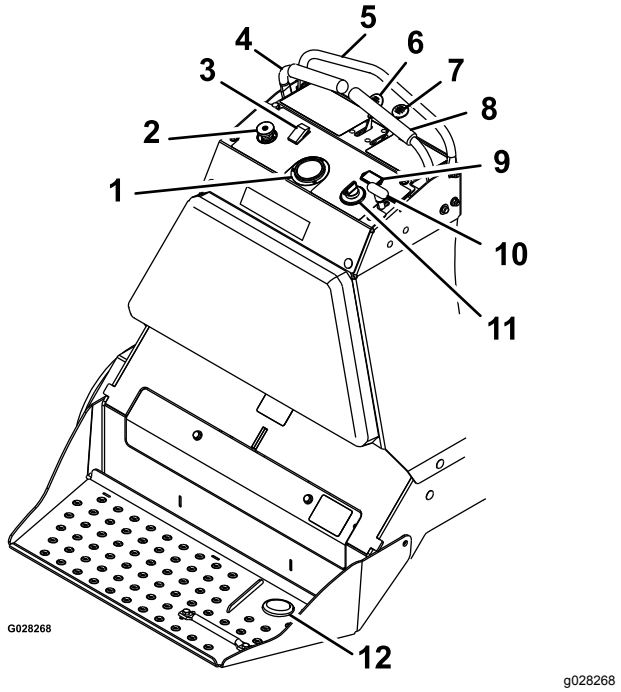

Figure 10

1. Tine down pressure gauge
2. Tine down pressure control
3. On/Off-Tine ground-engagement foot switch
4. Left motion-control lever
5. Front reference bar
6. Throttle lever
7. Choke lever
8. Right motion-control lever
9. Hour meter
10. Parking brake
11. Key switch
12. Tine ground-engagement foot switch

Throttle Lever

The throttle lever (Figure 10) is located on the control console (red lever).

Use the throttle lever to control engine speed. Move the throttle lever forward to increase engine speed; moving the throttle lever rearward to decrease the engine speed.

Note: Move the throttle lever forward into the detent for full throttle.

Choke Lever

The choke lever (Figure 10) is located on the control console (black lever).

Use the choke lever is used to aid in starting a cold engine. Move the choke lever forward to set the choke to the ON position; move the choke lever to the rearward to reduce the choke.

Note: Pull the choke lever back into the detent to set the choke to the OFF position.

Note: Do not run a warm engine with the choke in the ON position.

Parking-Brake Handle

The parking-brake handle is located on the control console, to the right of the key switch (Figure 10).

Note: The brake handle engages a parking brake in each of the transmissions.

- To engage the parking brake, pull the handle out and slide it rearward.
- To release the parking brake, push the handle forward into the detent.

When parking on a steep slope, chock or block the wheels in addition to engaging the parking brake. Tie down the machine and engage the parking brake when transporting the machine.

Hour Meter

The hour meter is located above the key switch (Figure 10).

The hour meter displays the total number of hours that you have run the machine.

Key Switch

The key switch is located on the right side of the control console (Figure 10).

Use the key switch to start and shut off the engine. The switch has 3 positions: OFF, ON, and START (Figure 11).

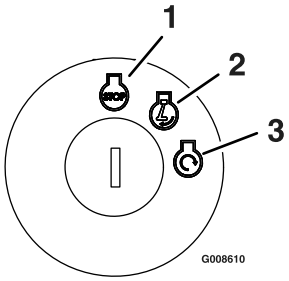

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Figure 11

1. OFF
2. ON
3. START

On/Off Tine Ground-Engagement Foot Switch

The tine ground-engagement foot switch is located above the tine down pressure control on the control console.

Push down on the top of the switch to enable the tine ground-engagement foot switch. Push down the rear of the switch to disable the foot switch.

Tine-Pressure Gauge

The tine-pressure gauge is located in the middle of the control console (Figure 10).

The tine-pressure gauge to indicates the downward pressure the machine exerts on the tines when aerating.

Tines-Elevation Switch

Keep your hands and feet away from the tines. Make sure that the tines area is clear of any obstructions before lowering it.

The tine-elevation switch is located on the operator platform (Figure 10).

To lower the tines into the ground, stand on the tine-elevation switch. To raise the tines, remove your foot from the switch.

Fuel-Shutoff Valve

The fuel-shutoff valve is located behind the engine and under the fuel tank (Figure 12).

Use the fuel-shutoff valve to shut off the fuel when the machine will not be used for a few days, when transporting the machine to and from the jobsite, or when the machine is parked inside a building.

- To open for fuel-shutoff valve, rotate the handle of the fuel-shutoff valve until it is aligned with the fuel line.
- To close the fuel-shutoff valve, rotate the handle 90° to the fuel line.

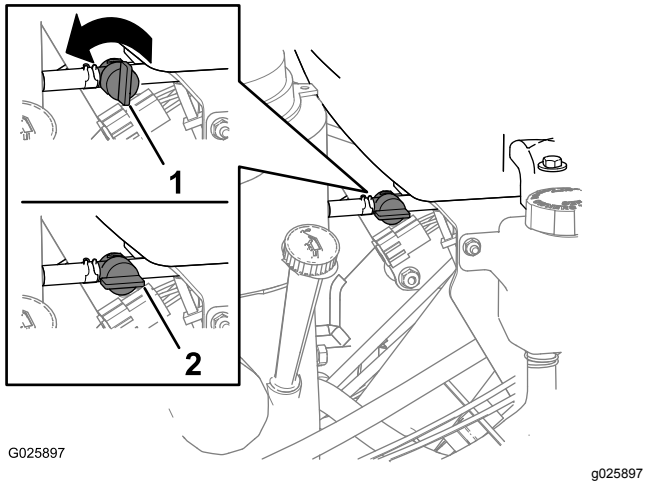


Figure 12

1. OFF position
2. ON position

Specifications

Height	132 cm (52 inches)
Length	163 cm (64 inches)
Width	121 cm (48 inches)
Aeration width	76 cm (30 inches)
Coring range	5.1 to 12.7 cm (2 to 5 inches)
Weight	460 kg (1,015 lb)

A selection of Toro approved attachments and accessories is available for use with the machine to enhance and expand its capabilities. Contact your Authorized Service Dealer or Distributor.

To best protect your investment and maintain optimal performance of your Toro equipment, count on Toro genuine parts. When it comes to reliability, Toro delivers replacement parts designed to the exact engineering specification of our equipment. For peace of mind, insist on Toro genuine parts.

Operation

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

Checking the Engine-Oil Level

Service Interval: Before each use or daily

Oil Type: Detergent oil (API service SJ or higher)

Oil viscosity: Refer to the table below.

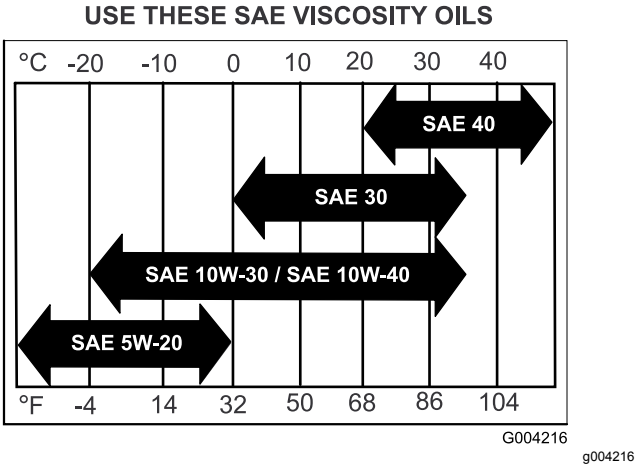
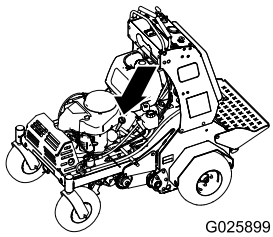


Figure 13

Important: **Do not operate the engine with the oil level below the Low (or Add) mark on the dipstick, or over the Full mark.**

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Allow the engine to cool.
3. Check the engine-oil level as shown in Figure 14.



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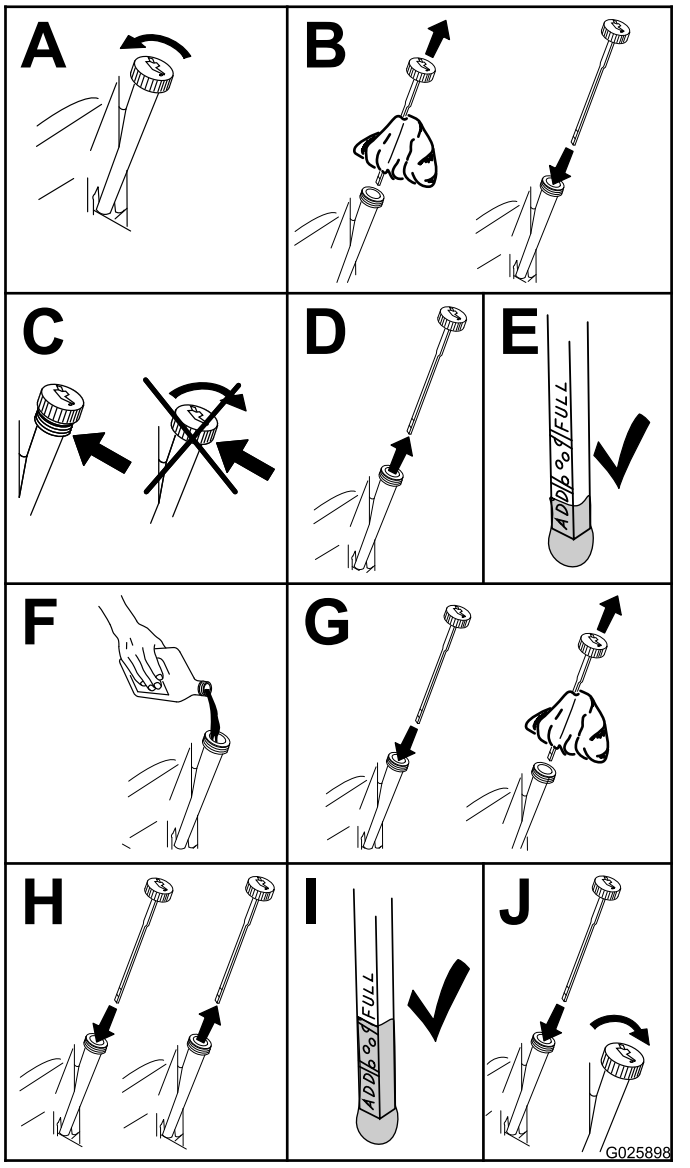

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Figure 14

4. If the oil level is low, wipe off the area around the oil fill cap, remove cap and add the specified oil until the oil level is at the Full mark on the dipstick.

   Note: **Do not** overfill the engine with oil.

Adding Fuel

Fuel-tank capacity: 18.9 L (5 US Gallons)

- For best results, use only clean, fresh (less than 30 days old), unleaded gasoline with an octane rating of 87 or higher ((R+M)/2 rating method).
- **ETHANOL**: Gasoline with up to 10% ethanol (gasohol) or 15% MTBE (methyl tertiary butyl ether) by volume is acceptable. Ethanol and MTBE are not the same. Gasoline with 15% ethanol (E15) by volume is not approved for use. Never use gasoline that contains more than 10% ethanol by volume, such as E15 (contains 15% ethanol), E20 (contains 20% ethanol), or E85 (contains up to 85% ethanol). Using unapproved gasoline may cause performance problems and/or engine damage which may not be covered under warranty.
- **Do not** use gasoline containing methanol.
- **Do not** store fuel either in the fuel tank or fuel containers over the winter unless you use a fuel stabilizer.
- **Do not** add oil to gasoline.

⚠ DANGER

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

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

⚠ DANGER

In certain conditions during fueling, static electricity can be released, causing a spark, which can ignite the fuel vapors. A fire or explosion from fuel can burn you and others and can damage property.

- **Always place fuel containers on the ground away from your vehicle before filling.**
- **Do not fill fuel 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 fuel-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 rather than from a fuel-dispenser nozzle.**
- **If you must use a fuel-dispenser nozzle, keep the nozzle in contact with the rim of the fuel tank or container opening at all times until fueling is complete.**

⚠ WARNING

Fuel is harmful or fatal if swallowed. Long-term exposure to vapors can cause serious injury and illness.

- **Avoid prolonged breathing of vapors.**
- **Keep your face away from the nozzle and fuel tank or conditioner bottle opening.**
- **Avoid contact with skin; wash off spills with soap and water.**

Using Stabilizer/Conditioner

Use a fuel stabilizer/conditioner in the machine to provide the following benefits:

- Keep fuel fresh during storage of 90 days or less. For longer storage, drain the fuel tank.
- Clean the engine while it runs
- Eliminate gum-like varnish buildup in the fuel system, which causes hard starting

Important: **Do not use fuel additives containing methanol or ethanol.**

Add the correct amount of fuel stabilizer/conditioner to the fuel.

Note: A fuel stabilizer/conditioner is most effective when mixed with fresh fuel. To minimize the chance of varnish deposits in the fuel system, use fuel stabilizer at all times.

Fueling the Machine

1. Clean around the fuel-tank cap.
2. Remove the cap from the tank.
3. Fill the fuel tank with fuel to within 6 to 13 mm (1/4 to 1/2 inch) from the top of the tank. **Do not fill into the filler neck.**

   Important: **Do not fill the tank more than 6 mm (1/4 inch) from the top of the tank because the fuel must have room to expand.**
4. Install the fuel-tank cap and wipe up any spilled fuel.

Lubricating the Chains

Checking the Condition of the Sprockets

Service Interval: Before each use or daily

1. Shut off the engine, engage the parking brake, wait for all moving parts to stop, and remove the key.
2. Inspect sprockets for wear and replace as required (Figure 15).

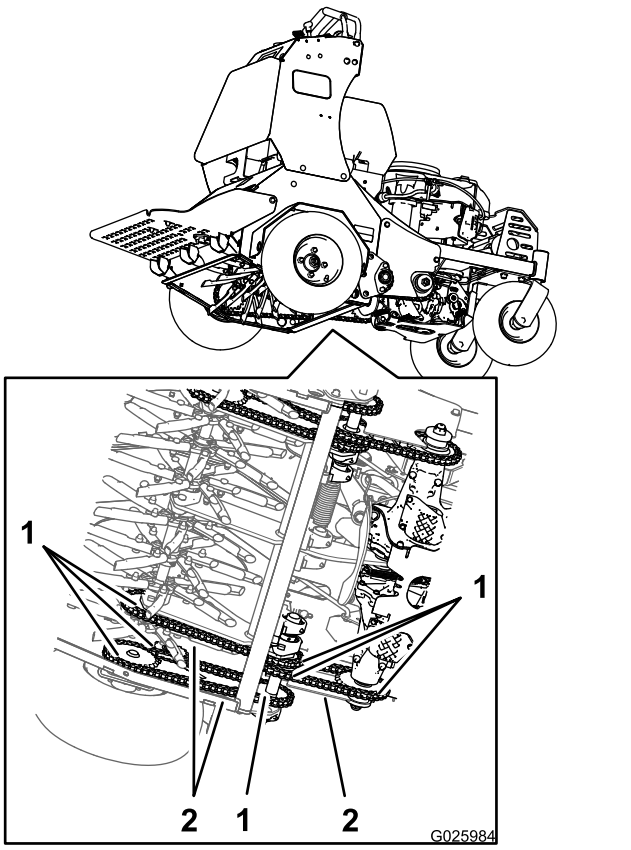

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Figure 15

1. Sprockets
2. Chains

Checking the Condition of the Chains

Service Interval: Before each use or daily

1. Shut off the engine, engage the parking brake, wait for all moving parts to stop, and remove the key.
2. Check the chain tension (Figure 15) at both sides of the machine.

   Note: The chains should move up and down 6 to 12 mm (1/4 to 1/2 inch).

3. If the chains pop or snap; refer to Adjusting the Jackshaft Drive-Chain Tension (page 40), Adjusting the Drive Wheel Chain Tension (page 41), or Adjusting the Tine Drive Chain (page 50).

Lubricating the Chains

Service Interval: Before each use or daily

Important: **Do not lubricate chains with penetrating oil or solvents. Use oil or chain lubricant.**

1. Shut off the engine, engage the parking brake, wait for all moving parts to stop, and remove the key.
2. Raise the machine and support it with jack stands with a 460 kg (1,015 lb) capacity.

⚠ CAUTION

Raising the machine for service or maintenance relying solely on mechanical or hydraulic jacks could be dangerous. The mechanical or hydraulic jacks may not be enough support or may malfunction allowing the machine to fall, which could cause injury.

Do not rely solely on mechanical or hydraulic jacks for support. Use adequate jack stands or equivalent support.

3. Start the engine and move the throttle level ahead to the half-throttle position.

⚠ WARNING

Engine must be running and drive wheels must be turning so adjustments can be performed. Contact with moving parts or hot surfaces may cause personal injury.

Keep your fingers, hands, and clothing clear of rotating components and hot surfaces.

4. Disengage the parking brake.
5. With the engine running, slowly move the motion-control levers forward and lubricate all 6 chains (Figure 15).
6. Check the condition and tension of the chains; refer to Checking the Condition of the Chains (page 21).

Checking the Safety-Interlock System

Service Interval: Before each use or daily

⚠ CAUTION

If the safety-interlock switches are disconnected or damaged, the machine could operate unexpectedly, causing personal injury.

- **Do not tamper with the interlock switches.**
- **Check the operation of the interlock switches daily and replace any damaged switches before operating the machine.**

Understanding the Safety-Interlock System

The safety-interlock system is designed to prevent the engine from starting unless the motion-control levers are in the neutral position.

Checking the Safety-Interlock System

1. Disconnect the spark-plug wires.
2. While on level ground, block the wheels of the machine to prevent unintended movement.
3. Disengage the parking brake.
4. With the motion-control levers in the neutral position turn the key to the START position—the starter must not crank.

Note: If the machine does not pass this test, do not operate the machine. Contact your Authorized Service Dealer.

Important: **It is essential that the operator safety mechanisms are connected and in proper operating condition prior to use.**

Checking for Loose Hardware

Service Interval: Before each use or daily

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop.
2. Visually inspect machine for any loose hardware or any other possible problem.

   Note: Tighten all loose hardware or repair the problem before operating the machine.

Operating the Machine

Using the Fuel-Shutoff Valve

Rotate the lever of the fuel-shutoff valve to align the lever with the fuel line.

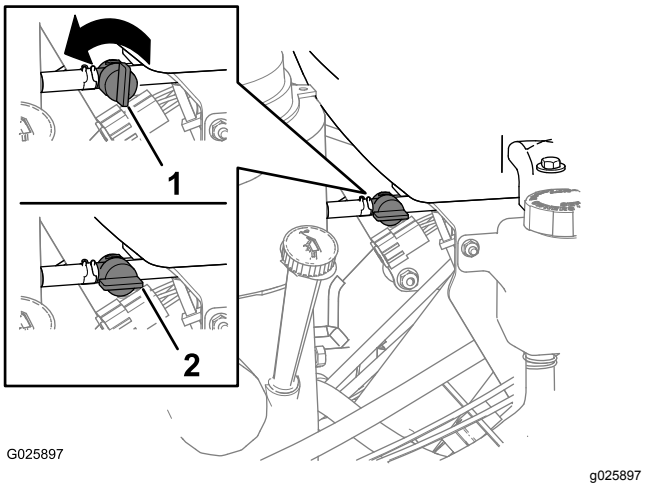

Figure 16

1. OFF position
2. ON position

Starting the Engine

1. Move the motion-control levers to the neutral position and engage the parking brake; refer to Motion-Control Levers (page 15) and Parking-Brake Handle (page 17).

   Note: To start the engine, the parking brake must be engaged. It is not necessary for the operator to be on the platform.
2. Place the throttle lever midway between the SLOW and FAST positions; refer to Throttle Lever (page 16).
3. If the engine is cold, push the choke lever forward to the ON position; refer to Choke Lever (page 16).

   Note: If the engine is warm, pull the choke lever to the OFF position.
4. Rotate the key switch to the START position; refer to Key Switch (page 17).

   Note: Release the switch as soon as the engine starts.

   Important: **Do not crank the engine continuously for more than 10 seconds at a time. If the engine does not start, allow a 60-second cooldown period between starting attempts. Failure to follow these guidelines can burn out the starter motor.**

5. If the choke lever is in the ON position, gradually move the lever toward the OFF position as the engine warms up.

Lowering the Tines

1. Set the throttle lever midway between the SLOW and FAST positions; refer to Throttle Lever (page 16).
2. Step on the tine-elevation switch to lower the tines (Figure 17).

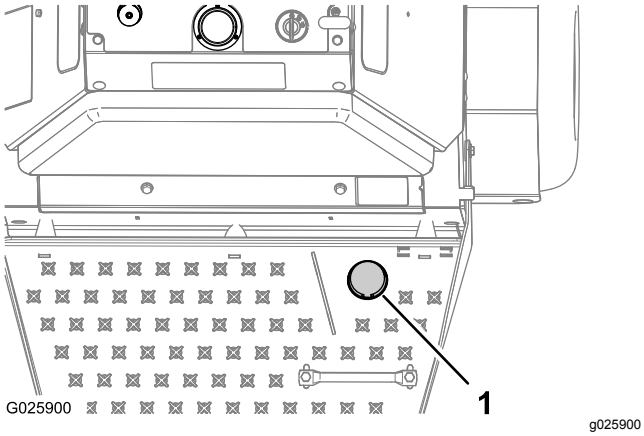

Figure 17

1. Tine-elevation switch

3. Stand on the switch and move the motion-control levers forward to aerate (Figure 17).
4. Adjust the throttle for the working conditions; refer to Throttle Lever (page 16).

Adjusting the Tine Down Pressure

Important: **Keep the drive tires on the ground at all times.**

Adjust the plug depth by rotating the tine-pressure control as follows:

Note: First time use: set the tine-pressure control so that the tine-pressure gauge (Figure 18) indicates 24 bar (350 psi).

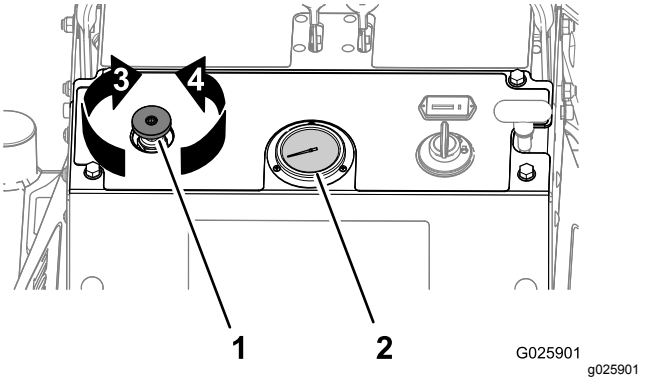

Figure 18

1. Tine-pressure control
2. Tine-pressure gauge
3. Decrease pressure (shorter plug)
4. Increase pressure (longer plug)

- Rotate the tine-pressure control **counterclockwise** (Figure 18) to decrease the downward pressure in order to remove a **shorter** plug.
- Rotate the tine-pressure control **clockwise** (Figure 18) to increase downward pressure in order to remove a **longer** plug.

Note: Ideal plug depth is 7.6 to 10 cm (3 to 4 inches). Rotate the tine-pressure control to adapt to the soil conditions.

Raising the Tines

To raise the tines, remove your foot from the tine-elevation switch (Figure 17).

Important: **The tines rotate when the motion-control lever is moved out of the neutral position.**

Shutting Off the Engine

1. Move the motion-control levers to the neutral position and bring the machine to a full stop; refer to Motion-Control Levers (page 15).
2. Lift your foot off the tine ground-engagement foot switch control to raise the tines; refer to Raising the Tines (page 23).
3. Place the throttle in the midway between the SLOW and FAST positions; refer to Throttle Lever (page 16).
4. Allow the engine to run for a minimum of 15 seconds, then turn the key switch to the OFF position to shut off the engine; refer to Key Switch (page 17).
5. Engage the parking brake; refer to Parking-Brake Handle (page 17).

6. Remove the key to prevent children or other unauthorized persons from starting the engine.
7. Close the fuel-shutoff valve when the machine will not be used for a few days, when transporting, or when the machine is parked inside a building; refer to Using the Fuel-Shutoff Valve (page 22).

Driving the Machine

⚠ CAUTION

Machine can spin very rapidly by positioning 1 lever too much ahead of the other. You may lose control of the machine, which may cause damage to the machine or injury.

- **Use caution when making turns.**
- **Slow the machine down before making sharp turns.**

Important: **To drive the machine (forward or backward), disengage the brake lever before you can move the motion-control levers.**

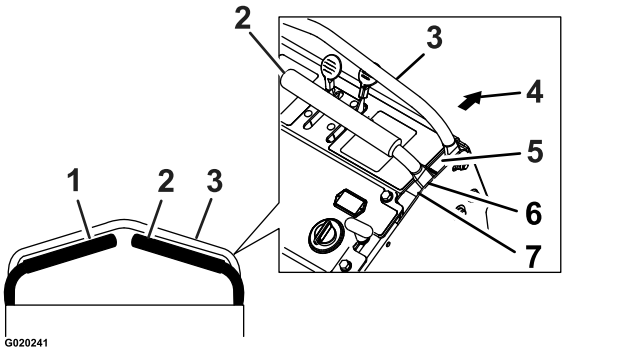

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Figure 19

1. Left motion-control lever
2. Right motion-control lever
3. Front reference bar
4. Front of the machine
5. Forward
6. Neutral
7. Reverse

Driving Forward

1. Make sure that the motion-control levers are in the neutral position.
2. Disengage the parking brake.
3. To move forward in a straight line, move both levers forward with equal pressure.

   Note: The machine moves faster the farther the motion-control levers are moved from the neutral position.

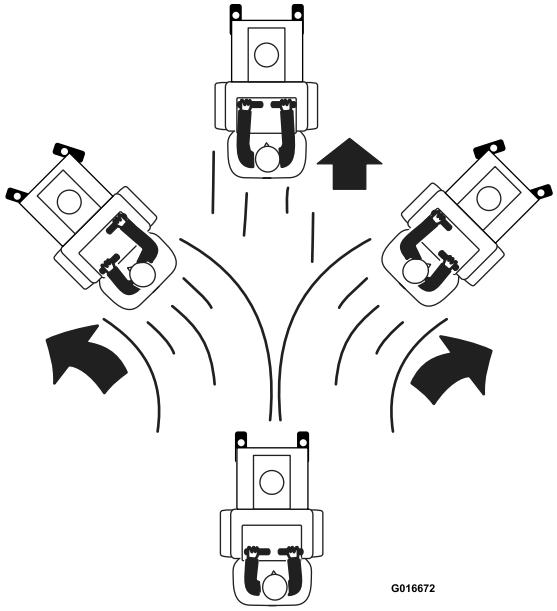

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Figure 20

4. To turn left or right, pull the motion-control lever back toward neutral in the desired turn direction. The tines can be in the down position when making gradual turns.
5. To make zero-turns, lift your foot off the tine engagement foot switch control to raise the tines. The head raises in 1 second.

   Important: **Do not make a zero-turn when the tines are down, otherwise you may tear the turf.**
6. To stop the machine, move both motion-control levers to the neutral position.

Driving in Reverse

1. Move the motion-control levers to the neutral position.
2. To move rearward in a straight line, slowly move both levers rearward with equal pressure.

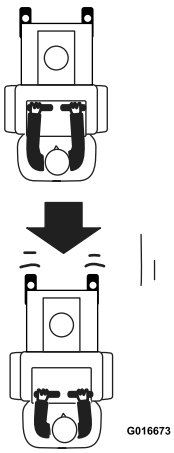

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Figure 21

3. To turn left or right, release pressure on the motion-control lever toward the desired turn direction.
4. To make zero-turns, lift your foot off the tine-elevation switch to raise the tines. The head raises in 1 second.

   Important: **Do not make a zero-turn when the tines are in the down position.**
5. To stop the machine, position both motion-control levers in the neutral operate position.

Transporting the Machine

Machine weight: 460 kg (1,015 lb)

⚠ CAUTION

This machine does not have proper turn signals, lights, reflective markings, or a slow moving vehicle emblem. Driving on a street or roadway without such equipment is dangerous and can lead to accidents, causing personal injury. Driving on a street or roadway without such equipment may also be a violation of state laws, and you may be subject to traffic tickets and/or fines.

Do not drive the machine on a public street or roadway.

Loading the Machine onto a Transport Vehicle

⚠ WARNING

Loading the machine onto a trailer or truck increases the possibility of tip-over and could cause serious injury or death.

- **Use extreme caution when operating a machine on a ramp.**
- **Use only a single, full-width ramp; do not use individual ramps for each side of the machine.**
- **If you must use individual ramps, use enough ramps to create an unbroken ramp surface wider than the machine.**
- **Do not exceed a 15-degree angle between ramp and ground, or between a ramp, a trailer, or a truck.**
- **Avoid sudden acceleration while driving machine up a ramp to avoid tipping backward.**
- **Avoid sudden deceleration while backing machine down a ramp to avoid tipping backward.**

Important: **Do not attempt to turn the machine while on the ramp; you may lose control and drive off the side.**

- Use extreme caution when loading units onto trailers or trucks.
- Use 1 full-width ramp that is wide enough to extend beyond the rear tires instead of individual ramps for each side of the machine (Figure 22). The platform, when down and locked into position, must extend back between the rear wheels and serves as a stop for tipping backward. Having a full-width ramp provides a surface for the platform to contact if the machine starts to tip backward. With the platform up, a full-width ramp provides a surface to walk on behind the machine.
- The ramp should be long enough so that the angles do not exceed 15 degrees (Figure 22). A steeper angle may cause tine components to get caught, as the machine moves from ramp to trailer or truck. A steeper angle may also cause the machine to tip backward. If loading on or near a slope, position the trailer or truck so it is on the down side of the slope and the ramp extends up the slope. This minimizes the ramp angle. The trailer or truck should be as level as possible.

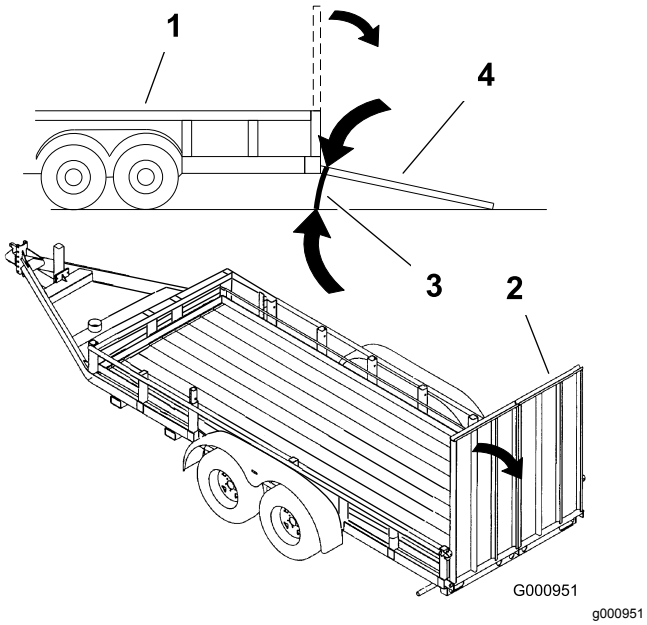

Figure 22

1. Trailer
2. Full-width ramp
3. Not greater than 15 degrees
4. Full-width ramp (side view)

- You should determine if it is best to have the platform up or down when loading, depending on conditions. If it is not possible to use 1 full-width ramp, use enough individual ramps to simulate a full-width, continuous ramp.
- Avoid sudden acceleration when driving up a ramp and sudden deceleration when backing down a ramp. Both maneuvers can cause the machine to tip backward.

Transporting the Machine

Use a heavy-duty trailer or truck to transport the machine. Ensure that the trailer or truck has all the necessary brakes, lighting, and marking as required by law. Please carefully read all the safety instructions.

1. Raise the tines of the machine before driving onto the trailer or truck.
2. If using a trailer, connect it to the towing vehicle and connect the safety chains.
3. If applicable, connect the trailer brakes.
4. Load the machine onto the trailer or truck.
5. Shut off the engine, remove the key, engage the parking brake, and close the fuel valve.
6. Engage the parking brake and block the tires.
7. Use the tie-down points on the machine to securely bind the machine to the trailer or truck with straps, chains, cable, or ropes (Figure 23).

   Note: Refer to your local ordinances for specific trailer and tie-down regulations.

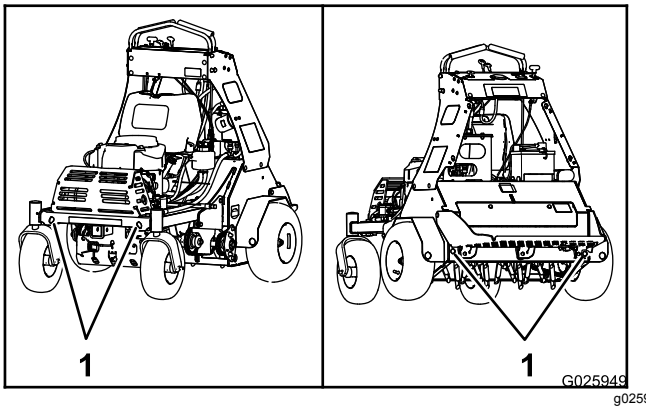

Figure 23

1. Tie-down points

Maintenance

⚠ WARNING

While you are maintaining or adjusting the machine, someone could start the engine. Accidentally starting the engine could seriously injure you or other bystanders.

Remove the key from the key switch, engage parking brake, and pull the wire(s) off the spark plug(s) before you do any maintenance. Also push the wire(s) aside so it does not accidentally contact the spark plug(s).

⚠ WARNING

The engine can become very hot. Touching a hot engine can cause severe burns.

Allow the engine to cool completely before service or making repairs around the engine area.

Recommended Maintenance Schedule(s)

Maintenance Service Interval	Maintenance Procedure
After the first 100 hours	• Change the auxiliary hydraulic reservoir filter and fluid. • Change the transmission filters. • Fill the transmission with fluid when changing the filter.
Before each use or daily	• Check the engine-oil level. • Check the condition of the sprockets. • Check the condition and tension of the chains. • Lubricate the chains. • Check the safety-interlock system. • Check for loose hardware. • Check the tines. • Clean the engine and the exhaust system area (more often in dry or dirty conditions). • Clean the grass and debris buildup from the machine.
Every 25 hours	• Grease the jackshaft bearings. • Grease the wheel bearings. • Grease the tine shaft bearings. • Grease the tine assembly idlers. • Clean the foam air-cleaner element (more often in extremely dusty or sandy conditions).
Every 50 hours	• Grease the control pivots. • Check spark arrester (if equipped). • Check the pressure in the tires. • Check the condition and tension of the belts. • Check the auxiliary hydraulic-fluid level. • Check the hydraulic transmission fluid level.
Every 80 hours	• Remove the engine shrouds and clean the cooling fins.
Every 100 hours	• Check the paper air-cleaner element (more often in extremely dusty or sandy conditions). • Check, clean and gap the spark plug. • Check the battery.
Every 200 hours	• Replace the paper air-cleaner element (more often in extremely dusty or sandy conditions). • Change the engine-oil filter (more often in extremely dusty or sandy conditions).

Maintenance Service Interval	Maintenance Procedure
Every 250 hours	• Replace the primary air-cleaner element (more often in extremely dusty or sandy conditions). • Check the secondary air-cleaner element (more often in extremely dusty or sandy conditions). • Change the auxiliary hydraulic reservoir filter and fluid. • Change the transmission filters. • Fill the transmission with fluid when changing the filter.
Every 500 hours	• Replace the secondary air-cleaner element (more often in extremely dusty or sandy conditions).
Every 800 hours	• Replace the fuel filter.
Yearly	• Grease the front caster pivots. • Grease the belt idler pivot. • Grease the caster pivots and hubs. • Lubricate the caster-wheel hubs. • Lubricate the caster-wheel hubs. • Check the torque of the wheel hub nuts. • Check the torque on the wheel lug nuts. • Check the torque of the transmission output shaft nut.
Yearly or before storage	• Touch up areas with chipped paint.

Pre-Maintenance Procedures

⚠ CAUTION

Raising the machine for service or maintenance relying solely on mechanical or hydraulic jacks could be dangerous. The mechanical or hydraulic jacks may not be enough support or may malfunction allowing the machine to fall, which could cause injury.

Do not rely solely on mechanical or hydraulic jacks for support. Use adequate jack stands or equivalent support.

Preparing for the Machine for Maintenance

Perform the following before servicing, cleaning, or making any adjustments to the machine.

1. Park the machine on a level surface.
2. Shut off the engine, engage the parking brake, wait for all moving parts to stop.
3. Remove the key from the key switch.

Accessing the Console Compartment

Removing the Console Pad

1. Loosen the 4 flanged-head bolts that secure the pad to the left and right console panels (Figure 24).

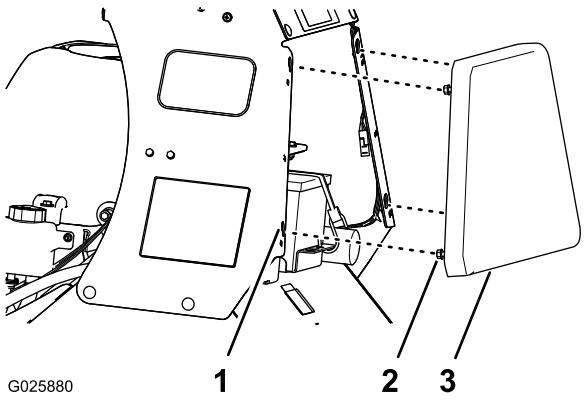

Figure 24

1. Keyhole slot (console panel)
2. Fanged-head bolt
3. Pad

2. Lift up the console pad (Figure 24) approximately 13 mm (1/2 inch).
3. Pull the console pad straight back and remove the pad from the machine (Figure 24).

Installing the Console Pad

1. Align the 4 flanged-head bolts at the forward face of the console pad to the 4 keyhole slots in the frame of the console (Figure 24).
2. Move the pad forward until the pad is flush to the console frame (Figure 24).
3. Move the pad down until the flanged-head bolts are seated in the keyhole slots (Figure 24).
4. Tighten the flanged-head bolts to 1978 to 2542 N·cm (175 to 225 in-lb).

Lubrication

Lubricating the Grease Fittings

Grease type: National Lubricating Grease Institute (NGLI) grade #2 multi-purpose gun grease.

Note: Refer to the lubrication chart for service intervals.

Lubrication Chart

Fitting Locations	Initial Pumps	Number of Places	Service Interval
1. Front Caster Pivots	*0	2	Yearly
2. Jackshaft Bearings	1	8	25 hours
3. Wheel Bearings	1	2	25 hours
4. Tine Shaft Bearings	1	4	25 hours
5. Tine Assembly Idlers	1	2	25 hours
6. Control Pivots	1	4	50 hours
7. Belt Idler Pivot	1	1	Yearly
8. Front Caster Hubs	*0	2	Yearly

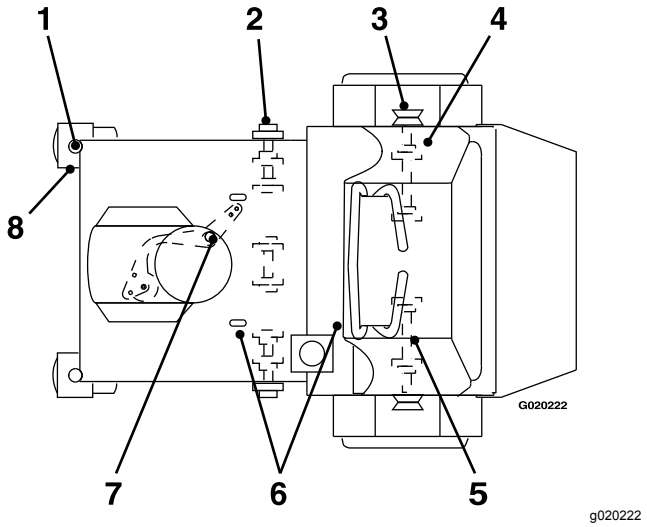

Figure 25

1. Shut off the engine, engage the parking brake, wait for all moving parts to stop, and remove the key.
2. Wipe clean the grease fittings with a rag (Figure 25).

3. Connect a grease gun to the fitting (Figure 25).
4. Pump grease into the fittings until grease begins to ooze out of the bearings.
5. Wipe up any excess grease.

Lubricating the Casters

Grease type: National Lubricating Grease Institute (NGLI) grade No. 2 multi-purpose gun grease.

Greasing the Caster Pivots

Service Interval: Yearly

1. Remove cap and hex plug from the top of the caster pivot (Figure 26).

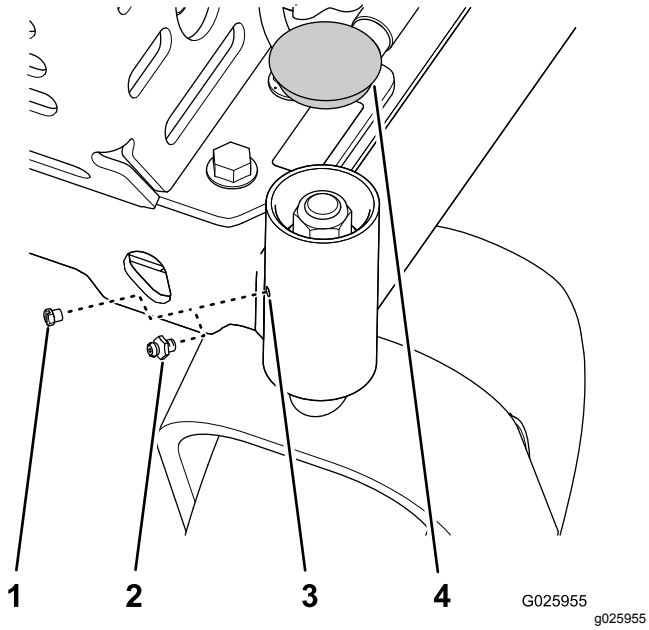

Figure 26

1. Hex plug
2. Grease fitting
3. Caster pivot
4. Cap

2. Thread grease fitting in hole (Figure 26).
3. Pump grease into the fitting until grease oozes out around top bearing (Figure 26).
4. Remove grease fitting and install the plug that you removed in 1 (Figure 26).
5. Install the cap that you removed in step 1 (Figure 26).
6. Repeat steps 1 through 5 to the other caster.

Lubricating the Caster-Hubs Bearings

Service Interval: Yearly

Removing the Caster-Wheel Assembly

1. Shut off the engine, engage the parking brake, wait for all moving parts to stop, and remove the key.
2. Lift the front of the machine and support it with jack stands.
3. Remove the wheel nut and bolt, and remove the caster-wheel assembly from the fork (Figure 27).

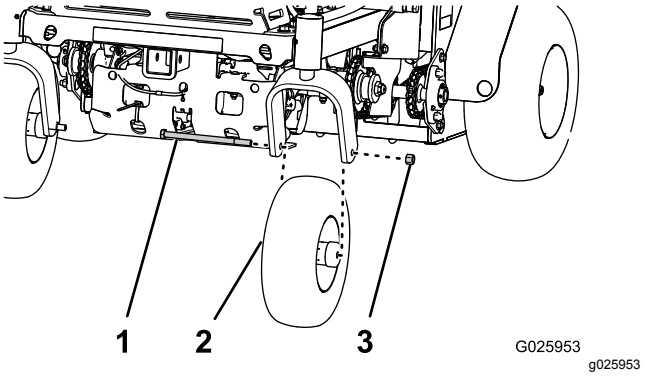

Figure 27

1. Wheel bolt
2. Caster-wheel assembly
3. Wheel nut

Disassembling the Caster-Wheel Hub and Greasing the Bearings

Service Interval: Yearly

Important: **Use new bearing seals when lubricating the caster-wheel hubs.**

Important: **To prevent seal and bearing damage, check the bearing adjustment often. Spin the caster tire. The tire should not spin freely (more than 1 or 2 revolutions) or have any side play. If the wheel spins freely, adjust torque on spacer nut until there is a slight amount of drag. Apply thread-locking compound.**

Grease type: National Lubricating Grease Institute (NGLI) grade No. 2 multi-purpose gun grease.

1. Remove the 2 seal guards from the wheel hub (Figure 28).

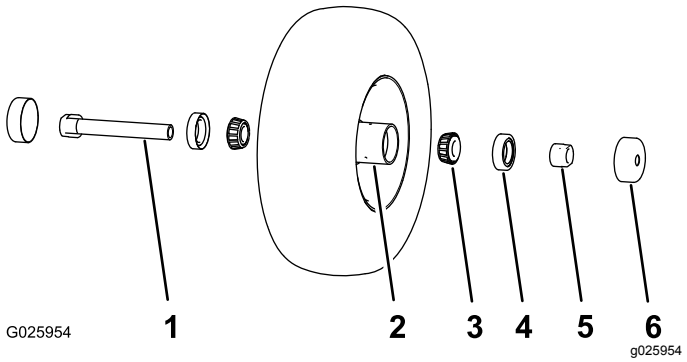

Figure 28

1. Axle (spacer nut still assembled)
2. Hub
3. Bearing
4. Spacer nut
5. Bearing seal
6. Seal guard

2. Remove 1 of the spacer nuts from the axle assembly in the caster wheel (Figure 28).

   Note: Note that thread-locking compound has been applied to lock the spacer nuts to the axle (Figure 28).

3. Remove the axle (with the other spacer nut still assembled to it) from the caster-wheel assembly (Figure 28).
4. Pry out both bearing seals (Figure 28).

   Note: Discard the old seals.

5. Remove both bearings and inspect them for wear or damage (Figure 28).

   Note: Replace the bearing if it is worn or damaged.

6. Pack the 2 bearings with the specified grease.

Assembling the Caster-Wheel Hub

1. Install 1 bearing into the hub of the wheel (Figure 28).
2. Install the bearing seal into the hub at the bearing (Figure 28).
3. If you removed (or broke loose) both of the spacer nuts from the axle assembly, perform the following:
   A. Clean the threads of the axle and spacer nut.
   B. Apply a thread-locking compound to the threads at 1 end of the axle.
   C. Thread the axle nut, with the wrench flats facing outward, onto the end of the axle that is prepared with thread-locking compound (Figure 28).

      Note: Do not thread spacer nut all of the way onto the axle. Leave approximately 3 mm (1/8 inch) from the outer surface of the spacer nut to the end of the axle inside the nut.

4. Insert the assembled nut and axle into the wheel at the side of the wheel with the new seal and bearing (Figure 28).
5. With the open end of the wheel facing up, fill the area inside wheel cavity (around the axle) with the specified grease.
6. Install the other bearing and new seal into the wheel (Figure 28).
7. Apply a thread-locking compound to the second spacer nut and thread it onto the axle with the wrench flats facing outward.
8. Torque the spacer nut to 8 to 9 N·m (75 to 80 in-lb), loosen, then torque it 2 to 3 N·m (20 to 25 in-lb).

   Note: Make sure axle does not extend beyond either nut.

9. Install the seal guards over the wheel hub (Figure 28).

Installing the Caster-Wheel Assembly

1. Align the hole in the axle of the caster-wheel assembly between the holes in the fork of the caster (Figure 27).
2. Secure the wheel assembly to the fork with the wheel nut and bolt (Figure 27) that you removed in step 3 of Removing the Caster-Wheel Assembly (page 30).
3. Torque the wheel nut to 91 to 113 N·m (67 to 83 ft-lb).

Engine Maintenance

Servicing the Air Cleaner

Service Interval: Every 250 hours—Replace the primary air-cleaner element (more often in extremely dusty or sandy conditions).

Every 250 hours—Check the secondary air-cleaner element (more often in extremely dusty or sandy conditions).

Every 500 hours— Replace the secondary air-cleaner element (more often in extremely dusty or sandy conditions).

Inspect the foam and paper elements, and replace them if they are damaged or excessively dirty.

Important: **Do not apply oil to the foam or paper element.**

Removing the Foam and Paper Elements

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Clean around the air cleaner to prevent dirt from getting into the engine and causing damage (Figure 29).

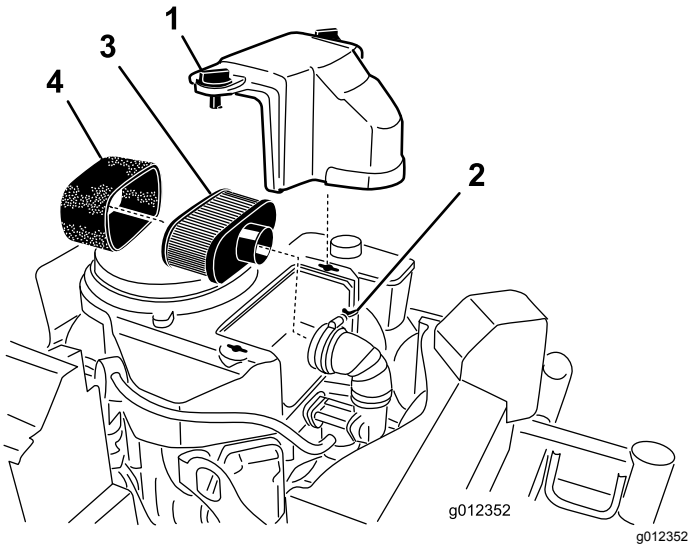

Figure 29

1. Cover
2. Hose clamp
3. Paper element
4. Foam element

3. Rotate the cover knobs 1/4 turn counterclockwise and remove the air-cleaner cover (Figure 29).
4. Rotate the thumbscrew of the hose clamp counterclockwise until you can separate the air-cleaner assembly from the inlet duct (Figure 29).
5. Carefully pull the foam element off the paper element (Figure 29).

Servicing the Foam Air-Cleaner Element

Service Interval: Every 25 hours (more often in extremely dusty or sandy conditions).

1. Inspect the element for tears, an oily film, or damaged (Figure 29).

   Important: **Replace the foam element if it is worn or damaged.**
2. Wash the foam element in liquid soap and warm water. When the element is clean, rinse it thoroughly.
3. Dry the element by squeezing it in a clean cloth.

Servicing the Paper Air-Cleaner Element

Service Interval: Every 100 hours—Check the paper air-cleaner element (more often in extremely dusty or sandy conditions).

Every 200 hours—Replace the paper air-cleaner element (more often in extremely dusty or sandy conditions).

Important: **Do not wash the paper air-cleaner element.**

1. Inspect the element for tears, an oily film, or damage to the rubber seal (Figure 29).

   Note: Replace the paper element if it is damaged.
2. Clean the paper element by gently tapping it to remove dust and debris.

   Note: If the element is very dirty, replace the air-cleaner element.

   Note: Do not use pressurized air to clean the paper element.

Installing the Foam and Paper Elements

Important: **To prevent engine damage, always operate the engine with the complete foam and paper air-cleaner assembly installed.**

1. Carefully slide the foam element onto the paper air-cleaner element (Figure 29).
2. Align the air-cleaner assembly onto the inlet duct and secure it with the hose clamp (Figure 29).
3. Align the air-cleaner cover onto the engine cover and secure the cover by rotating the cover knobs 1/4 turn clockwise (Figure 29).

Servicing the Engine Oil

Oil Type: Detergent oil (API service SJ or later)

Engine Oil Capacity: 1.7 L (1.8 US qt) with the filter removed; 1.5 L (1.6 US qt) without the filter removed

Oil viscosity: Refer to the table below.

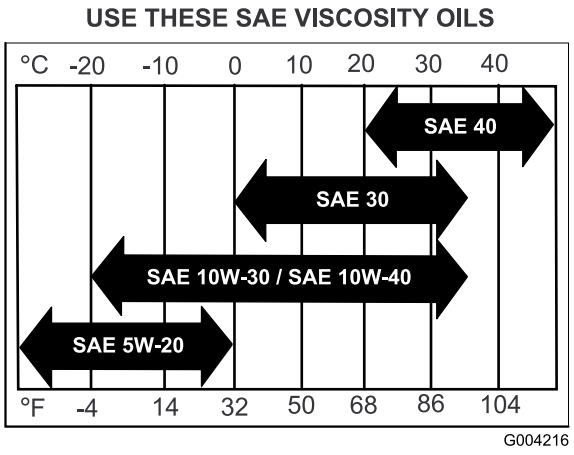

Figure 30

Changing the Engine Oil

Note: Dispose of the used oil at a recycling center.

1. Park the machine so that the drain side is slightly lower than the opposite side to assure the oil drains completely.
2. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
3. Change the engine oil as shown in Figure 32.

   Note: Torque drain plug to 27 to 33 N·m (20 to 24 ft-lb).

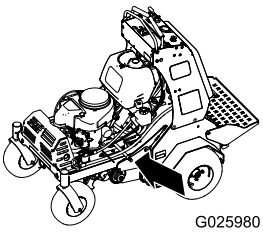

Figure 31

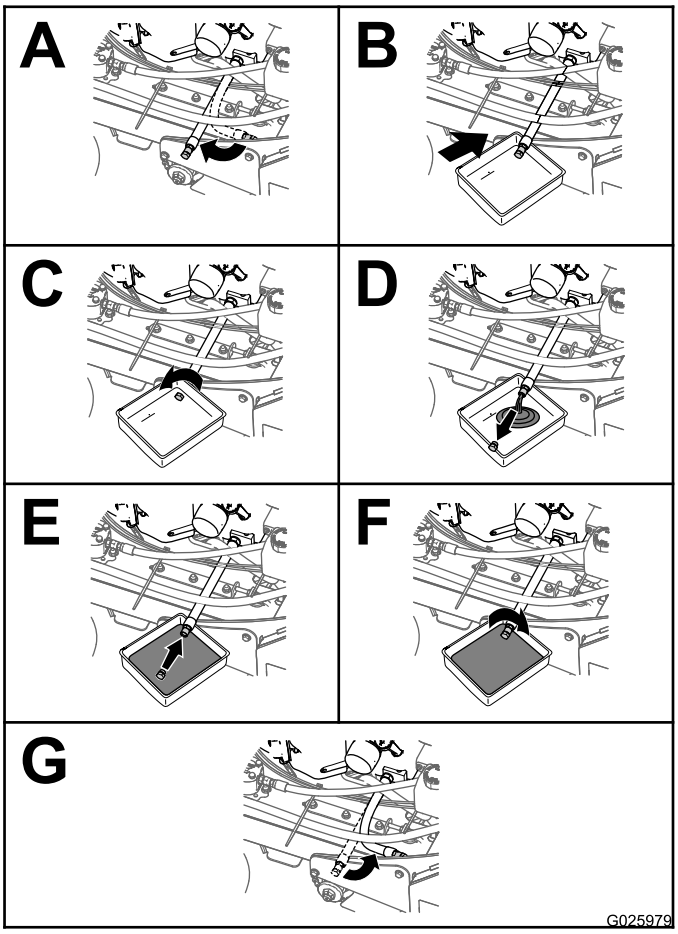

Figure 32

4. Slowly pour approximately 80% of the specified oil into the filler tube, and slowly add the additional oil to bring it to the **Full** mark (Figure 33).

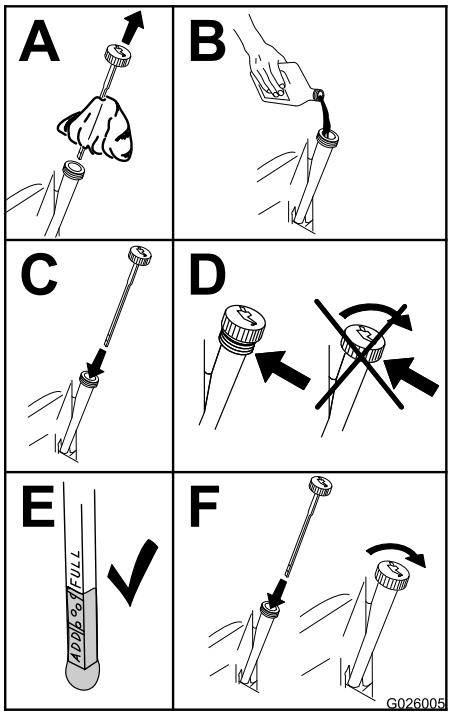

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Figure 33

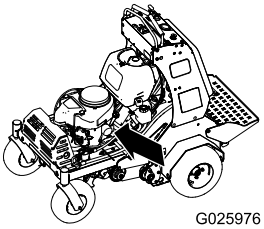
5. Start the engine and drive to a flat area.
6. Check the engine-oil level.

Changing the Engine-Oil Filter

Service Interval: Every 200 hours (more often in extremely dusty or sandy conditions).

1. Drain the oil from the engine; refer to Changing the Engine Oil (page 33).
2. Place a rag under the oil filter to soak up any spilled oil.

   Important: **Spilled oil may drain under the engine and onto the clutch. Oil spilled on the clutch may damage the clutch, cause the blades to stop slowly when the clutch is in the OFF position, and cause the clutch to slip when the clutch is switched to the ON position. Wipe up any spilled oil.**
3. Change the engine-oil filter (Figure 34).



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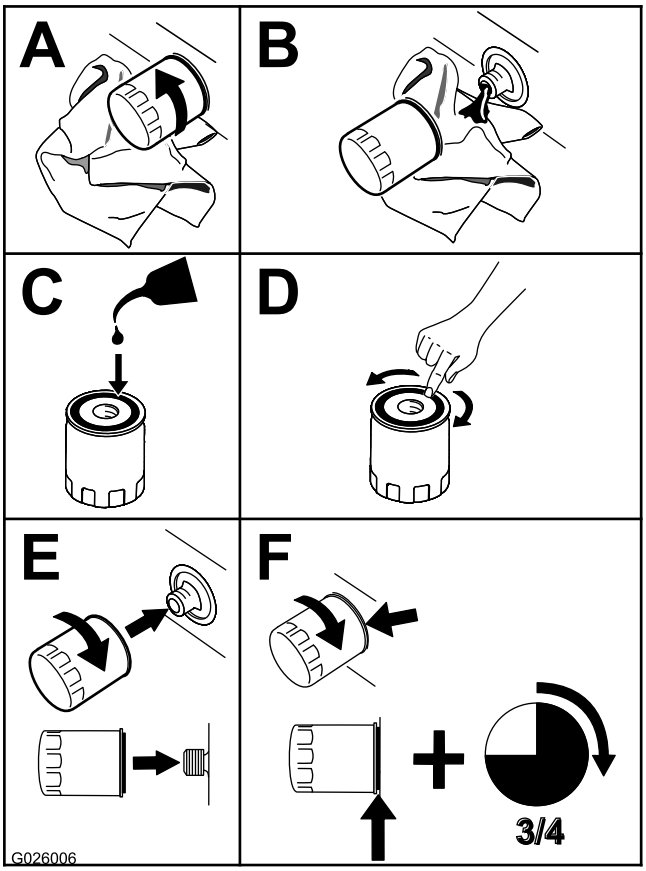

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Figure 34

   Note: Ensure that the oil-filter gasket touches the engine, and then turn the filter an extra 3/4 turn.
4. Fill the crankcase with the specified type of new oil; refer to Figure 30.

Servicing the Spark Plug

Service Interval: Every 100 hours

Type for all Engines: NGK BPR4ES or equivalent

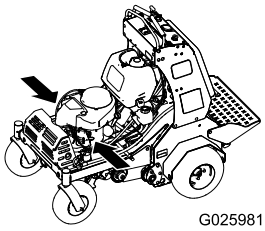
Air Gap: 0.75 mm (0.03 inch)

Make sure that the air gap between the center and side electrodes is correct before installing the spark plug.

Use a spark plug wrench for removing and installing the spark plug(s) and a gapping tool/feeler gauge to check and adjust the air gap. Install a new spark plug(s) if necessary.

Removing the Spark Plug

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Remove the spark plug as shown in Figure 35.



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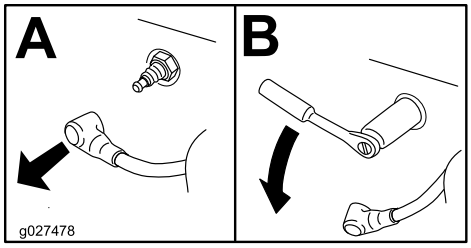

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Figure 35

Checking the Spark Plug

Important: **Do not clean the spark plug(s). Always replace the spark plug(s) when it has a black coating, worn electrodes, an oily film, or cracks.**

If you see light brown or gray on the insulator, the engine is operating properly. A black coating on the insulator usually means the spark plug is dirty.

Set the gap to 0.75 mm (0.03 inch).

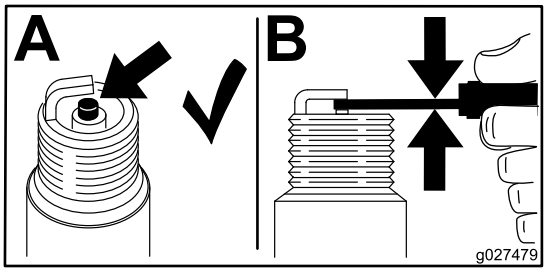

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Figure 36

Installing the Spark Plug

Tighten the spark plug(s) to 22 N·m (16 ft-lb).

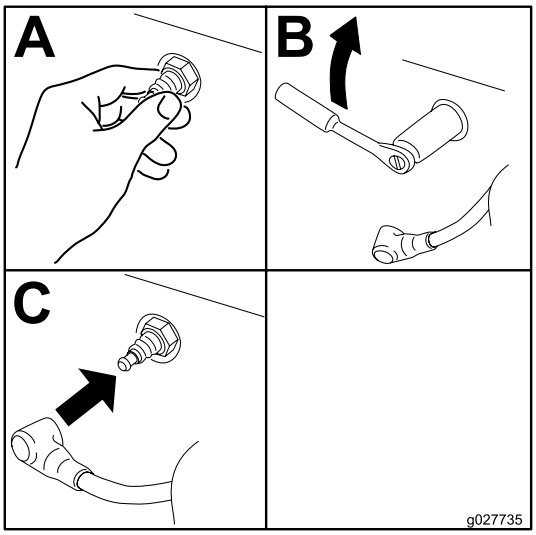

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Figure 37

Checking the Spark Arrester

Machines with a Spark Arrester Only

Service Interval: Every 50 hours

⚠ WARNING

Hot exhaust system components may ignite fuel vapors even after the engine is shut off. Hot particles exhausted during engine operation may ignite flammable materials. Fire may result in personal injury or property damage.

Do not refuel or run engine unless spark arrester is installed.

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Allow the muffler to cool.
3. Check the spark arrester for breaks in the screen or welds.

   Note: Replace the spark arrester if it is worn or damaged.
4. If you see that the screen is plugged, perform the following:
   A. Remove the spark arrester.
   B. Shake loose the particles from the arrester and clean screen with a wire brush.

      Note: Soak the arrester screen in solvent if necessary.
   C. Install spark arrester onto exhaust outlet.

Fuel System Maintenance

Servicing the Fuel Filter

Replacing the Fuel Filter

Service Interval: Every 800 hours/Yearly (whichever comes first)

Note: Wipe up any spilled fuel.

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Close the fuel-shutoff valve; refer to Using the Fuel-Shutoff Valve (page 22).
3. Squeeze the ends of the hose clamps together and slide them away from the filter (Figure 38).

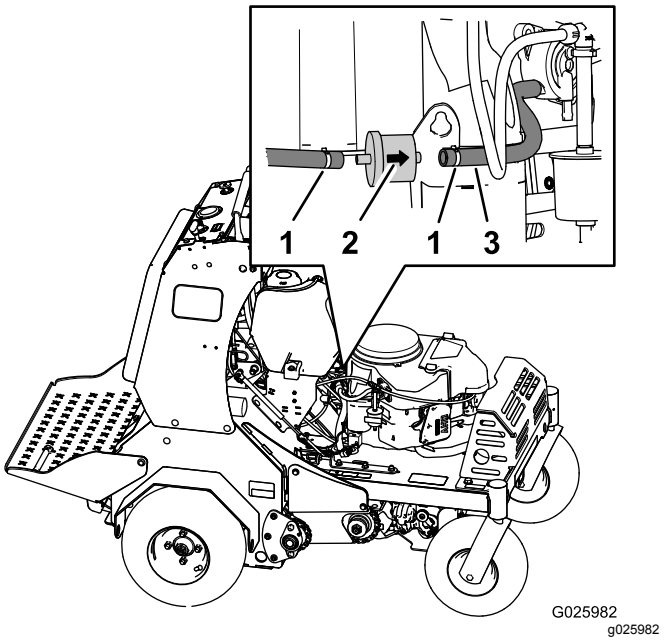


Figure 38

1. Hose clamp
2. Flow direction arrow (fuel filter)
3. Hose

4. Remove the filter from the fuel hoses (Figure 38).

   Note: Do not install a dirty filter after it is removed from the fuel line.
5. Install a new filter with the flow-direction arrow aligned as illustrated in Figure 38.

   Note: Ensure that the fuel hoses are fully seated onto the hose fittings of the fuel filter.
6. Align the hose clamps over the hose and the fuel-filter fittings (Figure 38).

7. Open the fuel-shutoff valve; refer to Using the Fuel-Shutoff Valve (page 22).
8. Check for fuel leaks and repair if needed.
9. Wipe up any spilled fuel.

Electrical System Maintenance

Servicing the Battery

Service Interval: Every 100 hours

Always keep the battery clean and fully charged. Use a paper towel to clean the battery case. If the battery terminals are corroded, clean them with a solution of 4 parts water and 1 part baking soda. Apply a light coating of grease to the battery terminals to prevent corrosion.

Voltage: 12 V

⚠ WARNING

CALIFORNIA
Proposition 65 Warning

Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.

⚠ DANGER

Battery electrolyte contains sulfuric acid, which is fatal if consumed and causes severe burns.

Do not drink electrolyte, and avoid contact with skin, eyes, and clothing. Wear safety glasses to shield your eyes and rubber gloves to protect your hands.

Removing the Battery

⚠ WARNING

Battery terminals or metal tools could short against metal machine components, causing sparks. Sparks can cause the battery gasses to explode, resulting in personal injury.

- **When removing or installing the battery, do not allow the battery terminals to touch any metal parts of the machine.**
- **Do not allow metal tools to short between the battery terminals and metal parts of the machine.**

⚠ WARNING

Incorrect battery-cable routing could damage the machine and cables, causing sparks. Sparks can cause the battery gasses to explode, resulting in personal injury.

- **Always disconnect the negative (black) battery cable before disconnecting the positive (red) cable.**
- **Always connect the positive (red) battery cable before connecting the negative (black) cable.**

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Remove the console pad; refer to Removing the Console Pad (page 28).
3. On the battery, lift the black terminal cover from the negative cable (Figure 39).

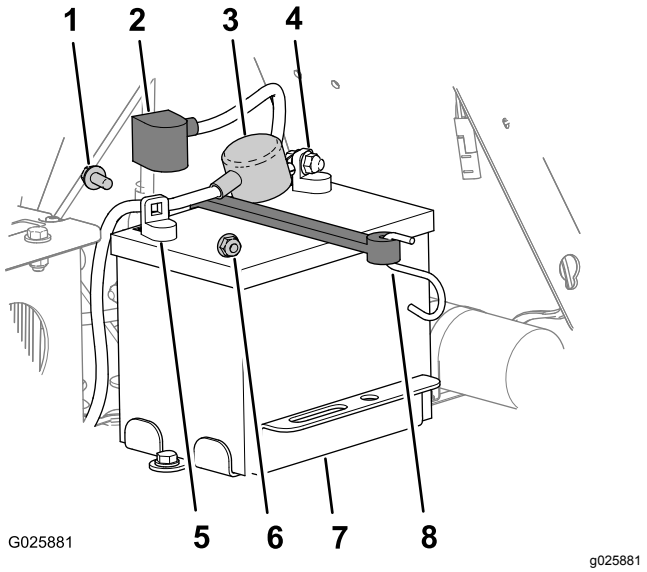


Figure 39

1. Flanged bolt
2. Terminal cover (black—negative battery terminal)
3. Terminal cover (red—positive battery terminal)
4. Positive (+) battery terminal
5. Negative (-) battery terminal
6. Flanged nut
7. Battery tray
8. Battery strap

4. Disconnect the negative battery cable from the negative (-) battery terminal, and remove the cable from the battery (Figure 39).
5. Slide the red terminal cover off the positive battery terminal (Figure 39).
6. Disconnect the positive (red) battery cable, and remove the cable from the battery (Figure 39).
7. Remove the hook of the battery strap from the battery tray (Figure 39), and remove the battery.

Installing the Battery

1. Place the battery onto the machine (Figure 39).
2. Secure the battery to the battery tray with the battery strap.
3. Install the positive (red) battery cable to positive (+) battery terminal with a flanged bolt and flanged nut (Figure 39).
4. Slide the red terminal cover over the positive-battery terminal.
5. Install the negative battery cable and the ground wire to the negative (-) battery terminal with a flanged bolt and flanged nut (Figure 39).
6. Slide the black terminal cover over the negative-battery terminal.

Charging the Battery

⚠ WARNING

Charging the battery produces gasses that can explode.

Never smoke near the battery and keep sparks and flames away from the battery.

Important: **Always keep the battery fully charged (1.265 specific gravity) to prevent battery damage when the temperature is below 0°C (32°F).**

1. Remove the battery from the chassis; refer to Removing the Battery (page 38).
2. Check the electrolyte level.
3. Ensure that the filler caps are installed on the battery.
4. Charge the battery for 1 hour at 25 to 30 A or 6 hours at 4 to 6 A.
5. When the battery is fully charged, unplug the charger from the electrical outlet, and disconnect the charger leads from the battery posts (Figure 40).
6. Install the battery onto the machine and connect the battery cables; refer to Installing the Battery (page 38).

   Note: Do not run the machine with the battery disconnected; electrical damage may occur.

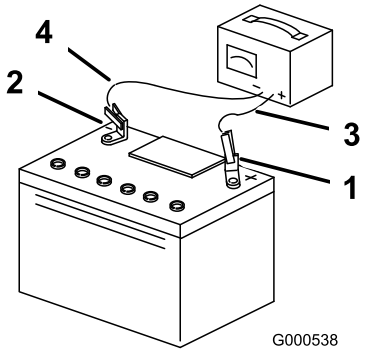


Figure 40

1. Positive battery post
2. Negative battery post
3. Red (+) charger lead
4. Black (-) charger lead

Servicing the Fuses

The electrical system is protected by fuses, and requires no maintenance. If a fuse blows, check the component or circuit for a malfunction or short.

1. Release the cushion from the rear of the machine.
2. Remove the negative-battery cable from the battery terminal; refer to steps 4 and 5 of Removing the Battery (page 38).

   Note: Ensure that the negative battery cable does not touch the battery terminal.
3. Pull the fuse from the socket of the fuse block (Figure 41).

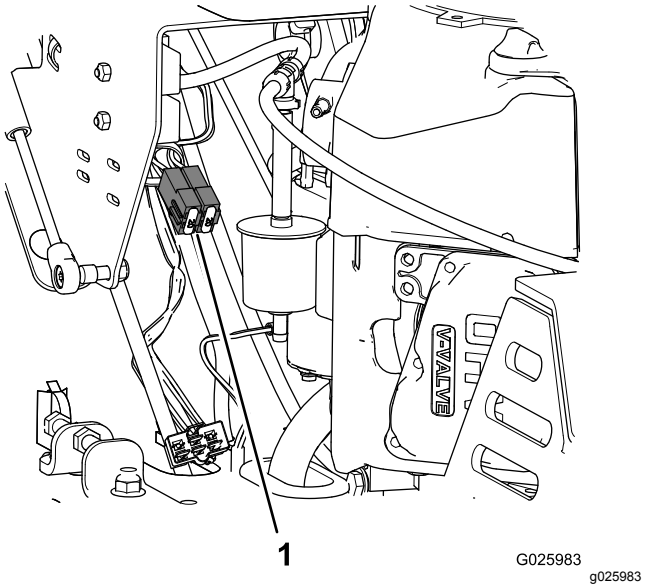


Figure 41

1. Fuse block

4. Install a fuse of the same type and amperes into the socket of the fuse block (Figure 41).
5. Install the negative-battery cable from the battery terminal; refer to steps 5 and 6 of Installing the Battery (page 38).

Drive System Maintenance

Checking the Air Pressure in the Tires

Service Interval: Every 50 hours

Note: The semi-pneumatic caster tires do not need to be inflated.

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Check the pressure of the drive tires.
3. Inflate the drive tires to 83 to 97 kPa (12 to 14 psi).

Checking the Wheel Hub Nuts

Service Interval: Yearly

Torque the wheel hub nuts (Figure 42) to 285 to 350 N·m (210 to 260 ft-lb).

Note: Do not use anti-seize compound on the wheel hub.

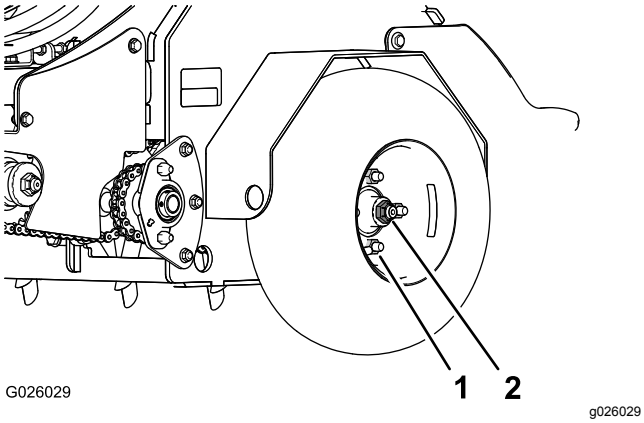


Figure 42

1. Lug nut
2. Hub nut

Checking the Torque of the Wheel Lug Nuts

Service Interval: Yearly

Torque the wheel lug nuts (Figure 42) to 122 to 129 N·m (90 to 95 ft-lb).

Adjusting the Caster Pivot Bearings Pre-Load

Note: If you disassemble the caster pivot bearings, ensure that the spring-disc washers are installed as shown in Figure 43.

1. Remove dust cap from caster hub (Figure 43).

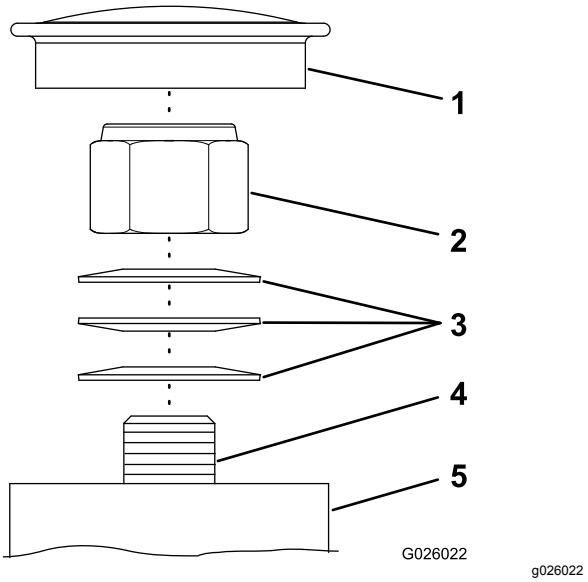


Figure 43

1. Dust cap
2. Locknut
3. Spring-disc washers
4. Spindle
5. Caster hub

2. Tighten the locknut clockwise until the spring-disc washers are flat (Figure 43).
3. Rotate the locknut counterclockwise 1/4 turn (Figure 43).
4. Install the dust cap (Figure 43).

Maintaining the Chain

Adjusting the Jackshaft Drive-Chain Tension

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Lift the rear of the machine and support it using jack stands or equivalent support.
3. Check the chains on both sides of the machine for proper tension.

   Note: The chains should move up and down 6 to 12 mm (1/4 to 1/2 inch).
4. At each side of the machine, loosen the 3 nuts and bolts that secure the transmission mount and tensioner plate, and the 2 nuts securing the

adjustment bolt at the tensioner plate as shown in Figure 44.

Note: You must loosen the nuts and bolts that secure the transmission mount and tensioner plate at both sides of the machine.

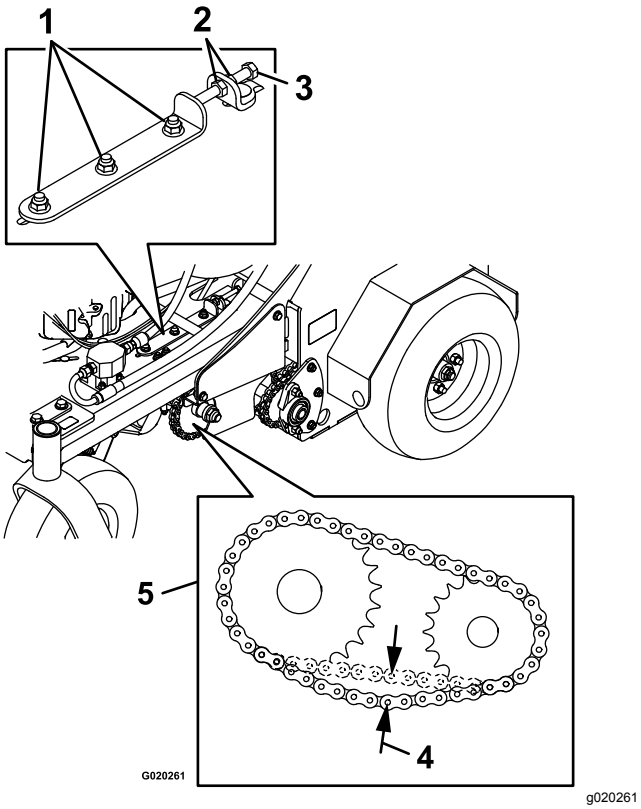


Figure 44

1. Hydro mounting bolts and nuts
2. Nuts
3. Adjustment bolt
4. 6 to 12 mm (1/4-1/2 inch)
5. Guard removed for clarity

5. Turn the adjustment bolt to move transmission adjustment plates and transmission.
6. When the chains can move up and down 6 to 12 mm (1/4 to 1/2 inch), tighten the nuts on both sides of the adjustment bolts.
7. Tighten nuts and bolts that secure the hydro mounting.
8. Adjust the traction-control linkage, refer to Adjusting the Traction-Control Linkage (page 45).

Adjusting the Drive Wheel Chain Tension

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Lift the rear of the machine and support it using jack stands.
3. Check the tension of the drive-wheel chains (Figure 45).

   Note: The chains should move up and down 6 to 12 mm (1/4 to 1/2 inch).

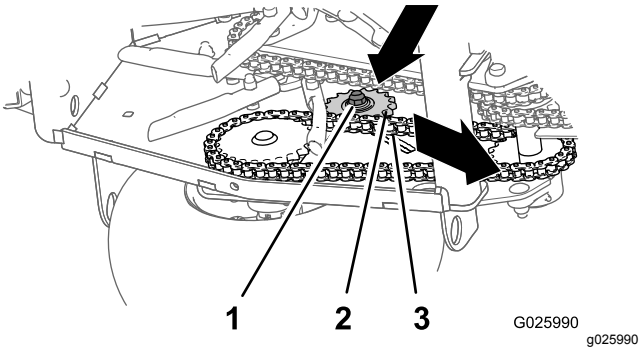


Figure 45

1. Locknut
2. Idler sprocket
3. Drive-wheel chain

4. Loosen the locknut and carriage bolt that secure the idler sprocket (Figure 45).
5. Increase or decrease chain tension by performing the following:
   - Push down and forward on the sprocket to increase the chain tension as shown in Figure 45.
   - Lift up and back on the sprocket to decrease the chain tension.
6. Torque the locknut to 91 to 113 N·m (67 to 83 ft-lb).
7. Check the chain tension and if necessary repeat steps 4 through 6 until you can move the chain up and down 6 to 12 mm (1/4 to 1/2 inch).

Checking the Torque of the Transmission Output Shaft Nut

Service Interval: Yearly

Torque the nut (Figure 46) on the transmission output tapered shaft to 285 to 353 N·m (210 to 260 ft-lb).

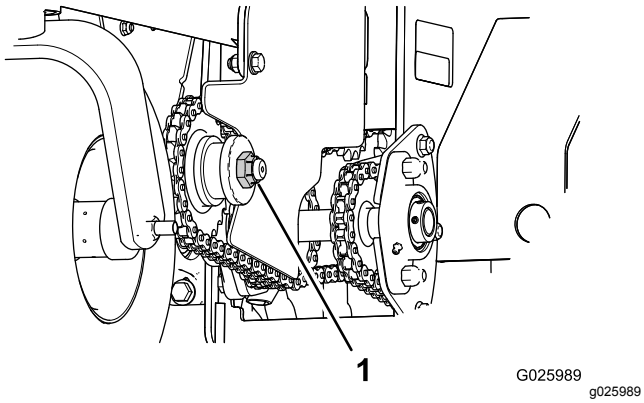


Figure 46

1. Transmission output shaft nut

Brake Maintenance

Adjusting the Parking Brake

If the parking brake does not hold securely, an adjustment is required.

1. Park the machine on a level surface.
2. Shut off engine and wait for all moving parts to stop.
3. Check the air pressure in the drive tires.

   Note: If needed, adjust to the recommended inflation; refer to Checking the Air Pressure in the Tires (page 40).
4. Loosen the jam nut on the brake cable under the console (Figure 47).

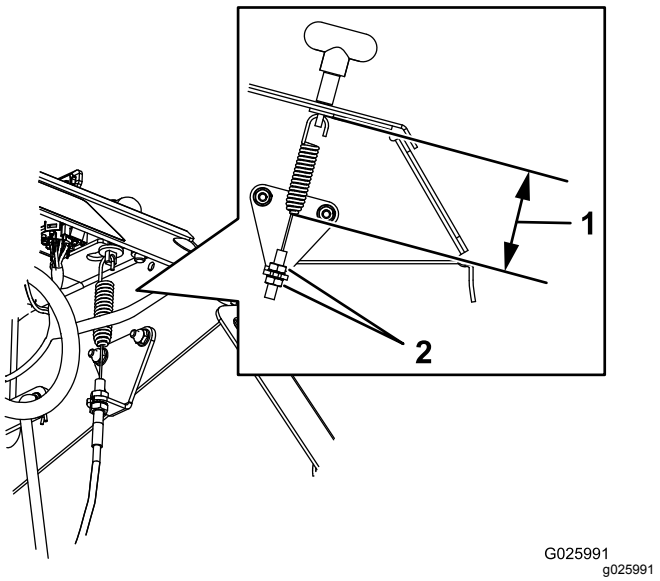


Figure 47

1. 7.9 cm (3-1/8 inch)

5. Engage the parking brake (Figure 47).
6. Adjust the jam nut position until 7.9 cm (3-1/8 inch) from the bottom of the link to the bottom of the spring (Figure 47).
7. Secure the adjustment of the cable by tightening the jam nuts (Figure 47).
8. Check the parking brake; if necessary, repeat steps 4 through 7.

Adjusting the Brake Switch

1. Park the machine on a level surface.
2. Shut off the engine and wait for all moving parts to stop.
3. Prior the adjusting the brake switch ensure that the parking brake is properly adjusted; refer to Adjusting the Parking Brake (page 42).
4. Engage the parking brake.
5. Check the distance between the parking brake-switch bracket to the brake arm of the transmission (Figure 48).

   Note: The distance should be 3.2 mm (1/8 inch).

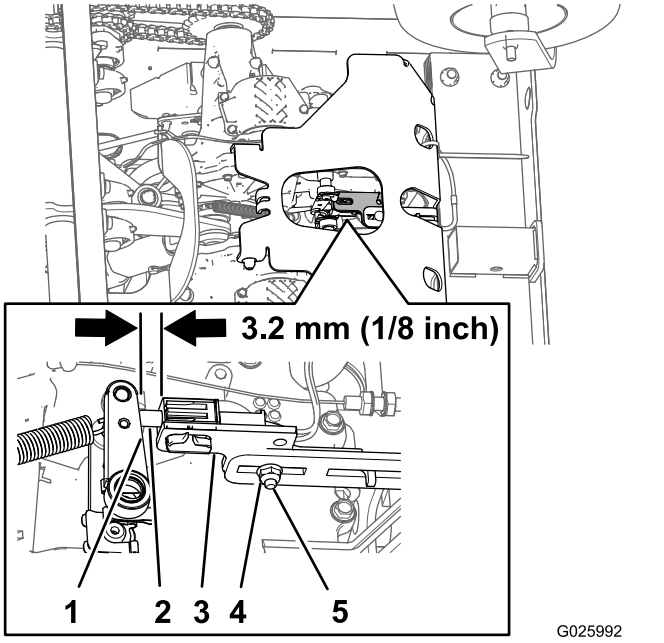


Figure 48

1. Brake arm (transmission)
2. Plunger (brake switch)
3. Brake-switch bracket
4. Locknut
5. Carriage bolt

6. If adjustment is required, preform the following:
   A. Loosen the locknut and carriage bolt securing the parking brake switch bracket (Figure 48).
   B. Adjust the position of the brake-switch bracket until the gap (Figure 48) between the switch bracket and the brake arm is 3.2 mm (1/8 inch)
   C. Tighten the locknut and carriage bolt (Figure 48) securing the brake-switch bracket to 1017 to 1243 N·cm (90 to 110 in-lb).

Belt Maintenance

Checking the Condition and Tension of the Belts

Service Interval: Every 50 hours

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Raise the machine and support it with jack stands with a 460 kg (1,015 lb) capacity.
3. Check the auxiliary pump-drive belt condition and tension (Figure 49).

   Note: The belt should deflect 1.3 cm (1/2 inch) when 1.4 kg (3 lb) of force is applied to the belt midway between the auxiliary pump and engine pulleys. If the belt tension is too high or too low, refer to Adjusting the Auxiliary Pump-Drive Belt (page 43).
4. Check condition of the transmission-drive belt (Figure 49).

   Note: The transmission belt has a automatic-spring tensioner.

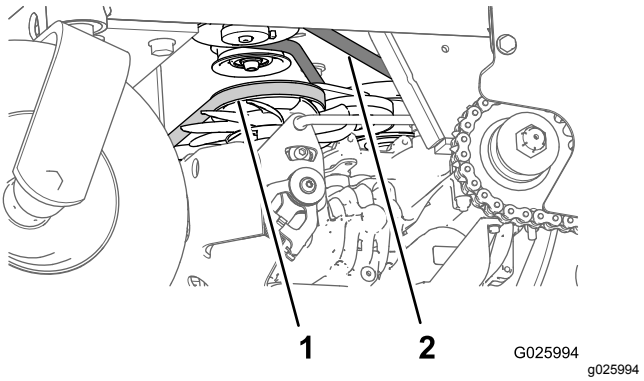


Figure 49

1. Transmission-drive belt
2. Auxiliary pump-drive belt

Adjusting the Auxiliary Pump-Drive Belt

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Loosen the locknut (3/8 inch) that secures the auxiliary pump-idler pulley to the chassis of the machine.

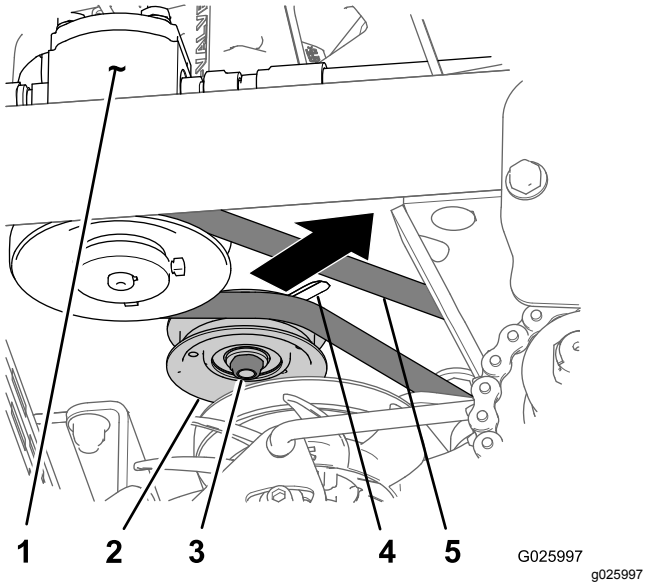


Figure 50

1. Auxiliary pump
2. Auxiliary pump-idler pulley
3. Locknut (3/8 inch)
4. Adjustment slot (chassis)
5. Auxiliary pump-drive belt

3. Adjust the belt tension as follows:
   - Move the auxiliary pump-idler pulley rearward and outward to tighten the belt.
   - Move the auxiliary pump-idler pulley forward and inward to loosen the belt.

   Note: The belt should deflect 1.3 cm (1/2 inch) when 1.4 kg (3 lb) of force is applied to the belt midway between the auxiliary pump and engine pulleys.
4. Tighten locknut to 37 to 45 N·m (27 to 33 ft-lb).

Replacing the Transmission-Drive Belt

Note: No adjustments are required for belt tension.

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Insert a breaker bar into the socket of the belt-tension bracket and move the bracket outward and forward (Figure 51).

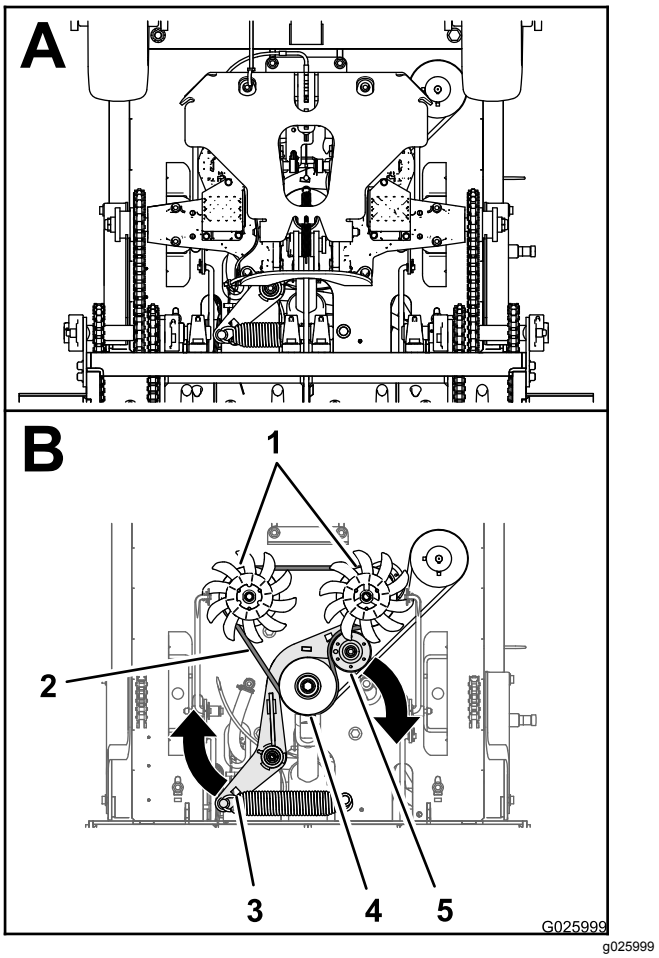


Figure 51

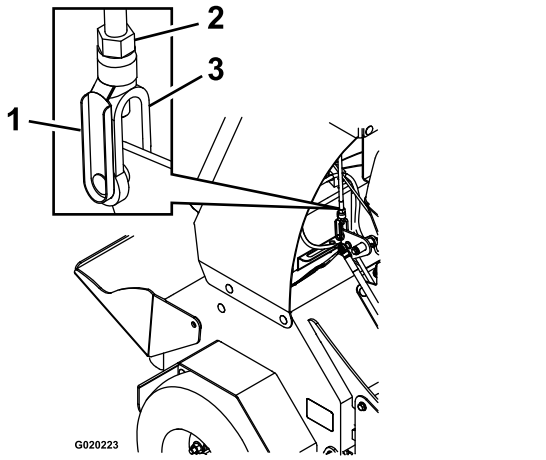
1. Transmission pulley
2. Transmission
3. Socket (belt-tension bracket)
4. Engine pulley
5. Tensioner pulley

3. Slip the transmission-drive belt of the engine, tensioner, and transmission pulleys (Figure 51).
4. Route the new transmission-drive belt around the engine, tensioner, and transmission pulleys as shown in Figure 51
5. Release the belt-tension bracket and allow the spring to tension the belt (Figure 51).

   Note: Make sure that the belt-tension bracket and pulley can move freely.

Adjusting the Traction-Control Linkage

1. Park the machine on a level surface.
2. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
3. Push the control lever all the way forward to the front reference bar.
4. If the control lever **contact the reference bar** or **do not contact the reference bar** perform the following:
   A. Release the control lever and allow it to return to the neutral position.
   B. Remove the spring-clevis pin from the fork fitting of the traction-control linkage (Figure 52).



g020223

Figure 52

1. Spring-clevis pin
2. Locknut
3. Turnbuckle

   C. Adjust the fork fitting to set the initial gap as follows:
      - If the control lever **contacts the reference bar**, rotate the fork fitting (Figure 52) counterclockwise (as viewed from the top of the machine).
      - If the control lever **does not contacts the reference bar**, rotate the fork fitting (Figure 52) counterclockwise.

   D. Install the spring clevis pin (Figure 52) and move the control lever forward.
   E. Repeat this steps A through D until there is a gap approximately 1.6 mm (1/16 inch) between the control lever and the front reference bar.
   F. Remove the spring-clevis pin, rotate the turnbuckle clockwise 1 additional turn, and insert the spring-clevis pin (Figure 52).
5. Repeat steps 4A through 4 F for the other traction-control linkage.

Hydraulic System Maintenance

Maintaining the Auxiliary Hydraulic System

Hydraulic fluid type: AW-32 hydraulic fluid

Checking the Auxiliary Hydraulic-Fluid Level

Service Interval: Every 50 hours

1. Park the machine on a level surface.
2. Lower the tines to the ground.
3. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
4. Remove the console pad; refer to Removing the Console Pad (page 28).
5. Clean the area around the hydraulic reservoir cap (Figure 53).

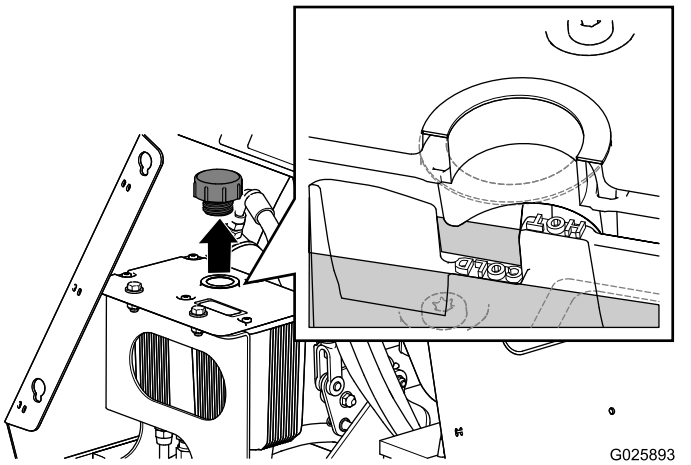


Figure 53

1. **Cold** fluid level
2. **Hot** fluid level

6. Remove the cap and check hydraulic-fluid level in the reservoir (Figure 53).

   Note: The hydraulic-fluid level should cover the word **Cold** that is embossed into the baffle of the reservoir.

7. If necessary, add the specified hydraulic fluid to the reservoir until the fluid covers the **Cold** fluid level on the baffle (Figure 53).

   Note: The baffle ion the reservoir is labeled **Hot** and **Cold**. Fill the reservoir to the appropriate level depending upon the temperature of the fluid. The fluid level varies with the temperature of the fluid. The **Cold** level shows the level of the fluid when it is at 24°C (75°F). The **Hot** level shows the level of fluid when it is at 107°C (225°F).

   For example: If the fluid is at ambient-air temperature, about 24°C (75° F), fill only to the **Cold** level. If the fluid is about 65°C (150° F), fill to halfway between the **Hot** and **Cold** levels.

8. Replace the hydraulic reservoir cap and tighten it until it is snug (Figure 53).

   Note: Do not overtighten the reservoir cap.

9. Install the console pad; refer to Removing the Console Pad (page 28).

Changing the Auxiliary Hydraulic Reservoir Fluid and Filter

Service Interval: After the first 100 hours

Every 250 hours thereafter

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Carefully clean area around the front of the auxiliary pump, fill cap for the reservoir, and filter (Figure 54).

   Important: **Ensure that no dirt or contamination enters hydraulic system.**

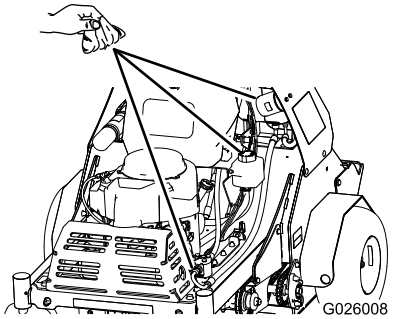


Figure 54

3. At the front of the auxiliary hydraulic pump, remove the inlet hose from the hydraulic fitting in the pump, place the end of the hose in a drain container, and allow the fluid to drain (Figure 55).

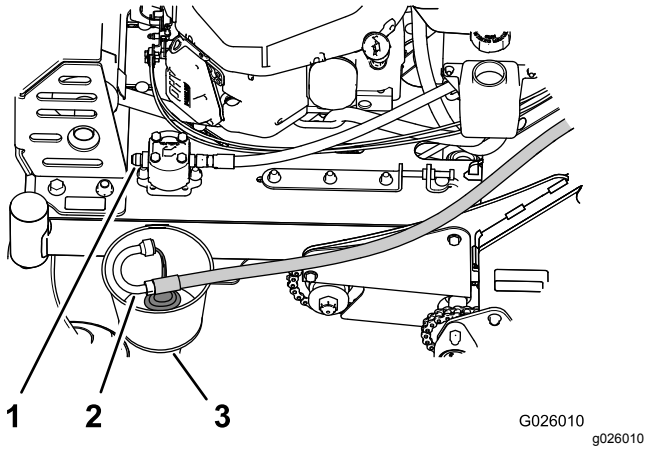


Figure 55

1. Hydraulic fitting (auxiliary hydraulic pump)
2. Inlet hose
3. Drain container

4. Clean around the fitting for the hydraulic pump.
5. Rotate the auxiliary hydraulic filter counterclockwise and remove it from the base of the filter adapter (Figure 56). Allow the fluid to drain.

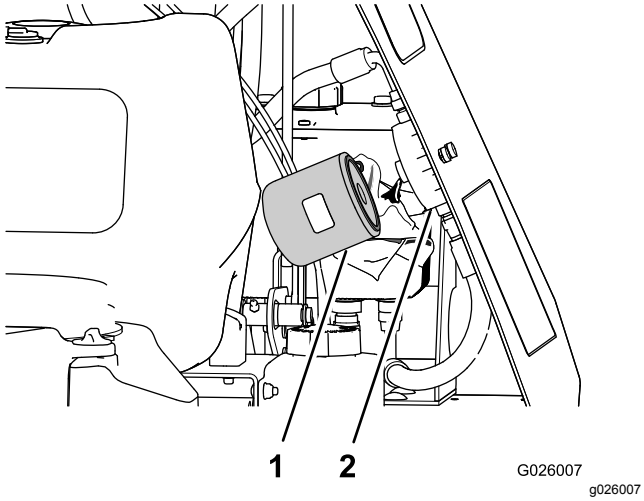


Figure 56

1. Auxiliary hydraulic filter
2. Filter adapter

6. Apply a thin coat of specified fluid onto the seal of the new hydraulic filter.
7. Install the filter by rotating it clockwise onto the filter adapter until the seal contacts the filter adapter, then tighten the filter an additional 2/3 to 3/4 turn (Figure 56).
8. Install the inlet hose onto the fitting in the pump and torque the hose fitting to 50 N·m (37 ft-lb).
9. Add the specified fluid until the level reaches the Cold fill line located on the reservoir tank; refer to Checking the Auxiliary Hydraulic-Fluid Level (page 46).
10. Start the engine and raise and lower the tines.
11. Lower the tines to the ground and refill the reservoir to the Cold fill line.

Maintaining the Transmission

Transmission fluid type: Toro® HYPR-OIL™ 500 hydraulic fluid or Mobil® 1 15W-50 synthetic motor oil.

Important: **Use the specified fluid. Other fluids could cause system damage.**

Checking the Transmission Fluid Level

Service Interval: Every 50 hours

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Allow the machine to cool.
3. Remove the cap from the expansion tank and check the hydraulic-fluid level in the tank (Figure 57).

   Note: The transmission fluid level should cover the Full Cold line molded into the side of the tank.

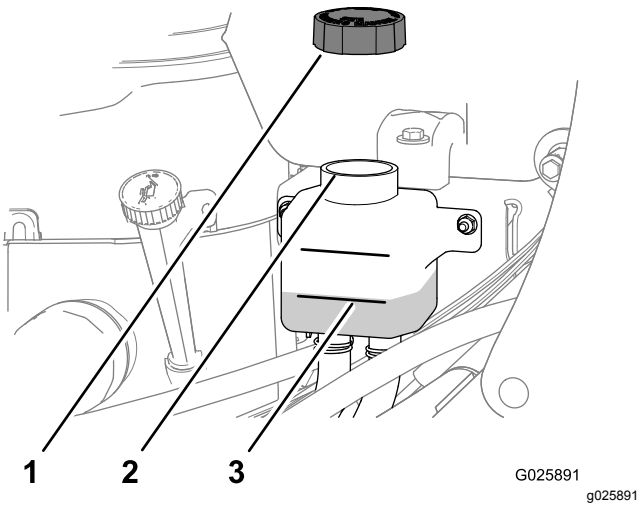


Figure 57

1. Cap
2. Filler neck (expansion tank)
3. Full Cold line

4. If necessary, add the specified transmission fluid until the fluid level is at the Full Cold line of the expansion tank (Figure 57).
5. Replace expansion-tank cap and tighten it until snug.

   Note: Do not overtighten the expansion-tank cap.

Changing the Transmission Filters

Service Interval: After the first 100 hours

Every 250 hours thereafter

Note: Do not change the hydraulic system fluid (except for what can be drained when changing filter), unless the fluid has been contaminated or been extremely hot.

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Raise the machine and support it with jack stands with a 460 kg (1,015 lb) capacity.
3. Remove the 3 washer-head bolts (1/4 x 3/4 inch) that secure the filter guard to the transmission, and remove the guard (Figure 58).

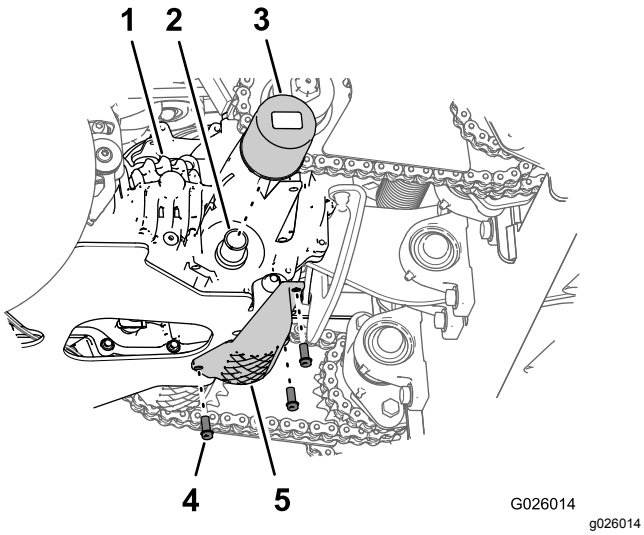


Figure 58

1. Transmission
2. Filter adapter
3. Transmission filter
4. Washer-head bolts (1/4 x 3/4 inch)
5. Filter guard

4. Clean the around the transmission filter (Figure 58).
5. Align a drain pan under the filter.
6. Rotate the filter counterclockwise and remove the filter (Figure 58).

   Note: Allow the fluid to completely drain from the filter adapter of the transmission.
7. Apply a thin coat of specified fluid onto the seal of the new transmission filter.
8. Install the filter by rotating it clockwise onto the filter adapter until the seal contacts the base of the adapter, then tighten the filter an additional 3/4 to 1 turn (Figure 58).
9. Install the filter guard with the 3 washer-head bolts (1/4 x 3/4 inch) that you removed in step 3 (Figure 58), and tighten the bolts to 1117 to 1243 N·cm (90 to 110 in-lb).

Filling the Transmissions with Fluid

Service Interval: After the first 100 hours

Every 250 hours thereafter

1. Raise the rear of machine up and support with jack stands (or equivalent support) just high enough to allow the drive wheels to turn freely.

⚠ CAUTION

Raising the machine for service or maintenance relying solely on mechanical or hydraulic jacks could be dangerous. The mechanical or hydraulic jacks may not be enough support or may malfunction allowing the machine to fall, which could cause injury.

Do not rely solely on mechanical or hydraulic jacks for support. Use adequate jack stands or equivalent support.

2. Align a drain pan under the sight plugs of the transmissions (Figure 59 and Figure 60).

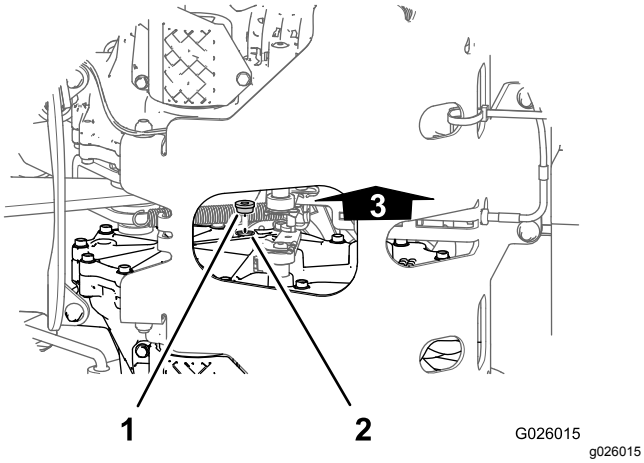


Figure 59

Left transmission shown

1. Sight plug
2. Sight-plug port
3. Up

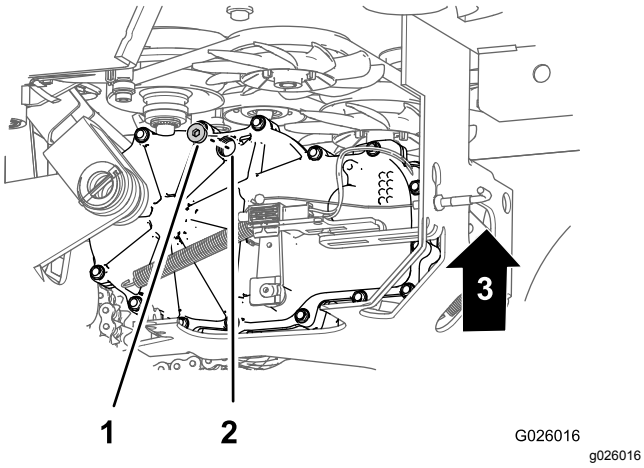


Figure 60

Left transmission shown

1. Sight plug
2. Sight-plug port
3. Up

3. At the inboard side of the transmission, near the top, remove the sight plug from 1 of the transmissions (Figure 59 and Figure 60).
4. Add the specified fluid to the expansion tank until fluid flows from the sight-plug port; refer to Checking the Transmission Fluid Level (page 47).
5. Install the sight plug and torque it to 244 N·m (180 in-lb).
6. Repeat steps 3 through 5 for the other transmission.
7. Add the specified fluid into the expansion tank until the fluid level is at the Full Cold line of the tank.
8. Start the engine and move the throttle midway between the SLOW and FAST positions
9. Disengage the parking brake.
10. Slowly move the motion-control levers in the forward and reverse directions 5 to 6 times.

    Note: Cycling the traction-controls forward and reverse purges air from the transmissions.
11. Shut off the engine and remove the key.
12. Check the fluid level in the expansion tank, and add the specified fluid as required; refer to Checking the Transmission Fluid Level (page 47).
13. Repeat steps 8 through 12 until all the air is completely purged from the transmissions.

    Note: The air is purged when the transmissions when the transmissions operate at normal noise levels and smoothly move forward and reverse at normal speeds.
14. Lower the machine and remove the jack stands.

Tine Maintenance

Checking the Tines

Service Interval: Before each use or daily

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Raise the machine and support it with jack stands with a 460 kg (1,015 lb) capacity.

⚠ CAUTION

Raising the machine for service or maintenance relying solely on mechanical or hydraulic jacks could be dangerous. The mechanical or hydraulic jacks may not be enough support or may malfunction allowing the machine to fall, which could cause injury.

Do not rely solely on mechanical or hydraulic jacks for support. Use adequate jack stands or equivalent support.

3. Remove the 2 bolts (3/8 x 1 inch) and 2 washers (3/8 inch) that secure the rear-cover panel to the chassis, and remove the panel (Figure 61).

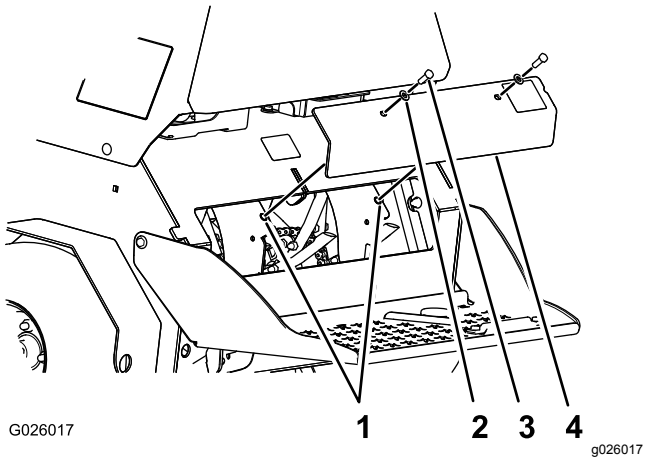


Figure 61

1. Chassis holes
2. Washer (3/8 inch)
3. Bolt (3/8 x 1 inch)
4. Rear panel

4. Remove rocks and other debris from the tines.
5. Inspect the tines for wear and damage.

   Note: Replace any tines that are worn or damaged.
6. Align the holes in the rear-cover panel to the holes in the chassis (Figure 61).
7. Secure the cover panel to the chassis with the 2 bolts and 2 washers (Figure 61) that you removed in step 3, and torque the bolts to 37 to 45 N·m (27 to 33 in-lb)

Adjusting the Tine Drive Chain

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Remove the rear cover; refer to step 3 of Checking the Tines (page 50).
3. Check the chains on both sides of the machine for proper tension.

   Note: The chains should move up and down 6 to 12 mm (1/4 to 1/2 inch).
4. Loosen the locknut and carriage bolt that secure the idler sprocket (Figure 62).

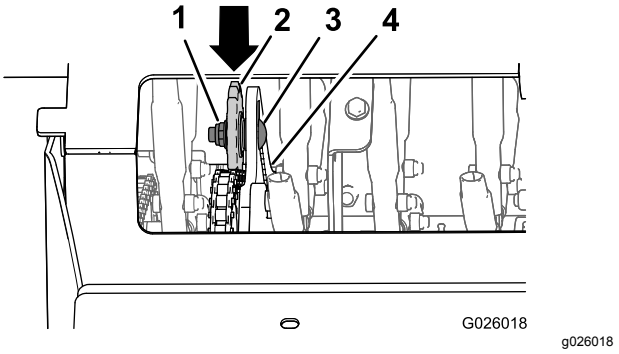


Figure 62

1. Locknut
2. Idler sprocket
3. Carriage bolt
4. Slot (trail plate)

5. Increase or decrease chain tension by performing the following:
   - Push down and forward on the sprocket to increase the chain tension as shown in Figure 62.
   - Lift up and back on the sprocket to decrease the chain tension.
6. Torque the locknut to 91 to 113 N·m (67 to 83 ft-lb).
7. Check the chain tension and if necessary repeat steps 4 through 6 until you can move the chain up and down 6 to 12 mm (1/4 to 1/2 inch).
8. Install the rear panel; refer to steps 6 and 7 of Checking the Tines (page 50).

Cleaning

Cleaning the Engine and the Exhaust System Area

Service Interval: Before each use or daily (more often in dry or dirty conditions).

⚠ CAUTION

Excessive debris around engine cooling air intake and exhaust system area can cause engine, exhaust area, and hydraulic system to overheat, which can create a fire hazard.

Clean all debris from engine and exhaust system area.

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Clean all debris from screen at the top of the engine, around engine shrouding, and exhaust system area.
3. Wipe up any excessive grease or oil around the engine and exhaust system area.

Removing the Engine Shrouds and Cleaning the Cooling Fins

Service Interval: Every 80 hours

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Remove cooling shrouds from engine.
3. Clean cooling fins of the engine.

   Note: Also clean dust, dirt, and oil from external surfaces of engine, which can cause improper cooling.
4. Install the cooling shrouds into the engine.

   Note: Operating the engine without cooling shrouds will cause engine damage due to overheating.

Cleaning the Debris from the Machine

Service Interval: Before each use or daily

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Clean off any oil, debris, or grass buildup on the machine and aerator deck.
3. Clean off any debris or grass under the chain guards, around the fuel tank, and around the engine and exhaust area.

Waste Disposal

Disposing of the Engine Oil

Engine oil and hydraulic fluid are both pollutants to the environment. Dispose of used oil at a certified recycling center or according to your state and local regulations.

Disposing of the Battery

⚠ DANGER

Battery electrolyte contains sulfuric acid, which is poisonous and can cause severe burns. Swallowing electrolyte can be fatal or can cause severe burns if it touches skin.

- **Wear safety glasses to shield eyes, and rubber gloves to protect skin and clothing when handling electrolyte.**
- **Do not swallow electrolyte.**
- **In the event of an accident, flush with water and call a doctor immediately.**

Federal law states that batteries should not be placed in the garbage. Management and disposal practices for batteries must follow relevant federal, state, or local laws.

If a battery is being replaced or if the machine containing the battery is no longer operating and is being scrapped, remove the battery and take it to a local certified recycling center. If no local recycling is available return the battery to any certified battery reseller.

Storage

1. Raise the tines, stop the machine, shut off the engine, engage the parking brake, and remove the key.
2. Remove dirt and grime from the entire machine.

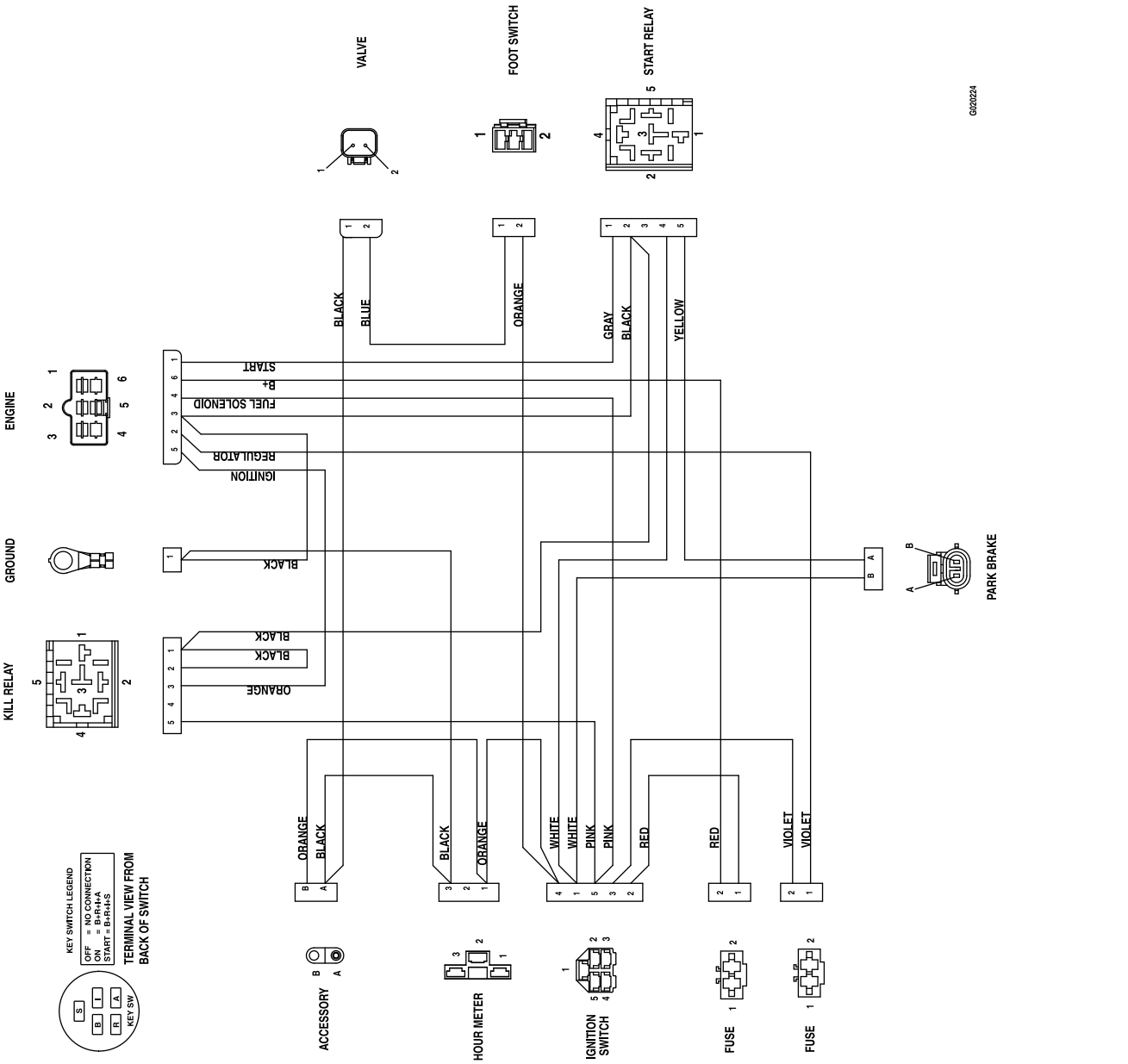
   Important: **You can wash the machine with mild detergent and water. Do not pressure-wash the machine. Avoid excessive use of water, especially near the engine and hydrostatic drive.**
3. Service the air cleaner; refer to Servicing the Air Cleaner (page 32).
4. Lubricate the machine; refer to Lubrication (page 29).
5. Change the engine oil; refer to Changing the Engine Oil (page 33).
6. Check and tighten all bolts, nuts, and screws. Repair or replace any part that is damaged.
7. Paint all scratched or bare metal surfaces. Paint is available from your Authorized Service Dealer.
8. Store the machine in a clean, dry garage or storage area.
9. Cover the machine to protect it and keep it clean.

Troubleshooting

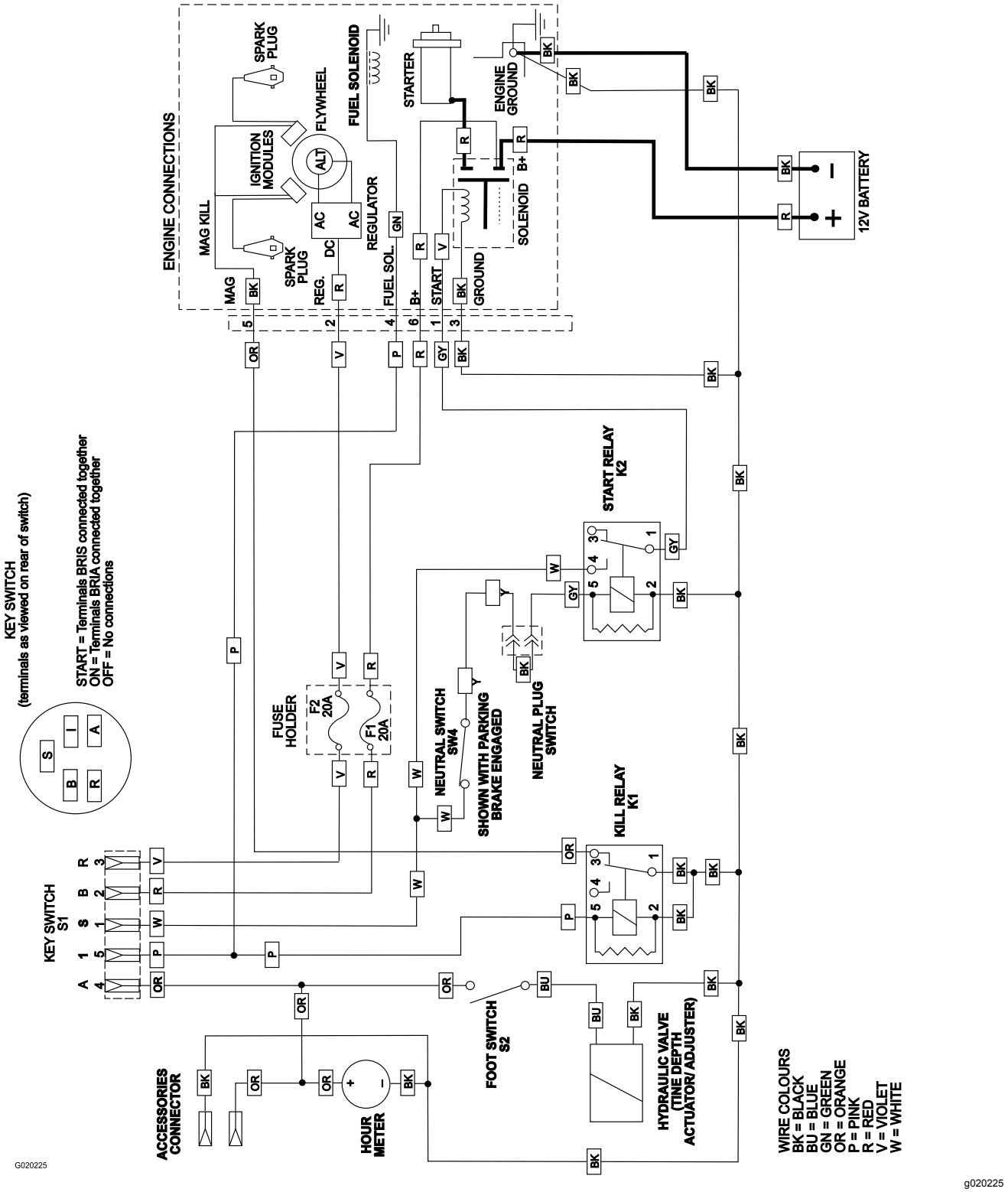
Problem	Possible Cause	Corrective Action
The starter does not crank.	1. The parking brake is not engaged. 2. The brake switch is not adjusted properly. 3. The battery does not have a full charge. 4. The electrical connections are corroded, loose or faulty. 5. A fuse is blown. 6. A relay or switch is defective.	1. Engage the parking brake. 2. Adjust the brake switch. 3. Charge the battery. 4. Check the electrical connections for good contact. Clean the connector terminals thoroughly with electrical contact cleaner, apply dielectric grease, and reconnect. 5. Replace the blown fuse. 6. Contact an Authorized Service Dealer.
The engine does not start, starts hard, or fails to keep running.	1. The fuel tank is empty. 2. The fuel-shutoff valve is closed. 3. The throttle and choke are not in the correct position. 4. There is dirt in the fuel filter. 5. There is dirt, water, or stale fuel is in the fuel system. 6. The air cleaner is dirty. 7. The electrical connections are corroded, loose or faulty. 8. A relay or switch is defective. 9. The spark plug is faulty. 10. The spark-plug wire is not connected.	1. Fill the fuel tank. 2. Open the fuel-shutoff valve. 3. Be sure that the throttle level is midway between the SLOW and FAST positions, and the choke is in the ON position for a cold engine or the OFF position for a warm engine. 4. Replace the fuel filter. 5. Contact an Authorized Service Dealer. 6. Clean or replace the air-cleaner element. 7. Check the electrical connections for good contact. Clean connector terminals thoroughly with electrical contact cleaner, apply dielectric grease, and reconnect. 8. Contact an Authorized Service Dealer. 9. Clean, adjust, or replace the spark plug. 10. Check the spark-plug wire connection.
The engine loses power.	1. The engine load is excessive. 2. The air cleaner is dirty. 3. The oil level in the crankcase is low. 4. The cooling fins and air passages for the engine are plugged. 5. There is dirt in the fuel filter. 6. There is dirt, water, or stale fuel is in the fuel system.	1. Reduce the ground speed or aeration depth. 2. Clean or replace the air-cleaner element. 3. Add oil to the crankcase. 4. Remove the obstructions from the cooling fins and air passages. 5. Replace the fuel filter. 6. Contact an Authorized Service Dealer.
The engine overheats.	1. The engine load is excessive. 2. The oil level in the crankcase is low. 3. The cooling fins and air passages for the engine are plugged.	1. Reduce the ground speed or aeration depth. 2. Add oil to the crankcase. 3. Remove the obstructions from the cooling fins and air passages.
The machine pulls left or right (with levers fully forward).	1. The tire pressure in drive tires is not correct. 2. The tracking needs adjustment.	1. Adjust the tire pressure in the drive tires. 2. Adjust the traction-control linkage.

Problem	Possible Cause	Corrective Action
The machine does not drive.	1. The transmission belt worn, loose, or broken. 2. The transmission belt is off a pulley.	1. Change the belt. 2. Change the belt.
There is abnormal vibration.	1. A tine is bent. 2. The tine mounting bolt is loose. 3. The engine mounting bolts are loose. 4. There is a loose engine pulley or idler pulley. 5. The engine pulley is damaged. 6. A belt is damaged. 7. The chains are not properly tensioned.	1. Install a new tine. 2. Tighten the tine mounting bolt. 3. Tighten the engine mounting bolts. 4. Tighten the appropriate pulley. 5. Contact an Authorized Service Dealer. 6. Install a new belt. 7. Check the jackshaft drive-chain tension, the drive wheel chain tension, and the tine drive-chain tension.
The tines do not raise.	1. There is an auxiliary pump belt problem. 2. The tine down pressure setting is too low. 3. There is a short in the wiring harness. 4. The auxiliary reservoir is low on fluid.	1. Tension or replace the belt. 2. Increase the down pressure. 3. Contact an Authorized Service Dealer. 4. Add fluid to the reservoir.

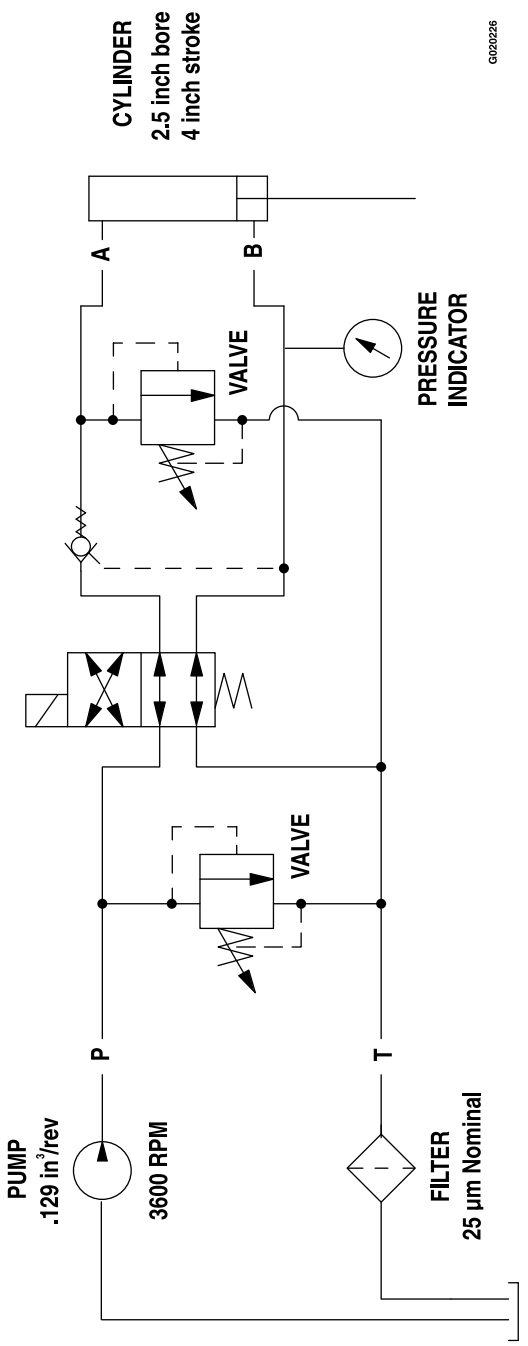
Schematics



Electrical Diagram (Rev. A)



Electrical Schematic (Rev. A)



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Hydraulic Diagram (Rev. A)

Notes:

Notes:

The Toro Warranty

A limited warranty (see warranty periods below)

SWS
Turf Renovation

Conditions and Products Covered

The Toro Company and its affiliate, Toro Warranty Company, pursuant to an agreement between them, jointly warrant your Toro Products listed below to be free from defects in materials or workmanship.

This warranty covers the cost of parts and labor, but you must pay transportation costs.

The following time periods apply from the date of purchase:

Products	**Warranty Period**
Turf Renovation	
Walk-Behind Aerator	1 year
▪ Engine	2 years
Stand-On Aerator	1 year
▪ Battery	90 days Parts and Labor 1 year Parts Only
▪ Engine	2 years
Dethatcher	1 year
▪ Engine	2 years
Turf Seeder	1 year
▪ Engine	2 years
Stand-On Spreader Sprayer	1 year
▪ Battery	90 days Parts and Labor 1 year Parts Only
▪ Engine	2 years
Walk-Behind Rotary Broom	1 year
▪ Engine	2 years

Where a warrantable condition exists, we will repair the Product at no cost to you including diagnosis, labor, and parts.

Instructions for Obtaining Warranty Service

If you think that your Toro Product contains a defect in materials or workmanship, follow this procedure**:

1. Contact any Authorized Servicing Outlet to arrange service at their dealership. To locate one convenient to you, access our website at www.Toro.com. Select “Where to Buy” and select “Contractor” under product type. You may also call our toll free number below.
2. Bring the product and your proof of purchase (sales receipt) to them.
3. If for any reason you are dissatisfied with the Service Outlet’s analysis or with the assistance provided, contact us at:

   SWS Customer Care Department
   Toro Warranty Company
   8111 Lyndale Avenue South
   Bloomington, MN 55420-1196
   Toll Free: 888-384-9940

**Toro Authorized Rental Customers who have purchased products directly from Toro and have signed the Toro Rental Customer Agreement have the ability to perform their own warranty work. Please visit Toro’s Rental Portal for electronic warranty clam filing procedures or call the toll free number above.

Owner Responsibilities

You must maintain your Toro Product by following the maintenance procedures described in the *Operator’s Manual*. Such routine maintenance, whether performed by a dealer or by you, is at your expense. Parts scheduled for replacement as required maintenance (“Maintenance Parts”), are warranted for the period of time up to the scheduled replacement time for that part. Failure to perform required maintenance and adjustments can be grounds for disallowing a warranty claim.

Items and Conditions Not Covered

Not all product failures or malfunctions that occur during the warranty period are defects in materials or workmanship. This express warranty does not cover the following:

- Product failures which result from installation and use of add-on, modified, or unapproved accessories
- Failure to perform required maintenance and/or adjustments
- Repairs necessary due to failure to follow recommended fuel procedure (consult *Operator's Manual* for more details)
  - Removing contaminants from the fuel system is not covered
  - Use of old fuel (more than one month old) or fuel which contains more than 10% ethanol or more that 15% MTBE
  - Failure to drain the fuel system prior to any period of non-use over one month
- Product failures which result from operating the product in an abusive, negligent or reckless manner
- Parts subject to consumption through use unless found to be defective. Examples of parts which are consumed, include, belts, cutters, blades, teeth, spark plugs, tires, filters, etc.
- Failures caused by outside influence include, weather, storage, contamination, lubricants, additives, or chemicals, etc.
- Normal “wear and tear” items incudes painted surfaces and scratched decals, etc.
- Any component covered by a separate manufacturer’s warranty
- Pickup and delivery charges

General Conditions

Repair by an Authorized Servicing Outlet or Self-Service as an Authorized Rental Customer is your sole remedy under the warranty.

Neither The Toro Company nor Toro Warranty Company is liable for indirect, incidental or consequential damages in connection with the use of the Toro Products covered by this warranty, including any cost or expense of providing substitute equipment or service during reasonable periods of malfunction or non-use pending completion of repairs under this warranty. All implied warranties of merchantability and fitness for use are limited to the duration of this express warranty. Some states do not allow exclusions of incidental or consequential damages, or limitations on how long an implied warranty lasts, so the above exclusions and limitations may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Except for the engine warranty coverage and the Emissions warranty referenced below, if applicable, there is no other express warranty. The Emissions Control System on your Product may be covered by a separate warranty meeting requirements established by the U.S. Environmental Protection Agency (EPA) or the California Air Resources Board (CARB). Refer to the California Emission Control Warranty Statement supplied with your Product or contained in the engine manufacturer’s documentation for details.

Countries Other than the United States or Canada

Customers who have purchased Toro products outside the United States or Canada should contact their Toro Distributor (Dealer) to obtain guarantee policies for your country, province, or state. If for any reason you are dissatisfied with your Distributor's service or have difficulty obtaining guarantee information, contact the Toro importer. If all other remedies fail, you may contact us at Toro Warranty Company.

Australian Consumer Law: Australian customers will find details relating to the Australian Consumer Law either inside the box or at your local Toro Dealer.